

Developing a consultation for Erasmus MC in 2030

By creating a strategic future vision

Master Thesis
Boris 't Hart

Master Thesis: Boris 't Hart

Strategic Product Design
Delft University of Technology

Studentnumber: 4134044

Under the supervision of:

Delft University of Technology

Chair:

prof. dr. ir. R.H.M. (Richard) Goossens
Head of Industrial Design department
prof. of physical ergonomics

Mentor:

Ir. A. Q. (Quiel) Beekman
Product Innovation Management
Management and Organisation

Erasmus MC

Mentor:

Dr. S.C.E. (Stephanie) Klein Nagelvoort-Schuit
Chair department of internal medicine

Photographs: Boris 't Hart, Quiel Beekman

Design: Boris 't Hart

Icons for visualizations: taken from: www.thenounproject.com



Delft University of Technology



Preface

This assignment is the one with which I conclude my master Strategic Product Design at faculty Industrial Design Engineering at the Delft University of Technology.

For the past 8 months I have been working on this project with the goal to create a future vision for consultations which is not only relevant now, but by 2030 as well. Throughout this assignment I have been assisted by a number of people who have helped me achieve my masters' degree.

To start off, I would like to express my appreciation for my supervisory team. Richard Goossens, my chair, who has offered me the chance to work on this project, which he set up together with Stephanie Klein Nagelvoort-Schuit, my coach from the Erasmus MC, whom I would like to thank for her enthusiasm. It has motivated me and given me confidence throughout the project. Quiel Beekman, I would like to thank you for asking the questions I was too tired to ask myself, and for showing me the importance of good visual presentation.

Second, I especially want to thank Andries van Vliet, the Medicine student with whom I was assigned to this project, for his perseverance, his knowledge of the medical world and simply his presence. I don't know how I would have completed the research phase without you, you were my guiding light.

Thirdly, I would like to thank everyone that has made time during this project to participate in interviews and creative sessions. Without your participation it would have been near impossible to gather all the information I did.

Finally, I would like to thank my friends and family, for their mental support throughout this project. I know I have been gone for a while, but it is time for me to resurface now.

Boris 't Hart
The Hague, June 2019

Executive summary

Over the past 30 years, there has been little to no change inside consultations, except for the introduction of the personal computer in the consulting room, which is used by doctors mostly for looking up information and administrative tasks. This paper is the documentation of a future vision research of which the goal is to create a vision which helps consultations improve their relevance and value to healthcare in 2030.

This project is commissioned by the Erasmus MC and Delft University of Technology, to create a future vision of consultations in 2030. It is a first cooperation between the two universities in the sense that two students, one industrial design engineering (TUDelft) and the other of medicine (Erasmus MC), work together.

The research was set up in different phases. Starting off with an orienting analysis phase. During this time a literature study is done which is used to define the research questions. Next, the research phase is discussed. During the research phase, expert interviews, field studies and a Delphi research are executed to be able to create a first future vision of consultations. This vision is validated during the fourth and final round of the Delphi study with a team of medical professionals. In the chapter vision 2030, the research questions are answered with the help of a future patient journey, and a roadmap on how to reach this presented journey.

The literature study shows that the Dutch healthcare system is one of the best in the world. Although, with the Erasmus MC being in the final four from a total of eight comparable hospitals, there is still room to improve.

Healthcare expenses are rising due to a number of factors. Not all of these rising healthcare expenses can be controlled by healthcare, such as the increasing age of the Dutch population or an increase in people with chronic conditions. There are, however, factors which can be used to lower the total healthcare expenses over time. These factors are: the increased use of healthcare, higher demands and the need for more guidance.

Literature has shown that there is already research done into the future of healthcare as a whole, but there is not much literature to find on the consulting room and its future. There are some significant changes coming to the healthcare industry. In the future there will be more focus on preventing getting sick for example.

There are also a number of technologies identified which are expected to significantly disrupt healthcare. These technologies are Artificial Intelligence (AI) and the Internet of Medical Things (IoMT). AI can be used to guide and diagnose patients, while IoMT can be used to monitor patients over a distance. Combining these technologies allows for new ways of offering care to patients. This will help consultations to stay relevant in the future.

During the literature research, the decision was made to step away from the idea of designing a physical consulting room. This is done because this paper is being written in 2019, for a consulting room in 2030, a lot might change in the coming 11 years. Continuous developments over time may cause insights to lose their relevance, which could make this paper obsolete before the new consulting room would be developed. To avoid this, the decision is made to focus the research on what a consultation is and what should be done to have it maintain its relevance by 2030.

At the end of the literature research, three research questions are introduced that will be used in the chapter 'Vision 2030' to explain the future patient journey and roadmap presented there. The research questions defined are:

1. What will healthcare look like in the year 2030?
2. What technologies are currently in development that will be useful during consultation in 2030?
3. What will a consultation look like in the year 2030?

For the field research the Dutch Design Week and Medica are visited. The concepts and technologies presented at these events, however, do not extend far enough into the future to help sketch a future vision of consultations. Luckily, the visits did provide a good overview of current and emerging techniques in healthcare, so they can be used to compare healthcare in 2019, to healthcare in 2030.

Most the insights in this report are gathered during the expert interviews. For these interviews, multiple healthcare professionals are interviewed to share their opinion on consultations from their professional point of view. The insights gathered this way are used to set up the Delphi study. Amongst the most important insights discovered here, are the goals of a consultation room in 2019, which are defined as:

- Offering empathic care
- Transfer of information
- Medical interventions

The Delphi study is a research method which is often used in healthcare to reach consensus on a specific topic. For this project, a modified Delphi study was created. The first round is a generative session which is used to map out the timeline of a consultation in 2019. Rounds 2 and 3 are online surveys, used to validate 50 statements which need to reach consensus to get a good idea of what the future of healthcare might look like. The final round of the Delphi study is used to validate the future patient journey through a session for which the interviewed experts are invited.

The future patient journey is build based up off the insights gathered until the third round of the Delphi study. The purpose of this journey:

'Bridge the gap of information surrounding the consultation to bring doctor and patient closer together.'

is stated in the design brief and validated in the fourth round of the Delphi study.

The chapter vision 2030, is the concluding chapter of this paper. In this research, a roadmap is presented to answer the first two research questions, the final research question is answered with the help of the final patient journey, validated in Delphi round 4.

Healthcare will see some major disruptive changes in the coming years, most of these changes come from digital developments. By 2030 these innovations are expected to have opened up new possibilities to offer care over a distance, patients have become clients and consultations focus mainly on offering empathic care.

The digital developments needed to realize these innovations are AI and the IoMT. There are, of course, other technologies in development, however, these two technologies are regarded as most disruptive. AI can be used to take over mundane, repetitive tasks, leaving more room for healthcare professionals to focus on their patients. The IoMT opens up new and easier ways to monitor patients over a distance. This will make providing care easier, as it is no longer location bound.

Consultations will probably not change all that much. The goals of consultations remain the same, with the addition of a fourth goal, which is defined as:

'Bringing doctor and patient together with a similar goal'

The goal is added because interaction between doctor and patient is one of the most important aspects of consultations. Yet, there is still a lot of miscommunication. Bringing doctor and patient together with a matching goal will improve communication and the interaction.

Eventually, this report is an overview of the research done into the potential future of consultations. Further research is needed into different topics presented here. For now, this paper can be used as an exploration to find new directions to innovate consultations in.

Chapter Index

1 Introduction

2 Analysis

Literature study

3 Research

Field research

Expert interviews

Delphi study

Conclusion

4 Validating the future patient journey

5 Vision 2030

Roadmap

Future patient journey

Conclusion

6 Concluding

Evaluation

Cooperating with a medicine student

References

Appendix

1. Introduction

Introduction

Introduction into this project

Assignment definition

The assignment explained

Relation to faculty IDE

How is this project relevant to the faculty of Industrial Design Engineering?

Relevance of this project to Erasmus MC

How is this project relevant to the Erasmus MC?

Goals of the project

The intended outcome of this project

Users of the consulting room

Who are the stakeholders in this project

Project overview

Project set up



Introduction

In the introduction the assignment this project was based on will be explained.

This is done by first explaining the reason for the need of this project. As healthcare is currently lagging behind other sectors in terms of digitization. The consulting room has not seen any significant changes over the past thirty years, since the introduction of the computer. To make sure the consulting room, and through that, healthcare maintains its relevance in the future, a vision of the consulting room in 2030 and a roadmap to show how to reach this vision are created. These two visualization will be used to frame the future of the consulting room.

Next, the relevance of this project to the Delft University of Technology and the Erasmus MC is explained, followed by the goals of this project. As this is a graduation paper from a Masters student of the Faculty of Industrial Design TUDelft.

In the following section, Franky Dutch is introduced, the persona of a patient who gives feedback on the different sections in the report, to get a patients point of view on the matter.

Finally, a project overview is given which explains the course of this project.

Introduction

1.1 Background

Over the past 30 years or so there have been rapid and disruptive innovations which are nowadays fairly accessible and affordable to the general public. Most of these innovations are digital or they are new ways to access, analyze and use the large amounts of data which is being generated by an increasing number of products and services.

In healthcare, however, it is extremely hard to adopt to these innovations. This difficulty comes partly due to the fact that everything in healthcare has to be working correctly once it is being put to use, since you are literally playing with the lives of people when you are not certain how a new drug, technology or innovation might affect its' user. So whenever you want to start working with a new technology, you will need enough time to test it.

Over the past years the healthcare sector is starting to digitize more and more, which can be seen in the amount of patient information which can be gathered with a plethora of devices and analyses. One of the aspects of healthcare which has not seen a lot, if any, innovation in the past decades, is the consulting room.

The only really new introduction of technology within the consulting room in the past thirty years has been the personal computer, which is supposed to help doctors keep track of their patients' statuses easier.

To make sure the consulting room will still be relevant in the future, Erasmus MC and the Delft University of Technology set out this graduation assignment to design a future vision of the consulting room in 2030. This is done by identifying the current state of the consulting room in 2030, analyzing innovations and trends within the world and healthcare, which will eventually be translated into a roadmap which will lead to the vision of healthcare in 2030.

1.2 Relation to faculty of IDE

This assignment is a first joint graduate collaboration between the faculty of Medicine at Erasmus University and the faculty of Industrial Design Engineering, in the sense that there has never been a joint graduation assignment between these two faculties before.

This project covers all pillars of the faculty of Industrial Design Engineering, which are:

Relationship to the Master Strategic Product Design

This project is relevant to the master Strategic Product Design, as the goal is to deliver a sound, strategic report, based on scientific research.

Business

Healthcare is getting more expensive every year, and one of the goals of this projects is to find new ways and means to keep these costs as low as possible.

Human Interaction

There is constant interaction between doctors and patients within hospitals. And there is a lot of room for improvement there.

Technology

A link with technology is created by looking at upcoming (medical) technologies which can be used in consultancy rooms.

Relevance of this project for Erasmus MC

In recent years many industries have seen disruptions caused by the increasing digitization of the world. Picnic is disrupting the supermarket industry by not having a physical store. AirBnB has disrupted the tourism sector. And Uber and Tesla have disrupted the transportation industry.

The common denominator for all these disruptive practices is that they combine innovative technologies to approach problems from a completely different angle to create opportunities no one has thought about before. Currently the healthcare industry is going through a large number of innovations. Amongst which are the introduction of Artificial Intelligence (AI), Telemedicine, Wearables, and more.

To make sure the Erasmus MC stays relevant as a tertiary hospital in the future, it is important that it is prepared for upcoming innovations which will disrupt the healthcare sector. Through this report Erasmus MC is presented an overview of current and emerging innovations and a possible way to implement a number of these innovations.

1.3 Goals of the project

The goal of this project is to create a roadmap which will lead to a future vision of the consulting room in 2030 accompanied by a patient journey. These two deliverables can then again be used in future research, as this project will be continued by two, or maybe more, graduation students, to keep the Erasmus MC up to date with the latest innovations and to prepare the hospital for the future.

As the goal of this project is to create a future vision of the consulting room, it is highly likely that no actual, physical room will be created. This report should be considered a preliminary scan of possibilities for innovation of the consulting room in the future and it should, therefore, be regarded as such.

Introduction

1.4 Project overview

This project can be divided into three different phases. First the analysis took place. During this analysis phase, a general understanding of the consulting room was created through multiple studies into the subject.

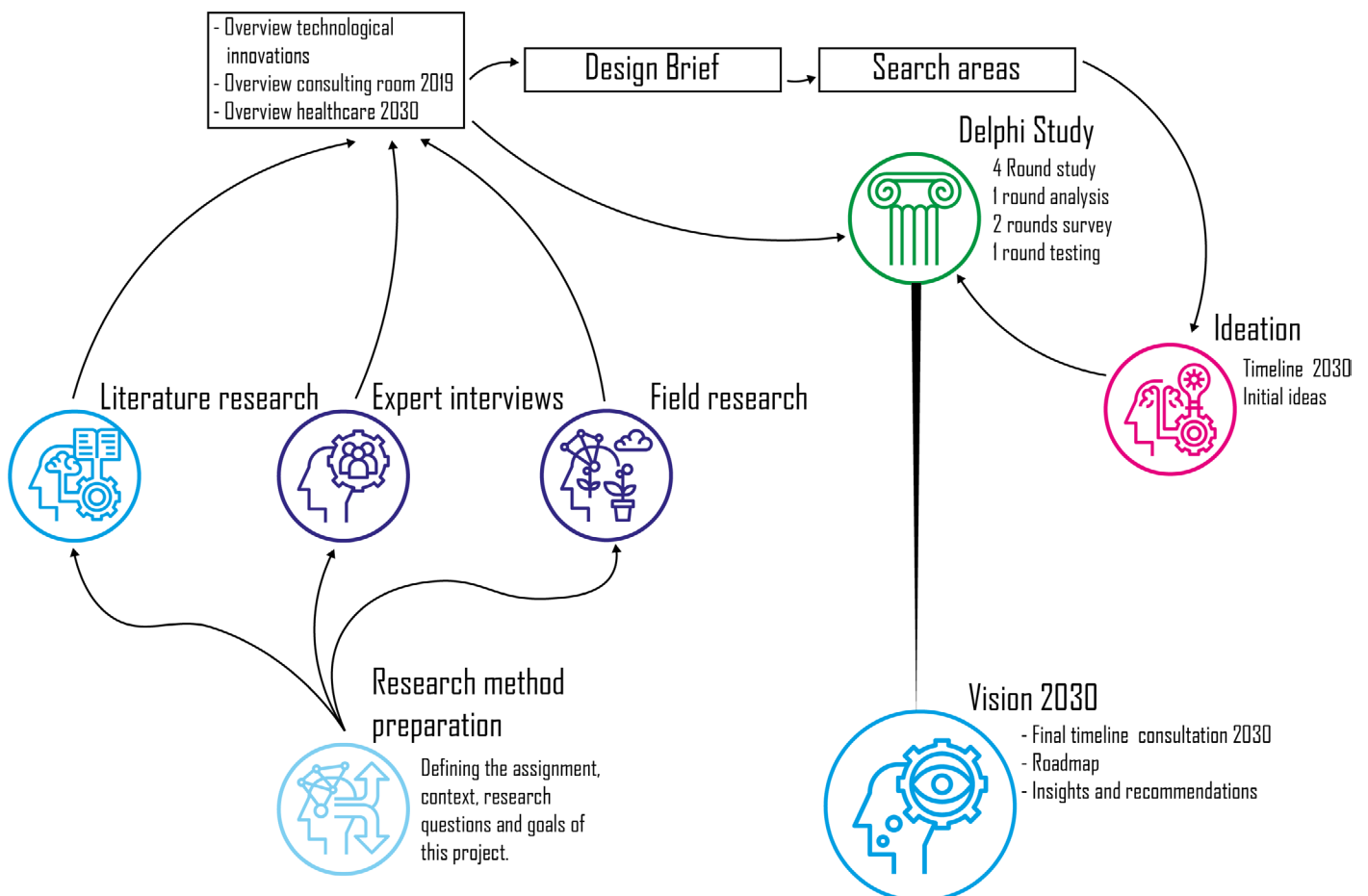
At the same time a Delphi research was set up, which was used to lay out a regular consultation and to identify its opportunities and weaknesses.

With the information gathered from the analysis phase and Delphi research, a consultation for the year 2030 has been created during the ideation phase.

Next, the consultation created for 2030 has been tested in the final round of the Delphi research to determine its validity.

The overview of this process can be found in image 1

image 1 Visual overview of the steps taken during this project.



2. Analysis



Introduction

Literature study

Healthcare
Innovation
Consulting room

Research Questions

Conclusion



Introduction

The analysis phase, discusses the literature study done to frame the context of the assignment and to set up research questions.

During the literature study, the Dutch healthcare system is introduced, to get an understanding of how it works. After this, the Erasmus MC is analyzed and compared to other academic Dutch hospitals. Lastly, the consulting room itself has been studied, to frame what a consulting room actually is and to step away from the idea of a physical consulting room.

After the literature study has been concluded, the research questions are introduced. The research questions are based upon findings done in the literature study, and they will be answered in chapter 5, Vision 2030.

In the final section of this chapter an overview can be found with the most important insights and conclusions from the literature study.



Introduction

To get a better understanding of the assignment, a literature study has been executed. This study discusses several topics. After starting with a general overview of the healthcare system in the Netherlands, the research focusses more and more on the consulting room. This section is concluded with a research question, which will be used in the remainder of this report as a guide and *raison d'être*.

2.1 Healthcare

2.1.1 Healthcare in the Netherlands

Traditionally, healthcare in the Netherlands was separated into four different 'lines'/lijnen, from zero line care to third line care (table 1), based on the complexity of this care, and how patients get access to it (Hoogendoorn, 2018, "De lijnen in de gezondheidszorg", 2017, & Royal Haskoning DHV, 2018).

In the past few years however, the Dutch society has shifted from being a welfare state to a participation state, meaning that people will have to do and arrange more by themselves, as they are being asked to 'participate' in society.

Within healthcare this has led to a changing of the healthcare lines, in an attempt to bring healthcare closer to the patient. Bringing care closer to the patients is often done by making higher levels of care more accessible to patients. This has become a possibility with the introduction of websites and apps like 'thuisarts.nl' and 'Moet ik naar de dokter?' (Lips, 2017).

Healthcare in the Netherlands is relatively expensive. According to the World Databank, 9.5% of the gross national product (GNP) was spent on healthcare in 2014. This percentage increased to 10.9% by 2016 and the numbers are still rising (CBS, 2018, Koen – Zorgwijzer, 2017).

However, the high price of the Dutch healthcare system does pay off. It offers

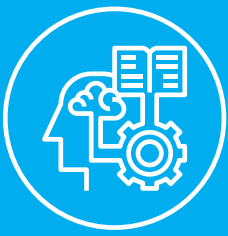
Thuisarts.nl

Websites like: 'Thuisarts.nl' can be used by anyone to get a better understanding of the symptoms they might be experiencing. By giving people access to medical knowledge they are able to get an understanding of what they are dealing with, and if it is nothing too serious, they can even help themselves.

Using websites like these can significantly decrease the number of visits to general practitioner and through that, health care expenses (Lips, 2017).

Line	Specifics
0	<p>What is it? Pre-emptive care without a patients request for help</p> <p>Offered by: Municipal Health service</p> <p>Examples: Vaccinations, National Health Researches</p>
1	<p>What is it? The first place you go when you are in need of general care</p> <p>Offered by: General Practitioner, Psychologist, Dentist, Obstetrician</p> <p>Examples: Minor diseases, Dental Problems, Childbirth</p>
2	<p>What is it? Specialized care which can be accessed through a first line referall</p> <p>Offered by: Hospitals and the specialists within; Neurologists, Radiologists and more</p> <p>Examples: Revalidation, Treatment of serious diseases</p>
3	<p>What is it? Highly specialised care</p> <p>Offered by: In the Netherlands the UMC's are third line care providers</p> <p>Examples: treatment of comorbidities</p>

table 1 The Dutch lines of healthcare explained (Nictiz, (n.d.) & Hoogendoorn (2018))



one of the highest qualities of care in Europe. It scores second place as Europe's best healthcare system (Björnberg & Phang, 2019), and third as the world's best healthcare system (Schneider, Sarnak, Squires, Shah, & Doty, 2017b).

Websites like thuisarts.nl and apps like 'Moet ik naar de dokter?' have already proven that they can be used to lower the healthcare expenses, by assisting people in deciding whether or not to go to a doctor. They not only allow for more self-management, they also lower the number of visits to general practitioners' offices, lowering the total healthcare expenses (Lips, 2017).

As healthcare expenses in the Netherlands are still rising, even though the expenses in most other European countries are flattening out or even declining (Kossarova, Blunt & Bardsley, 2015), it is important to aim to improve the consulting room and healthcare in the Netherlands, in such a way, it leads to a decrease in healthcare expenses. If this is not done, it will be hard to maintain an affordable healthcare system.

When trying to create a vision for the consulting room for 2030 it is therefore important to consider both the quality and costs of healthcare.

2.1.2 The Erasmus MC compared to other Dutch hospitals

To get a better understanding of the position of the Erasmus MC within the Dutch healthcare sector it will be compared to similar hospitals within the Netherlands. There are namely three different types of hospitals (Twerda, 2018).

First, there are regional hospitals. These are the hospitals people go to for the most common form of healthcare. When patients can't be treated by these hospitals anymore, they are often sent to specialized or academic hospitals.

Secondly, there are specialized hospitals. Specialized hospitals are often aimed at patients with a particular condition, like breast cancer or rheumatism. Due to the specialization into one specific condition, specialized hospitals are able to provide knowledge and experience.

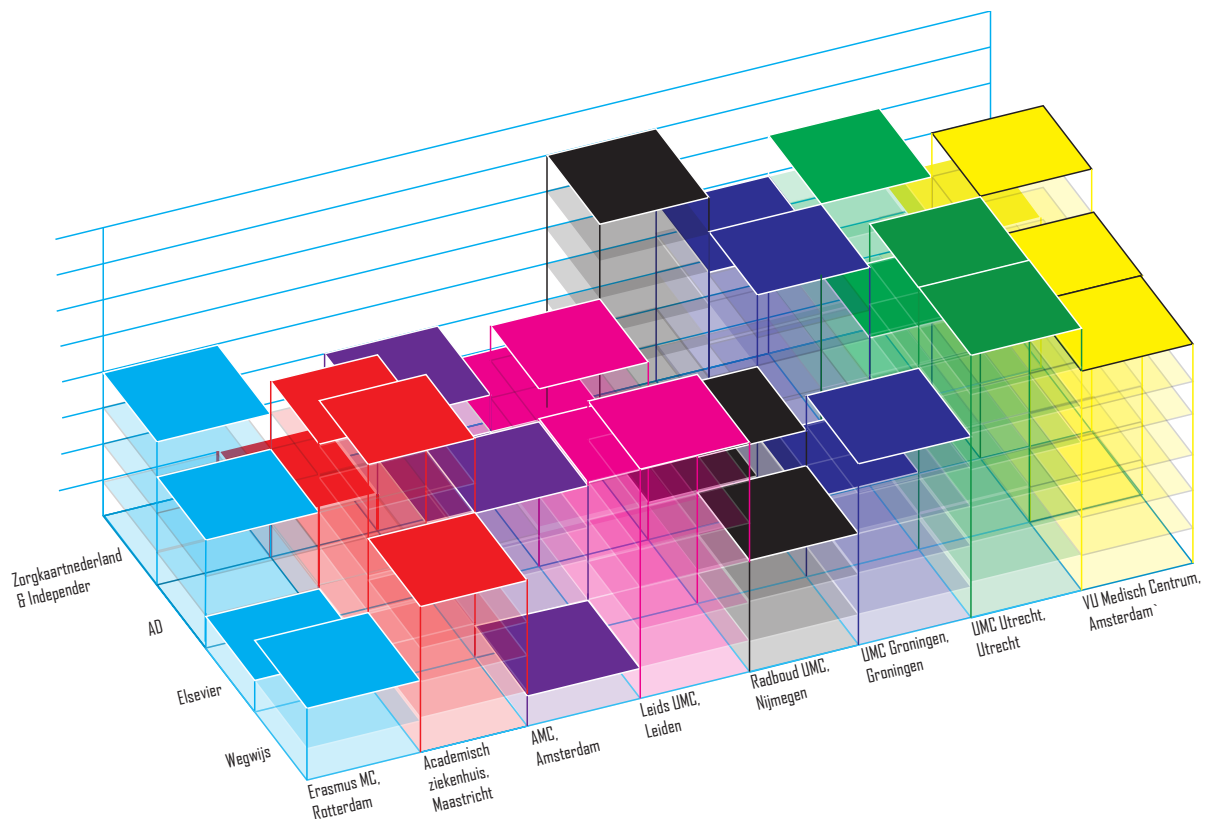
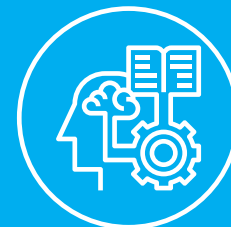


table 2 The different academic hospitals in the Netherlands compared to each other. The different scores are gathered from Wegwijs (2018), where the scores were taken from different sources which scored all Dutch hospitals.



Finally, there are tertiary, or academic hospitals (UMC's) in the Netherlands, of which the Erasmus MC is one. These hospitals are connected to universities and they offer care at a high level of complexity. At the same time UMC's are used for scientific research and to develop new treatments. (Independer, n.d.)

Academic hospitals can't be compared to the other types of hospitals, as they get less patients, offer more complex care, and have a higher mortality rating. Even though they are essential to the Dutch healthcare system, because these hospitals are at the frontier of medical research. (Wegwijs, 2018)

An overview has been created by Twerda showing the scores of academic hospitals compared to each other. This overview can be found in table table 2.

The Erasmus MC scores 5th to 8th place compared to other academic hospitals within the different studies. This shows that there is still room for improvement for the hospital. Sadly enough, the specific indicators used to set up these studies aren't given, so it can't be determined on which points the Erasmus MC should improve.

2.1.3 Rising healthcare expenses

As healthcare expenses in the Netherlands are still rising, even though the expenses in most other European countries are flattening out or even declining (Kossarova, Blunt & Bardsley, 2015), it is important to improve the consulting room and through that, healthcare in the Netherlands as a whole, in such a way, it leads to a decrease in healthcare expenses. If this is not done, it will be hard to maintain an affordable healthcare system.

The rising of the healthcare expenses in the Netherlands can be explained by a number of reasons (Vastelastenbond, 2015):

1. Aging population

Older people require more care. As the Dutch population is aging heavily, medical expenses will increase. Still, this growth is not as much as some may think. It is estimated that the increase in medical expenses caused by an aging population comes down to approximately 1% by 2040.

2. New Technologies

New technologies are expensive, but they are often cheaper than the existing ones. They can be used to cure formerly untreatable diseases. And they can be used to discover new diseases, for which a treatment needs to be developed. These technologies allow us to live longer and healthier, but that, again, increases the cost of healthcare in the Netherlands

3. Increase of people with a chronicle medical condition

Many of the diseases which were previously terminal, have now become chronicle conditions. There are also diseases like Asthma or diabetes, which seem to occur at a younger age due to a specific lifestyle (e.g. smoking, unhealthy diet). These chronicle conditions require lifelong treatments and lead to high medical costs.

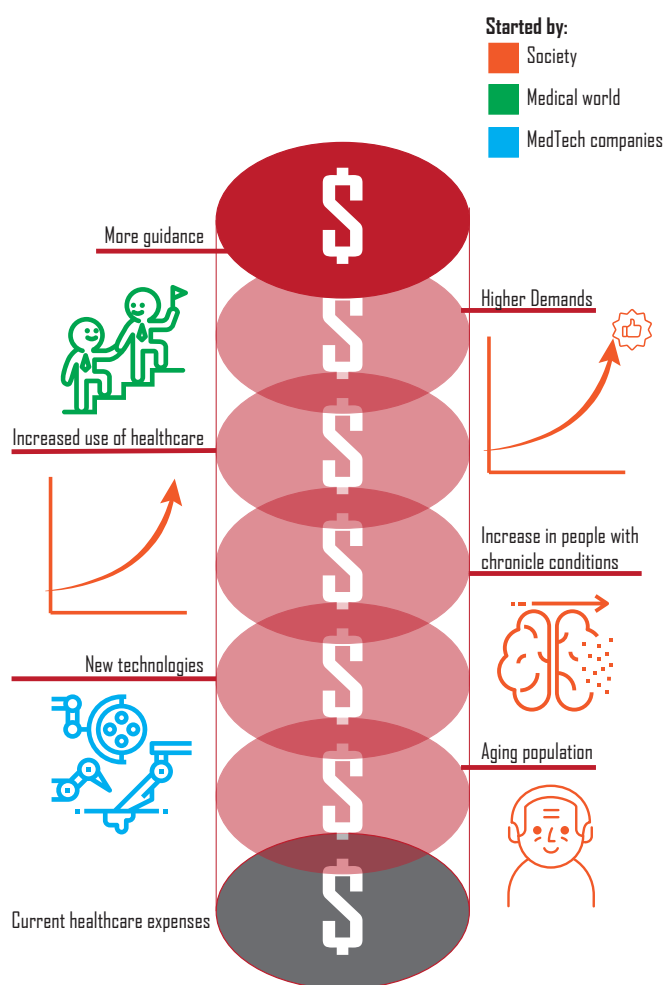


image 2 The causes of rising healthcare expenses and where they come from.



4. *Increasing use of healthcare*

People make more use of all types of healthcare, even though this isn't necessary. A number of visits to the general practitioner are often not necessary for example.

5. *Higher demands*

Besides wanting more care, people also want care of higher quality. An example of this is people not wanting to sleep in the same room in a nursing home anymore. This of course, also leads to an increase in costs.

6. *More guidance*

The Netherlands is shifting towards being a participatory state. In an attempt to help people who are lagging behind (e.g. elderly, sick and/or disabled) to be able to keep up with society, investments have to be made for them as well.

From the reasons the cost of healthcare is rising, not all can be traced back to the consulting room. The aging population (1), for example, is something healthcare itself can do little about. Making it a problem which can't be solved by healthcare.

The second reason, new technologies (2), should be a means to decrease the total cost of healthcare, as they should support healthcare professionals and patients alike, to achieve their goals without an increased effort. Of course, purchasing such equipment is expensive, such purchases should, however, earn back their investment costs over time.

The increase of people with a chronic condition (3) is also something which can't be really helped through innovation of the consulting room.

The final three points, increasing use of healthcare (4), Higher demands (5) and more guidance (6) all have touchpoints with the consulting room and can be addressed to lower the total expenses made in the Dutch healthcare system.

Concluding, it can be said that the Dutch healthcare system is one of the best in the world, but at the same time it is one of the most expensive ones as well. When designing a new consulting room, the aim should be to maintain, or rather improve quality, while at the same time lowering the expenses of the total healthcare system. This can be achieved by using new technologies to decrease the use of healthcare, answer higher demands and offer guidance to patients.



2.2 Innovation

This section will discuss innovation relevant when designing a future consulting room for the Erasmus MC. First, innovation within the healthcare sector in general will be discussed based on two reports. Next, Innovations specifically relevant to the consulting room will be discussed. Finally, Non-relevant medical innovations will be addressed. Based on the findings from the current and previous section, research questions are defined which will be presented at the end of this chapter.

2.2.1 Innovation within the healthcare sector

In 2018, both 'Rijksinstituut voor Volksgezondheid en Milieu' (RiVM) and Royal HaskoningDHV (RHDHV), released reports about the future of the Dutch healthcare system.

The report 'Volksgezondheid en toekomstverkenning' (Rijksinstituut voor volksgezondheid en milieu, 2018), discusses the future of healthcare in the Netherlands up to the year 2040. In short it can be said that they find the state and future of the Healthcare system positive, but there lie numerous challenges ahead.

Royal HaskoningDHV (2018), an international advising and consultancy company has done a Delphi study into the future of the Dutch healthcare system. The vision has been created for the year 2030. One of the most interesting findings they had was that hospitals as we know them are very likely to disappear. This will happen because care will become more localized.

To summarize the findings made through these papers, a visual overview has been made which shows the combined points of interest about the future of healthcare image 3. The full explanation can be found on the next page.

Conclusion

There are big changes coming to the healthcare sector. From this research it can be seen that a lot of these changes have to do with a change in our social lives and the medical culture.

Still, it is necessary to do more research into technical innovations. A lot of the changes which have been mentioned can be facilitated with these developments. The next part of this chapter will discuss these innovations and their relevance to this project.

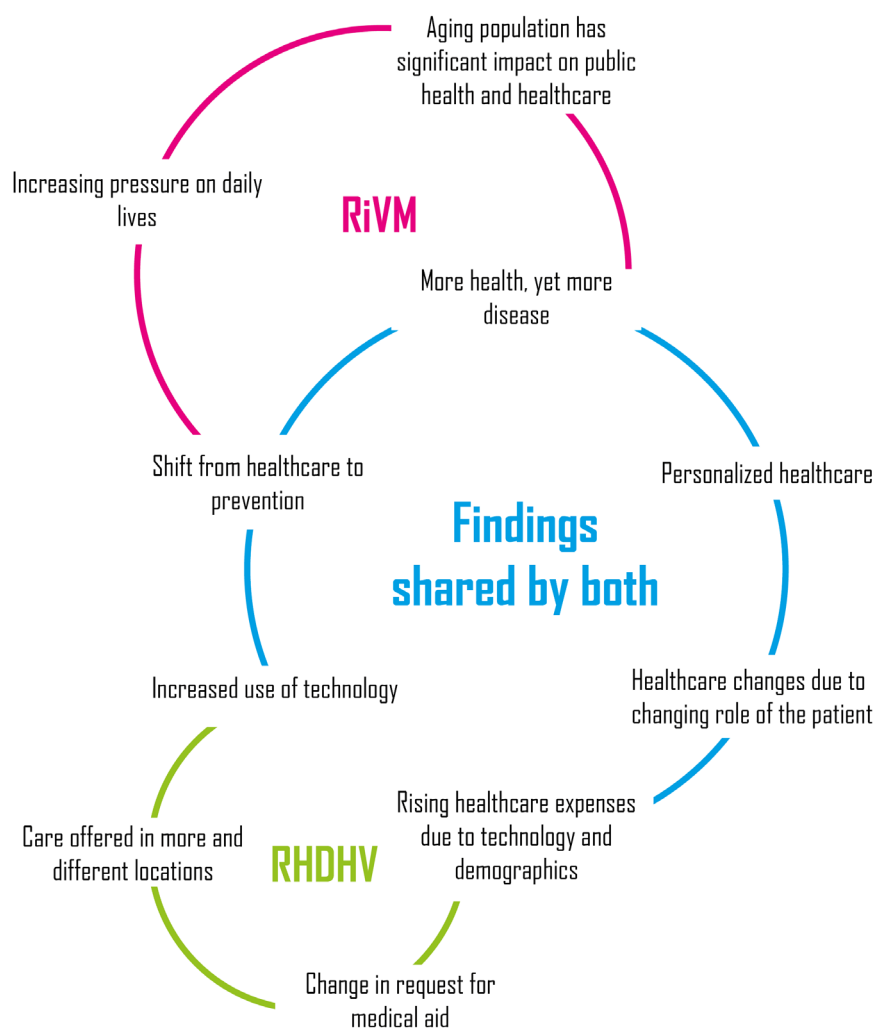


image 3 Most of the important insights are shared by both reports and they are therefore placed in the middle circle. Insights found in only one of the reports are placed in the circle of the respective report.



Points of interest shared by both:

More health, yet more disease

The life expectancy will increase from 81.5 in 2015 to 86 in 2040. The years added will be with good quality of life. On the other side, however, more people will have chronic conditions which come from the possibility to treat diseases like cancer, making them chronic instead of terminal

Personalized healthcare

This will be the standard, as opposed to the generalized care which is currently offered. Through knowledge of global medical data, it will become possible to offer highly tailored personalized care. Patients will take of themselves if possible, else the extra care will be purchased.

Healthcare changes due to the changing role of the patient

Patients will get to make their own decisions when it comes to their health. They will look to healthcare for information and guidance, yet they will make the decisions for their treatments themselves.

Rising healthcare expenses due to technology and demographics

Healthcare expenses are expected to rise with 2.9% yearly, leading to €174 Billion in healthcare expenses by 2040. This increase in expenses is caused for one third by an aging population and growth of the population. The other two thirds can be explained by other developments, such as new medicines or technologies.

Increased use of technology

Technology will only get a more significant role in the future of healthcare. It can be used to personalize care and aid patients in making their own medical decisions. For this to be possible, however, people should openly discuss issues like privacy and embrace technological innovations.

Shift from healthcare to prevention

By 2030, the focus will be on maintaining a patients' health and prevention of disease. Healthcare will become a pitstop in most human lives. Healthcare will still take place in hospitals, while prevention will mostly take place at a distance.

Points of interest according to RiVM:

Increasing pressure on daily lives

There is an increasing pressure on our daily lives, which can lead to stress and health issues. People who are probably mostly affected by this are working people with children and who are simultaneously informal care givers.

Aging population has significant impact on public health and healthcare

The percentage of elderly people is increasing in the Dutch society. Because of this, the number of people with chronic conditions like arthritis, neck- or back complaints is increasing. Besides that, these people are more likely to get multiple conditions. Dementia will be the number one cause of death and disease by 2040.

Points of interest according to RHDHV:

Care offered in more and different locations

Healthcare will no longer be bound to a physical location. This can be done because a significant part of care can be offered digital as well. More complex care will still be given in specialized health centers.

Change in request for medical aid

Patients will get more control over their health, treatment and well-being. Care will come closer to the patient and they will take a more active role by engaging in activities like self-monitoring.



This section of the report will focus on innovations relevant for the consulting room, found during the literature research.

After an online scan of technologies current available within the healthcare sector, an overview has been made of technologies which are currently being worked on which are relevant for the consulting room image 4. The different techniques have been clustered based on their purpose. This way, not all separate techniques have to be discussed, only their working principle/option made possible through their implementation.

2.2.2 Relevant medical innovations

2.2.2.1 Digital

Most sectors have adopted digital innovation in the past few years. At the same time digital innovation has found its way into the lives of most people in the Netherlands. Yet, the healthcare sector is still lagging behind on this front. During a meeting with MORE, 12th of march 2019, the student council of the Erasmus MC, one of the attendants mentioned that technology in healthcare is more than 17 years behind. Healthcare is being offered in an increasingly digital manner, though it still has some catching up to do, before it is as advanced as most technology people use in their daily lives and other areas of work.

The digital innovations which are currently being used and/or developed can be grouped into 4 domains. These domains are:

1. Administrative
2. Telecare
3. Imaging techniques
4. Analyzation techniques

These four domains will be discussed in the next page with their most interesting purposes.

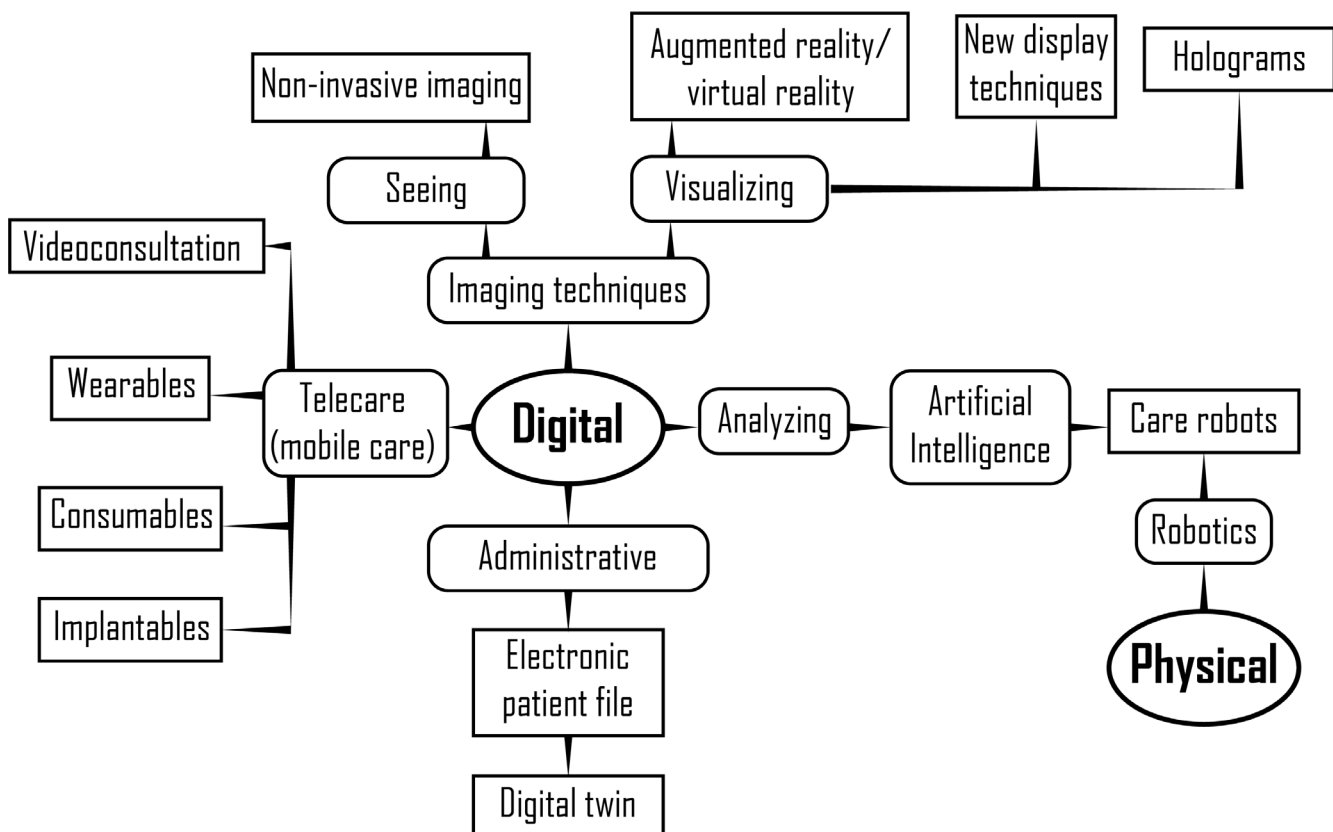


image 4 Overview of the identified technical innovations relevant for the healthcare sector



2.2.2.2 Administrative

One of the first administrative innovations implanted is the digital patient file image 5. This is currently still a digitalized version of the paper patient file, and it is said to be a crude means in this day and age to keep track of a patients' medical data.

There is luckily a new type of patient file in development. Which is called the 'Digital Twin'. the idea for the digital twin comes from aerospace engineering, when in the 1970s, NASA had to remotely come up with solutions for malfunctions of the Apollo 13, while it was in space. They did this by simulating the conditions the Apollo 13 was in, in a physical replica still on earth (Philips, 2019).

Since that moment, technology has advanced immensely. Instead of physical replica's, 'digital twins' are used in a number of industries. They are used to monitor engines of airplanes, model material flows, simulate an exact replica of a factory and more (ABB, n.d.).

Healthcare is currently working hard on adopting this technology, to allow for the delivery of data-driven personalized medicine. By feeding a digital twin individual and personal data, a digital model of the patient is created which can be used to study disease, drugs and new medical tools. According to Healthcare industry leaders and FDA authorities these models can help in the acceleration of innovation and approval of regulations (Marchal, 2018).

Concluding, it can be said that the digital twin is a digital copy of all medical data of the patient, which can be used to simulate different treatments and select the best one based on the outcome of the simulation. It is very likely that this technique will come to good use during a consultation, as it can be used as a tool by both patient and caregiver to determine the best possible treatment plan.

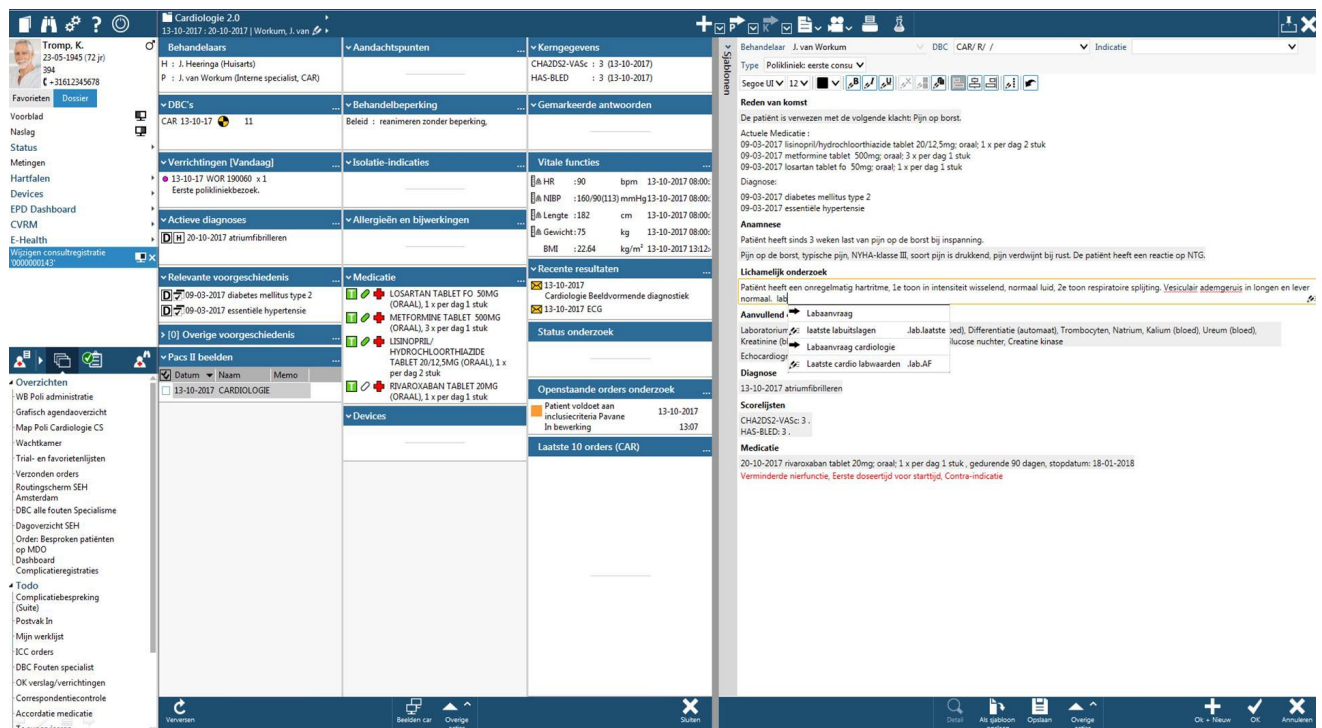


image 5 The current Electronic Patient File program HIX, used by the Erasmus MC.



2.2.2.3 Telecare

According to the TSA (TSA, n.d.), Telecare is:

"...Support and assistance provided at a distance using information and communication technology. It is the continuous, automatic and remote monitoring of users by means of sensors to enable them to continue living in their own home, while minimizing risks such as a fall, gas and flood detection and relate to other real time emergencies and lifestyle changes over time."

The applications found for telecare are: Video consulting and telemonitoring with the help of wearables, consumables and implantables.

Video consulting:

With this technique a consultation can take place over a distance. Instead of having doctor and patient in the same room, they have their conversation through a video calling service, similar to skype.

Telemonitoring:

Telemonitoring is the collection of data over a distance. This can be done with wearables, consumables and implantables. Telemonitoring is done with the help of the Internet of Medical Things.

The Internet of Things is a global (wireless) interconnected network of the internet, digital devices and humans. These devices can be anything, from computers to wearable devices or washing machines (Morgan, 2014).

When IoT is used to connect devices to the network for medical purposes it becomes the Internet of Medical Things. "... Collecting data this way is useful to gain extra insights into symptoms and trends – Econsultancy, 2019".



image 6 A visualization of a hypothetical IoT



Analysis Literature study

lo(M)T takes up a lot of bandwidth, and especially for medical information, it is important that it is reliable and secure. With the projected number of devices connected to the lo(M)T for 2020 reaching over 20 billion (Dr. Hempel Digital Health Network, 2019), which is far too demanding for the current 4G network, a technique which is being looked at to guarantee the network is protected and fast, is 5G. 5G will be the fifth generation of wireless networks (Magsi, Sodhro, Chachar, Abro, Sodhro, & Pirbhulal (2018)).

There are also concerns towards this new technology. As it is more powerful, it also releases more electromagnetic radiation. In 2017, a group of over 180 scientists even sent an appeal to the European Union, to warn them of for the potential dangers of implementing a 5G network and they urged that an independent research was done before it is implemented (JRS ECO, 2017).

It is said that T-mobile, a network provider, will roll out 5G in the Netherlands at the beginning of 2020 in The Hague, where their Dutch headoffice is located. Before T-mobile, and other network providers can cover nationwide they have to have approval from the government (Mens, 2019).

A lot of people already monitor themselves by making use of wearables, and there are already video consulting services available. It is, therefore, plausible to assume that these techniques will develop even more in the following years, to eventually become an essential part of healthcare.

With loMT, providing care over a distance has become a possibility. Data collection can be done with the help of wearables and consultations can be replaced with video consultations. Healthcare does not have to be practiced from a single location, and patients do not have to go to a hospital if they want to talk to their doctor.



image 7 A visualization of the Light Field Deck created by LightFieldLabs

2.2.2.4 Imaging Techniques

Over the past decades, imaging techniques have improved as well. Not only the resolution of imaging has improved, but new ways to display images are being created as well.

Light field displays:

According to van Hooijdonk (2018), one of the new display techniques of the future will come in the form of light field displays. Transparent screens on which an holographic image is displayed with the help of lasers (Chinnock, 2018). The images created with this type of display can already be used to create a 3D-image behind the screen image 7. Light field displays are currently already being used in augmented- and virtual reality glasses such as the Oculus Go and the Microsoft Hololens. Although the first smartphone with this imaging technique was introduced in October 2018 by Red, a camera manufacturing company (Holland & Hollister, 2018).

Augmented Reality and Virtual Reality glasses

Augmented reality and virtual reality are two very similar imaging techniques, which project a digital image on a pair of glasses right in front of the eyes of the user so it is placed in the space the user can see. The difference between the two techniques comes from the immersion created by the glasses image 8.



Analysis Literature study

Virtual reality is created for full immersion. Users who put on virtual reality glasses get to see a fully digital image projected in front of their eyes. It should, however, be noted that the users view of the world outside the VR-glasses is completely blocked.

Augmented reality can be created in two different ways. The first is through an optical see through. Devices that use this technique allow the user to watch through optical elements which allow for a graphical lay over on the real world. The second way is through video see through. With this technique the user views an image which is first captured by one or two cameras. This image is then combined with computer generated images for the user to see (Chinnock (2018), Hackernoon (2018)).

AR- and VR-goggles can be seen as a new medium because they offer new ways to communicate. Yet, these new display techniques are still in development and companies are already working on getting rid of the bulky AR-/VR-glasses. Light field lab (2018), is for example currently developing a Star Trek 'Holodek' in which no glasses are needed to create a virtual real-life experience image 7.

The new medium created with these new visualization techniques can be used in future consulting rooms to improve communication between doctor and patient. How these new visualization techniques will be used in the future is currently unknown, as the techniques are still developing. Yet, the possibility to communicate in a virtual, holographic or augmented manner allows for innovative new types of interactions.

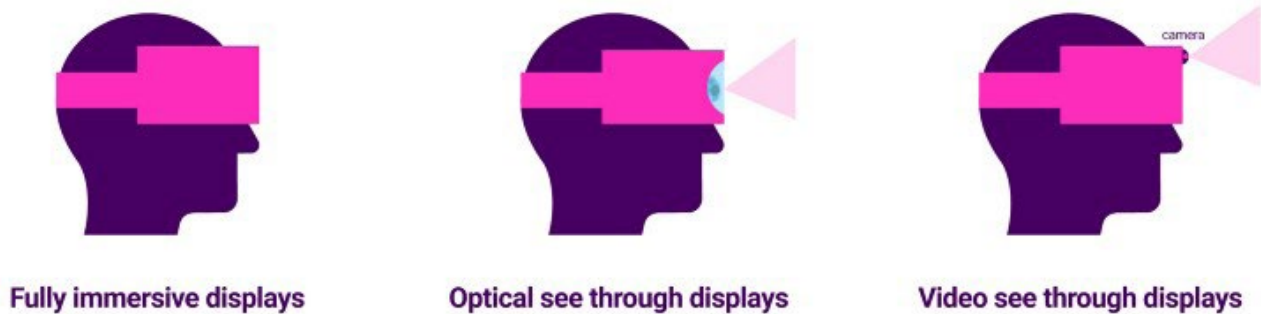


image 8 Different types of VR- and AR goggles Source: Hackernoon (2018)



2.2.2.5 Analyzation techniques

The final, and perhaps most promising, technique currently in development and already being used in healthcare is Artificial Intelligence (AI). AI was described in the 1950s by Minsky and McCarthy as:

any task performed by a program or a machine that, if a human carried out the same activity, we would say the human had to apply intelligence to accomplish the task.

(Heath - 2019)

Nowadays, AI is omnipresent in our daily lives. It can be used to give its' users recommendations on what to buy, recognize spam, detect credit card fraud and more (Heath 2019). Besides these features, AI can also be used to improve healthcare. There are, for example, already forms of AI which are able to identify tumors more accurately and faster in patients than actual radiologists (e.g. IBM's Watson, Googles LYNA) (Steadman (2017) and Wiggers (2018)).

Bejjani (2019), states that AI can also be used to improve the life of healthcare patients. Diagnostic software can triage patients, for example, helping them to determine if, and what specialist they might need.

There some downsides to AI as well which have to be taken into account. AI learns from the data that is put in. This means the datasets need to be representative for the AI to work, otherwise it will learn the wrong lessons and treat them as right (Bejjani, 2019).

For an AI system to work in the Dutch healthcare system it will therefore need to have a representative sample of the Dutch population to be able to come to the right conclusions.

Another downside of AI is social acceptance. Society is going through significant changes, and some people think their job might be taken over by forms of AI. McKendrick (2018), says this is an unnecessary worry, as long as companies and CEOs invest in finding new jobs with less repetitive tasks, which can be taken over by AI and more tasks where human involvement is required. For healthcare this means that it is wise to start looking at jobs which might be (partially) taken over by AI to see how these repetitive tasks can be replaced with higher level tasks which are satisfying for humans to fulfill.

AI is capable of taking over a number of tasks of humans already and it has a place in healthcare. For AI to reach its' full potential the mentioned downsides need to be addressed. Otherwise the validity of and trust in this technology making it practically useless.



2.2.2.6 Physical

The most interesting physical development is the introduction of robotics into the healthcare sector. Robots are able to take over, or assist in a number of daily tasks. Yet, they are currently unable to care for patients in an empathic manner.

Robotics (Murison, 2018 and (Al Jazeera English, 2017, Samsung, 2019, Softbank Robotics, n.d., and Robot Care Systems, 2019):

One of the first new physical techniques which can be found for the future of healthcare are (care)-robots. Some robots can be used to perform surgeries, which is not really relevant for the consulting room as surgeries are usually not performed during a consultation. An example of such a surgical robot is the Da Vinci surgical robot. With this robot the doctor performs a surgical by programming it into the robot.

Robots which are more relevant are non-surgical care-robots image 9. These types of robots focus on caring for their patients in a more social way. This is done by their ability to measure biometrics, give reminders to take medication, or even assist patients in rehabilitation.

Yet, it is still hard to imagine these care-robots finding their place during a consultation. As there seems to be no specific need for these robots during a consultation.

Some examples of these care-robots are: Samsung care-bot, LEA and Pepper

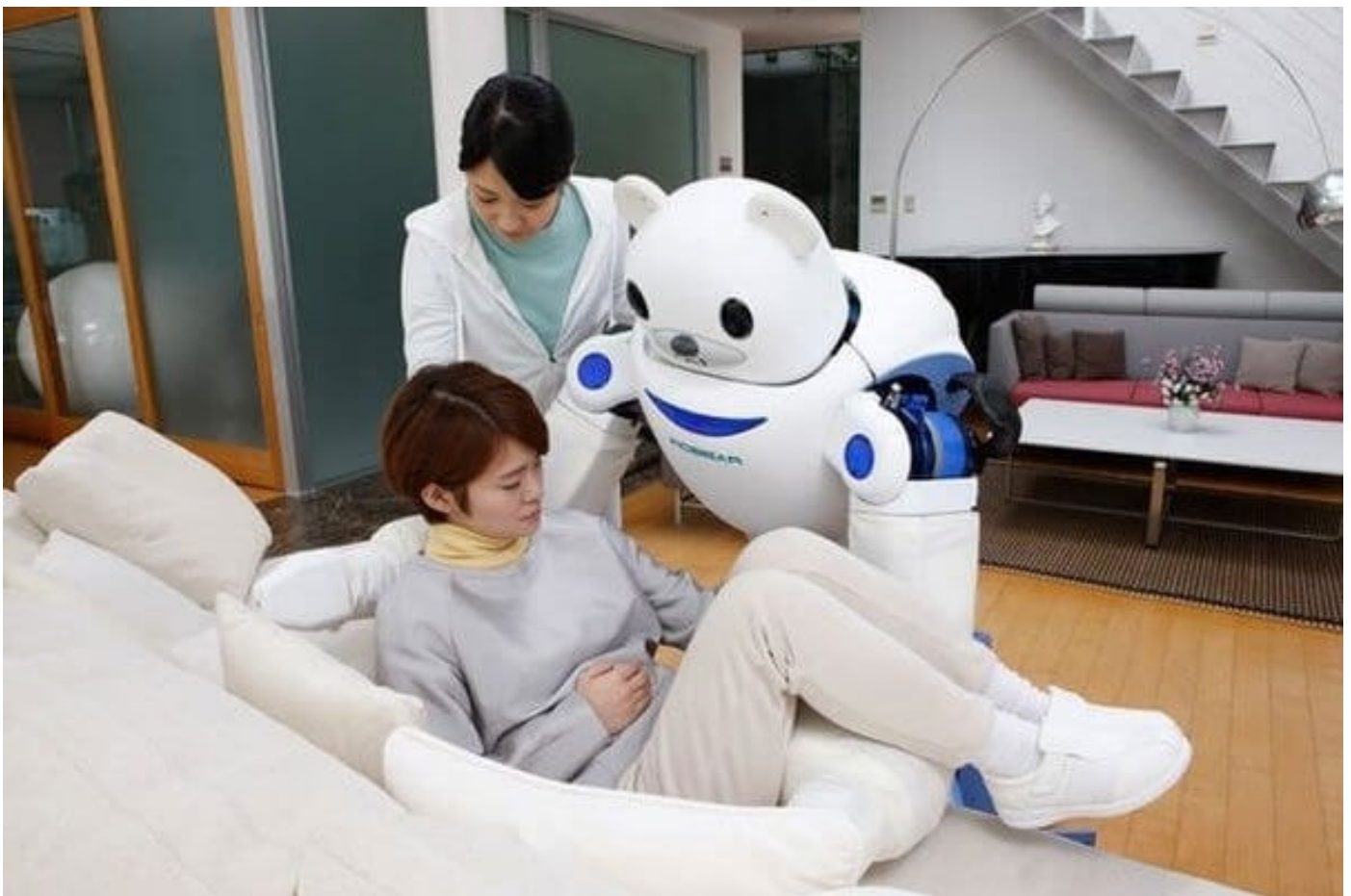


image 9 A Japanese care-robot. Murison (2018)



2.2.3 Non-relevant medical innovations

As mentioned above, there is a number of (medical) technologies in development which can significantly disrupt the possibilities of healthcare. There are, however, also developments which are promising, but not yet relevant to the consulting room. These developments are:

Biomanufacturing (van Hooijdonk, 2018)(Berman, 2016)(Hoover, 2017)

Biomanufacturing is a production technique which uses biological system to create biomaterials which can be used in medicine, but has other applications as well.

Medical applications of this technique are endless. It can be used to create bio-degradable heart stents, regenerate nerves, and smart pills which can measure the medicine intake of a patient.

Examples: Hormones, enzymes antibodies

Relevant to the consulting room?

No. It is too complex to use this treatment during a consultation.

Implantables (van Hooijdonk, 2018 and IEEE EMBS, 2019)

Because of all technological advances of the past few decades it has become possible to create miniature monitoring devices which have a plethora of applications.

Implantables sense parameters of variable diseases and they can transfer the collected data to a remote health center, direct the patient to take specific action, or automatically perform a function based on the sensors' output.

Examples: Smart tattoos, Dermalily implanted sensors

Relevant to the consulting room?

Yes, but not directly. Using implantables is useful before or after a consultation. Yet, actual bio-medical data collection is not done during a consultation itself.

CRISPR-CAS6 (van Hooijdonk, 2018)

CRISPR (Clustered regularly interspaced palindromic repeats), is a technique which has been discovered in the 1980's. Originally, CRISPRs are sequences of virus-DNA saved by bacteria to protect themselves against viruses, by cutting up any piece of DNA carrying the CRISPR saved by the bacteria. It has been discovered, however, that it is also possible to adjust CRISPR in such a way that it can be used to precisely recognize and cut up any piece of DNA. This has led to the possibility to adjust any DNA, even human DNA (Van Straten, Van der Lende, & NPO Focus, n.d.).

Examples: Cure hereditary conditions, create or alter (new) species

Relevant to the consulting room?

No. Currently this technique can not be used during a consultation as it is too complex. Also, the long-term consequences have to be considered. As changes made through using CRISPR are permanent and may lead to significant impact on the human race because the sequences are hereditary.



Overview of the most interesting innovations

Interesting innovations which are going to have a significant impact on healthcare can be seen in image 10 below. For a full size image, see appendix I.

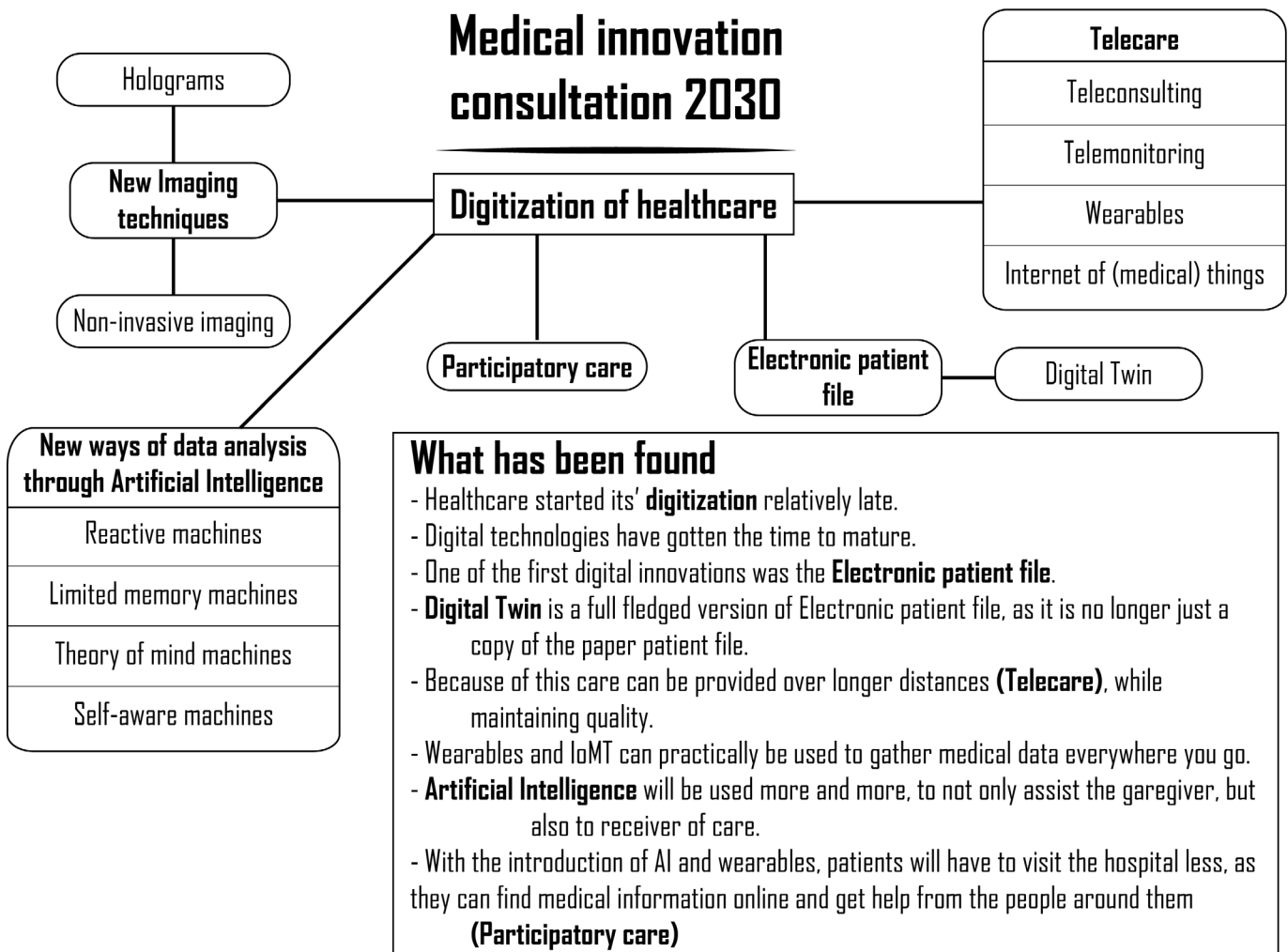


image 10 An overview of the most impactful innovations with regards to the consulting room.

Analysis

Research questions and Conclusion



2.3 The consulting room

For this project it is important to consider that a consulting room doesn't necessarily have to be physical anymore by 2030. Cambridge Dictionary defines a consulting room as:

"An office where a doctor talks to and examines patients."

- (Cambridge Dictionary)

It is however, important to determine why a consulting room should or should not be a physical space. The way it is defined in the Cambridge Dictionary makes it look like the consulting room is a room because it offers a private space where doctors can talk and examine their patients.

Yet, an increasing number of interactions taking place in a consulting room can be achieved in the digital space as well, negating the need for a physical consult.

To clarify, de Haes and Bensing (2009), identified six functions of medical communication, which currently, mostly occurs during a medical consult between caregiver and patient. The six functions identified are: (1) fostering the relationship, (2) gathering information, (3) information provision, (4) decision making, (5) enabling disease and treatment-related behavior, and (6) responding to emotions. All of the functions defined can actually be satisfied to a certain extent. It can also be imagined that through innovations in the coming ten years, some of these functions can eventually be fulfilled better in the digital space, then the actual physical space.

Because of this shift in the 'space' a medical consultation can take place (digital or physical), the decision has been made to step away from the idea to create a physical consulting room.

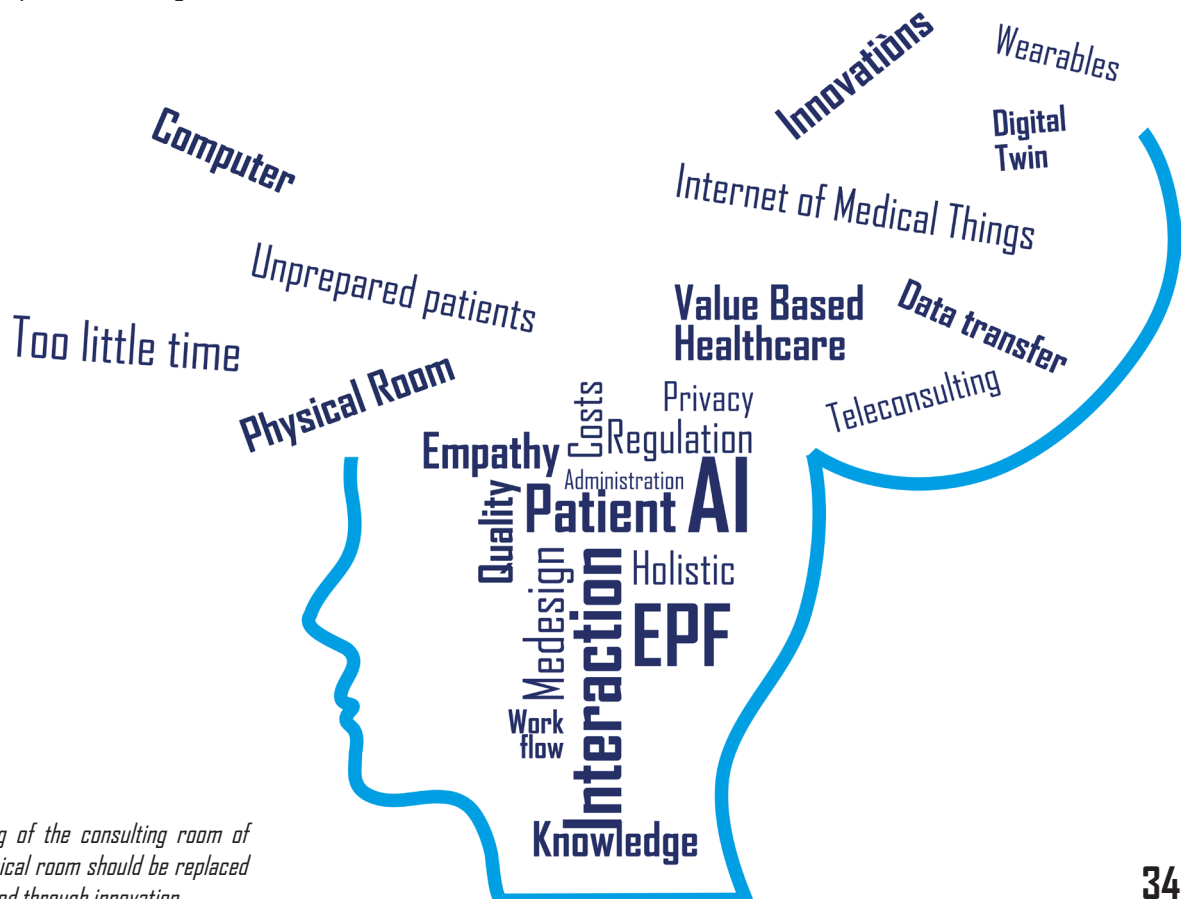


image 11 When thinking of the consulting room of 2030, the idea of a physical room should be replaced by the possibilities created through innovation.

2.4 Research questions

Based on the project assignment and the literature research, a number of research questions has been set up. The research questions are:

1. What will healthcare look like in the year 2030?
2. What technologies are currently in development that will be useful during consultation in 2030?
3. What will a consultation look like in the year 2030?

These questions will be answered throughout the report and a complete overview of the answers to the research questions can be found in the final chapter, Vision 2030.

2.5 Conclusions

The Erasmus MC is an academic/tertiary hospital, offering the most complex form of care as the hospital is focused on coming up with new treatments and treating patients who can't be helped in regional hospitals. Among the eight academic hospitals in the Netherlands, the Erasmus MC is ranked with the final four in different evaluations. This suggests there are still points on which the Erasmus MC can improve.

Healthcare in itself is currently going through significant changes which are disrupting the entire industry and which will lead to a completely different view on healthcare by 2030. A number of these changes is caused by changes in society and others are caused by innovation. These changes can improve the healthcare sector. It is, however, important that these changes are guided into the right direction. Especially the technical innovations as these might have unforeseen implications.

As there are many changes and innovations are going on right now, the decision has been made not to design a vision for a physical consulting room. This decision has been made as it is impossible to determine what materials, techniques and products will be used in ten years' time. Healthcare is also becoming more digital, which implies that the consultation room of 2030 does not necessarily have to be physical.

Therefore, instead of a physical consulting room, a patient journey has been created which shows applications of potential techniques which can be used to improve a consultation.

The next chapter will discuss the user- and field research and Delphi study. The research have been done to expand upon the literature review and to gather insights from people who actually work with and around a consulting room.

Summary of the analysis chapter

Innovation within healthcare

Currently there are a lot of developments which might impact the healthcare industry. These developments will lead to different changes within healthcare, some will be cultural changes and others will be technological.

The cultural changes which are likely to come to the healthcare sector are:

- Healthcare will become more personalized
- The role of the patient is changing, patients will take a more active role in their treatment
- There will be a shift from healthcare towards prevention
- Care will be offered in more and different locations
- There will be a change in requests for medical aid

The most impactful technological innovations identified are:

- New imaging techniques
- TeleCare
- Artificial Intelligence (A.I.)
- Digital Twin

These are the changes that are likely to change the healthcare industry. The technological innovations allow for new ways to practice medicine and the cultural changes are expected to follow.

The consulting room

For this project, it is necessary to step away from the idea of a physical consulting room. Instead, it is more productive to look at a consultation, the reason people come to a consulting room.

Before departing from the idea of a physical consulting room the goals of such a room are identified by de Haes and Bensing (2009). The goals of the consulting room are:

1. Fostering the relationship between doctor and patient
2. Gathering information
3. Information provision
4. Decision making
5. Enabling disease- and treatment-based behavior
6. Responding to emotions

With these six goals of the consulting room identified, it is now possible to let go of the notion of a physical consulting room. From here on out the paper will look at ways to prepare consultations at the Erasmus MC for the year 2030.

Conclusion of the analysis chapter

Research questions

The research questions set up and that will be answered at the end of this report are:

1. What will healthcare look like in the year 2030?
2. What technologies are currently in development that will be useful during consultation in 2030?
3. What will a consultation look like in the year 2030?

3. Research

Introduction

Field Study

DDW

Method

Results

Conclusion

Medica

Method

Results

Conclusion

Conclusion

Expert interviews

Method

Results

Conclusion

Conclusion



Introduction

To get an overview of the current medical innovations and developments two different types of research were performed during the research phase.

Field study

To get an overview of current healthcare products and innovations within the healthcare sector a field study was done by visiting the Dutch Design Week and Medica in Germany, one of the biggest medical trade fairs in the world. Combined with the literature study the field research will be used to create a roadmap, which in its turn will be used in the user research.

Expert interviews

Next, a user research was set up, in the form of expert interviews. The insights gathered through these interviews have been used to set up a Delphi research. In the final round of the Delphi research, the roadmap, created with the results from the field- and literature study, will be used to come up with a vision of a treatment process for 2030.

The findings from the analysis phase will be used to create a vision of scenario of the consulting room of 2030.

Delphi Study

Finally, the Delphi study will be discussed, a four round research designed to collect insights about contemporary healthcare and consultations, which were then translated into a future imeline for a consultation which is checked by medical experts.



3.1 Field Study

Introduction

To get an overview of current medical innovations the Dutch Design Week (DDW) and Medica, one of the largest medical trade fairs in the world, have been visited. This section goes into these visits and discusses the insights gained at these events.

After discussing both the DDW and Medica separately, an overall conclusion will be given about the insights gained at these events.

3.1.1 DDW

The Dutch Design Week is an annual design festival based in Eindhoven, which, at the time of visiting took place from October 20th until October 28th. It's a place where over 2600 designers get to present their concepts to over 300.000 visitors. During the DDW there are over 110 locations with different types of expositions.

For this project we visited the Philips Museum and the 'Embassy of Health', as they both had expositions focused on healthcare.

Method (Observation, n=27)

The visit to the DDW was set up as an observation. Beforehand the most interesting locations were selected. The first location was the Philips Museum, as Philips has been a pioneer in healthcare and their museum was used as an exhibition for healthcare innovations produced by Philips. The second location was the 'Innovation Powerhouse', which was home to the 'Embassy of Health'.

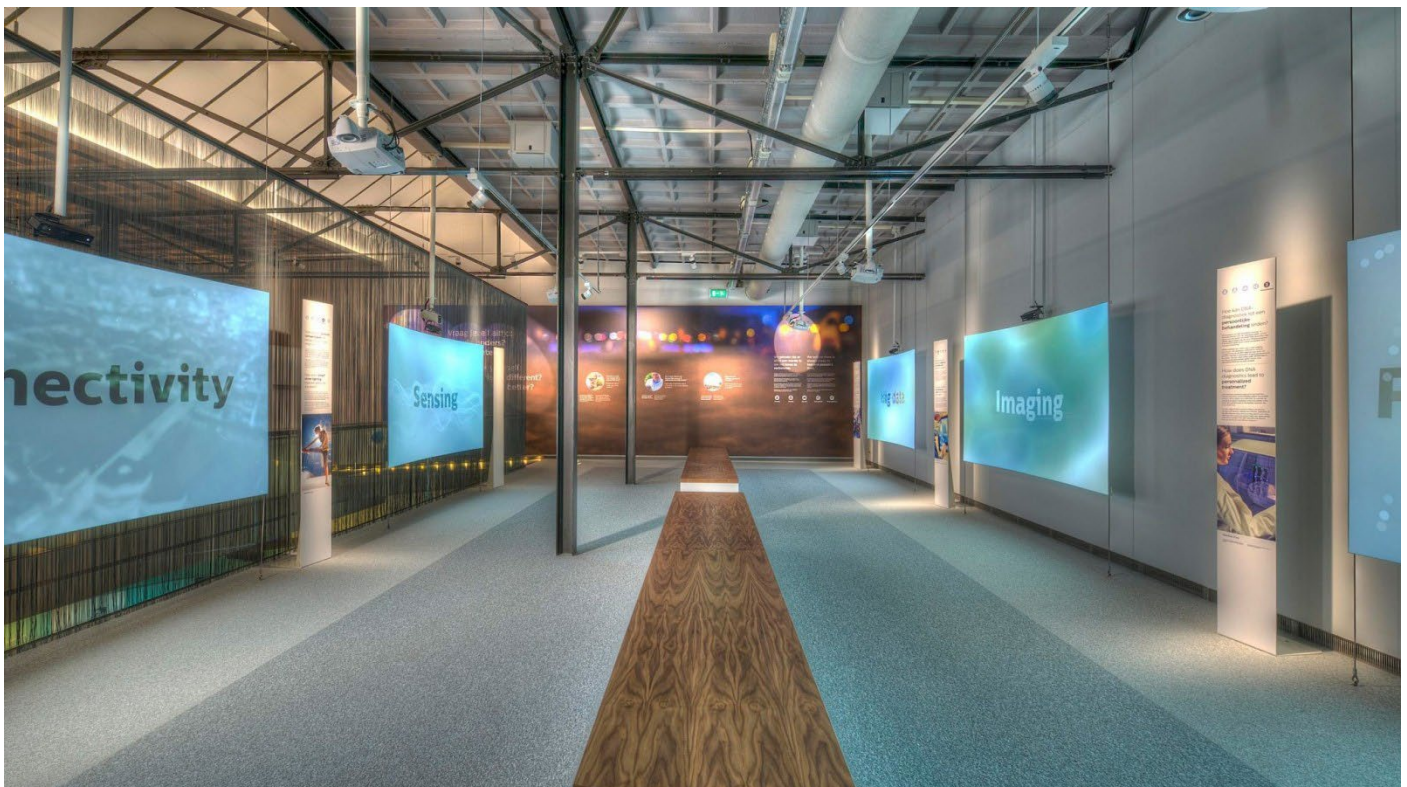


image 12 Entry hall to the medical section of the Philips Museum in Eindhoven. The different screens showed different types of healthcare innovation Philips is currently working on. 10-2018



Results

Most innovations and ideas presented at the DDW, showed a way how care could be delivered in the future. This might not seem relevant for a consulting room of the future at first, but as these concepts helped to sketch an image of the state of healthcare by 2030, the insights gathered still seem to hold value for this project. An overview of all techniques and technologies seen at the DDW can be found in appendix 5.

The Philips Museum

This Museum was chosen to visit, as Philips has a healthcare division which is focused on developing new medical technologies (“Zinvolle innovaties in de gezondheidszorg | Philips Healthcare”, z.d.).

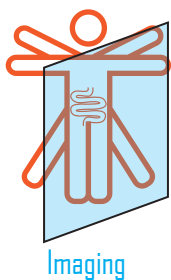
During the DDW, this museum was used to exhibit some of the award winning healthcare technologies developed by the company. The relevant technologies found there are described below.

Inside the Philips museum there was a presentation on the most innovative medical techniques developed by Philips. These techniques were presented through videos in which the new techniques and their applications were explained. The three most interesting techniques will be explained in the following section:



Sensing:

Sensing can be described as remotely perceiving and/or measuring a certain physical value with the help of sensors. Currently, Philips is looking into the possibilities and applications of this technology. Right now, it can not only be used to check your own health, by showing you your blood pressure or heart rate, but it can also be used by doctors and nurses to check the health of their patients remotely.



Imaging:

Imaging is the ability to generate images of the body of a patient without having to actually enter the body. Currently existing examples of this are the MRI-machine and the X-ray scanner. Philips, however, is working on even more advanced systems and software, allowing for more precise images. These images of higher resolution allow doctors to look inside a body during surgery by only making a small incision, and sometimes it is even possible without the doctor having to make an incision.



Personalization:

Personalization allows for tailored treatment- and prevention plans for individual patients. For example, by analyzing the genetic properties of the disease carried by the patients. Philips states that this way of treatment will become more important. Because of this increasing importance, Philips is developing devices and software to help doctors choose the most suitable treatment for their patients.



There were more innovations exhibited at the Philips museum, such as a portable ultrasound device and a new program aimed at workflow optimization for caretakers inside a hospital. Still, these innovations are not taken into account as they do not show a clear relation with a consulting room.

The three techniques discussed above, however, are relevant as they illustrate how healthcare is changing and what direction it is taking for future developments.

The innovation powerhouse

The Embassy of Health was the second location visited during the DDW. It was located at the Innovation Powerhouse where there was an exhibition of all types of medical design and -innovation. Besides the exposition, a visit was paid to the meeting: "Health and Big Data", located at de Waag as well. The gathering was organized by 'NWO' (Nederlandse organisatie voor Wetenschappelijk onderzoek | Dutch Organisation for Scientific Research) and 'Stimuleringsfonds creatieve industrie' (Incentive fund creative industries).

The meeting itself was focused on bringing designers, healthcare- and life science professionals together. This was done through a number of presentations in which different designers explained how they applied their design strategies on healthcare related projects. An overview of the different innovations found inside the Innovation Powerhouse can be found on the next page (image 13).

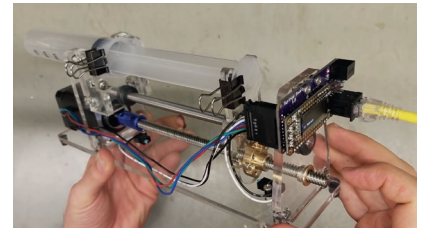


Research Field Study



Tiger Penis Project

A project aimed at maintaining cultural medical traditions whilst at the same time merging them with traditional medicine. This is done to prevent the poaching of endangered animals. By replacing biological materials with synthetics.



D.I.Y. Syringe Pump

A syringe pump which can be fabricated with a 3D-printer



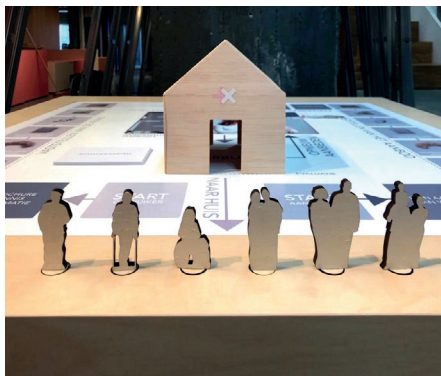
Artificial Womb

An artificial womb to help premature born babies grow.



Smart furniture Sensor

A syringe pump which can be fabricated with a 3D-printer



CareBnB

A new way to provide care. Instead of going to the hospital to be taken care of, patients can go to a careBnB to be taken care of by their peers or strangers.



NITI Support Stocking

A stocking which offers comfort to the user, which is easy to put on and take off.



Design for Flies

Let patients with rare conditions test their medication on flies.

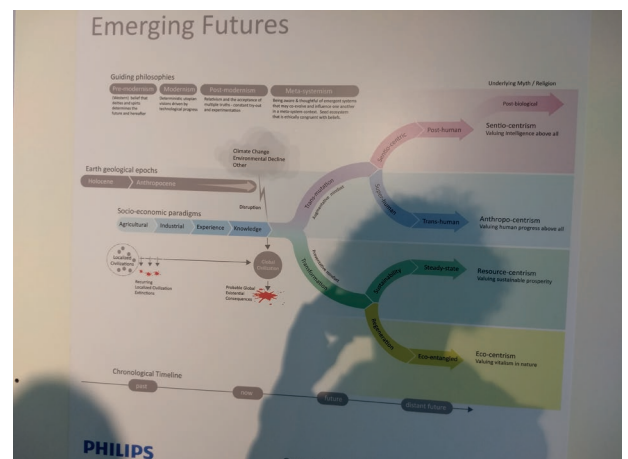


image 13 A short overview of the most interesting projects found at the Embassy of Health at the DDW 2018

Emerging (Medical) Futures

An overview of Philips, showing the different directions society and healthcare might develop in, in the possible future



3.1.2 Medica

To expand upon the overview of current innovations within the medical sector created, a visit was paid to the Trade Fair Medica, in Düsseldorf Germany as well. With over 5.200 exhibitors and 130.000 trade fair visitors, Medica is one of the biggest international medical trade fairs.

There were all kinds of companies present, which were selling everything health related, from precise actuators to medical lasers.

For this project, the most interesting techniques and innovations shown at the fair were the innovations which were able to disrupt the health care system at multiple points within a hospital or healthcare practice. To be more precise, the innovations for which Medica was visited were the ones related to digitization.



image 14 The 'Welcome'-banner at Medica 2018



Method (Observations & unstructured interviews, n=23)

For this project, the most interesting techniques and innovations shown at the fair were the innovations which were able to disrupt the health care system at multiple points within a hospital or health care practice. To be more precise, the innovations for which Medica was visited, were the ones related to digitization and telecare devices.

In the warehouse where these products were presented, all stands of the vendors were visited. Still not all will be discussed as not all of them held products relevant for the purpose of the visit. The more interesting visits and technologies will be discussed in detail in the following section.

Results

To get a clear overview of the relevant medical technologies which are currently being developed several distinctions have to be made. As the goal of this project is to develop a consultancy room for the Erasmus Medical Centre and general practitioners (gp's), a first distinction can be made in whether or not medical innovations are relevant within the area of work which is currently covered in consultancy rooms for both the hospital and gp's.

A second distinction can be made for the technologies which are relevant for this project, by looking at the target user for each technology. The distinctions which have been determined are the following:

- *Techniques and innovations for practitioners*
- *Techniques and innovations for both practitioners and patients.*
- *Techniques and innovations for patients*

This distinction is made to get an understanding of the amount of influence each stakeholder has when a certain technique is being used.

The different groups of techniques and innovations are shown below, along with the requirements for a technique to fall into one of the different groups and an overview of the found innovations within this area.



3.1.2.1 Techniques and innovations for practitioners:

These kind of techniques and innovations are specifically designed to be used by medical personnel. These innovations can be used by practitioners to for example diagnose their patients, or to keep track of their medical data. A list of these techniques and innovations can be found on the following pages.

KOMEET

Komeet (Uniklinik Aachen, Philips Aachen, Pixelus Köln, 2017) is a tool developed to enable improved health care quality and patient safety through digitization. It is aimed at healthcare professionals and it allows them to track the condition of the patient easier.

The tool works through an app which can be used to input patient data in the correct patient file very easily. Usually, when medical data of a patient has to be registered, the data has to be read from medical devices and put into a patients' medical file. With KOMEET doctors and nurses can simply take a picture of the screen of a medical device (image 15), and as most screens are standardized, KOMEET will be able to identify the required information and put in the patients' medical file directly.



image 15 Administration can be done by taking pictures with the help of KOMEET.

KOMEET can be used in all kinds of different segments of the healthcare sector. An example given at the fair was for patients who have to lie in bed for a longer period of time. For these patients it is important that they change their position every now and again to prevent bedsores. By attaching a QR-code to the handle of a hospital bed the angle of the bed can be easily determined and registered by KOMEET. This is done by taking a picture of the QR code, and by comparing the angular position of the QR code compared to the position the phone is held, the angle the bed is in can be determined. This enables nurses and doctors to see when and how much the position of the bed has changed. These are just some minor examples, but they are a clear indication of how digitalization can influence healthcare. It takes away time-consuming work, and offers a new way to collect data about patients and the way they are treated.



Multitone Electronics

Multitone was present at Medica to promote their module Appear. Which is a tool for practitioners to give up their availability, which allows for easier planning and making groups (for, for example the surgery of an IC patient).

MultiTone is a company which focusses on healthcare communications. Appear is already available, and it is highly likely that we will only see more and improved versions of their product in the future. It is, however, a good example of a digitized workflow system for the healthcare sector.

Bio-Tekna

Non-invasive body composition scanner, can be used to determine one's body composition within 10 seconds to 5 minutes (highly likely that it will be implemented in consultancy rooms as it is small and fast).

Products like these can be used within consultancy rooms during a consult, as they take up little space and time, but they can give a physician data which can not yet be gathered by patients. As this product already exists, it is highly likely that a cheaper, more reliable version will be developed by 2030.

It is imaginable that this technique will be developed so far by 2030 that most patients will have a similar function on their personal device. This would allow for patients to analyze their body composition by themselves, negating the need to visit a doctor or specialist to determine their body composition.

This is in line with the trend that patients gather more and more data about their persona lwell being.

Handshoe Mouse

The Handshoe mouse is an ergonomic mouse developed specifically to minimize strain on the forearm to prevent Repetitive Strain Injury (RSI) and Carpel Tunnel Syndrome (CTS) (image 16).

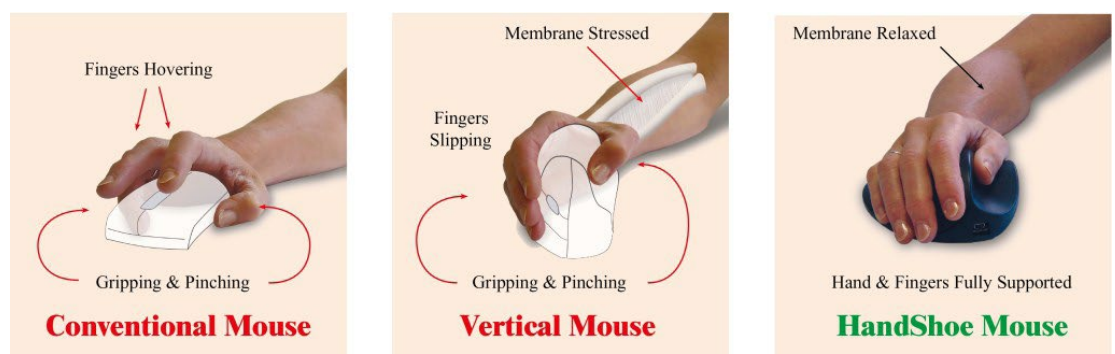


image 16 Flyer explaining how the handshoemouse is better than other types of computer mice.

Evolution of the Mouse



3.1.2.2 Techniques for both practitioners and patients

The following techniques and products are useful for both practitioner and patient, as they often create a network between the two. Within these systems it is often the case that the patient is monitored, with the ability to access their own data. The caretaker often also has access to this data, and is notified when the patient seems to be in need of medical attention.

Below is a collection of the most interesting techniques for both practitioners and patients.

Compugroup Medical

Compugroup Medical is a company specialized in developing software (ehealth) for the healthcare sector. The main aim of the company is to develop medical and practical systems for the medical sector by creating more efficient systems and digital patient files.

CGM has developed a range of software solutions which are being used by healthcare professionals worldwide specialized for different sectors of healthcare, such as Pharmacies, general practitioners and patients.

The software is handled centrally by CGM, so if there are any technical issues, the pharmacy staff only has to address this, so it can be solved by CGM, leaving more time for pharmacists to do their work.

Pharmacies

The services provided for pharmacies are mainly aimed at improving the efficiency and workflow. This is done by taking care of logistics, information about different drugs and it allows for a clear overview of a patient's profile among other things. ("CompuGroup Medical | CGM APOTHEEK", n.d.)

General Practitioners

For General Practitioners, CGM has developed a web-based information system which can be used anywhere. This service is fully integrated in the workflow of the GP, as it is a central system, which can be used to call up a patient's file, make notes about episodes, write out a recipe, request a labresearch and more. ("CompuGroup Medical | CGM HUISARTS - op de toekomstige groei, compleet, gemakkelijk in gebruik en schaalbaar", n.d.)

With a system developed by CGM it is possible to run a practice without having to make use of paper. This website can be used on computers, laptops and tablets with the latest browsers for teleconsulting (consults over a distance). These kinds of consults save both the doctor and patient time and strain, and it can be used anytime, anywhere.

Patients ("CompuGroup Medical | Elife Services", n.d.)

The platform for the patient is fully integrated in the platform of the general practitioner. Through a link provided via mail, patients can log onto their account after activation in the practitioner's office. This increases efficiency as there is just one system which can be used for administration. The patient services consist of 5 modules which can be turned on or off by the practitioner., the modules are:

- Appointment
- Monitor
- E-consult
- Recipe
- File

Overall CompuGroup Medical delivers a service for the full spectrum of healthcare, they offer modules for healthcare providers to patients.



Umana TI Ecosystem

This system is described as 'an end-to-end solution for vital signs monitoring'. It consists of a Smarter Skin sensor, TI heart monitor (with an app), user control center, medical control center, a bio signals studio and a hub control center. The hub control center works in combination with AI to analyze the gathered data, use pattern recognition, identify abnormalities and more.

SIDLY CARE BAND

At the heart of the whole system, there is the **SIDLY CARE WRISTBAND**, which monitors key parameters of human body and notifies caregivers if something unusual happens to their loved ones.



image 17 A flyer with explanation about the Sidly care wristband.

TeleCare 2.0 Sidly Care

The SIDLY system is described by the company as the most revolutionary and helpful telecare system based on proprietary artificial neural networks and medical band developed on the basis of innovative European technologies holding a quality certificate of a medical product.

This system consists of 3 components, which are; a platform (PC), application (Mobile) and a telemedical band (image 17). the administrator's module, the caregiver's module and the user's module. Each of the modules has its own authorizations to suit the user of that specific application.

CardioSecure Active

The CardioSecure Active is a smartphone based 15-lead ECG for patients image 18. After recording an initial reference reading, the patient can do a control reading at any time, to see if he or she needs medical attention. This is based on a comparison between the reference and control ECG, depending on the outcome the app gives an advice to indicate whether or not visiting a doctor is recommended. The user has the option to share the ECG with their doctor, so he or she will not have to worry about their data falling into the wrong hands.

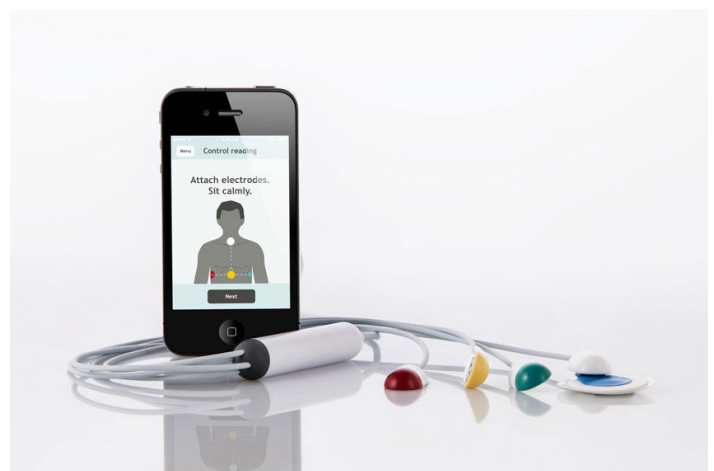


image 18 CardioSecure allows patients to make regular ECG's at home. And it already indicates if contacting a doctor is necessary or not.



Medikationsplan PLUS

From April 1st 2017 on, German citizens who take more than three different types of drugs are required by the E-health law to get a printed medication plan.

This is a standardized electronic medication plan for healthcare institutions and patients. Medikationsplan PLUS is developed to help converting data from and to Ultrakurzformat (Hoffman, Meyer, & Elze, 2017) file format to FHIR (Stichting HL7 Nederland, z.d.). This is useful as UKF is a German standard, whereas FHIR is an international standard.

This system is an example of how companies are currently working on making sure the healthcare sector will be able to participate in this digital age while taking globalization into account.

3.1.2.3 Techniques for patients

iThermonitor II

The iThermonitor is a smart thermometer which can be used for continuous monitoring for up to 360 hours (15 days). It is a patch which, after being applied to the patient, can be connected to a phone through Bluetooth. The connection with a phone adds a number of key features to the product. Besides continuous monitoring, it has a smart alert, it saves the collected data in the cloud and the product offers fever advice.

The product is designed to continuously monitor the health of patients in a non-invasive way. Which is especially helpful with, for example, premature born babies. This product allows patients to monitor their own temperature over a longer period of time without the interference of doctors.

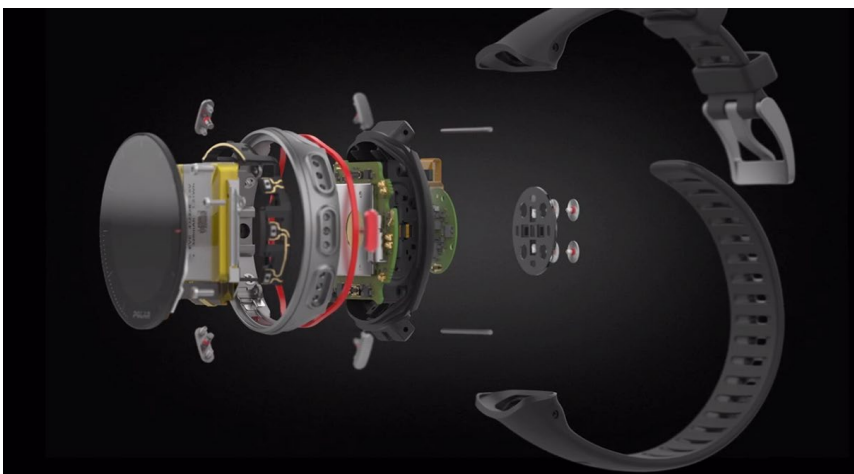


image 19 An exploded view and a view showing the different components of the polar vantage series smartwatches



Polar Vantage Series smart watches

The Polar Vantage Serie consists of two smartwatches developed for people who want to gather data about their sporting activities, to help make schedules and improve overall. The watches can be used to collect data from 130 different types of sporting activities. Besides that, it measures your heartrate, the strain of a workout on your different muscle groups, it creates an overview of the way your body is recovering, swimming data, the way you sleep and more.

It is interesting to see what kind of data these products are already able to gather. The swimming data which is collected, for example, does not just register that you are swimming. It keeps track of your heartrate, stroke type, distance, speed and number of strokes and resting times.

Smartwatches and other wearables are getting increasingly popular and the type of data they can gather is growing rapidly as well. With the ability for patients to gather their physical data in a safe and reliable way opens the possibility for patients to analyze their own physical condition. This possibility opens a new way to approach medical consults, as (part of) the anamnesis can be performed by the patient beforehand, leaving more time for the social and emphatical aspect of the medical consult.

3.1.3 Conclusion field study

Both DDW and Medica were insightful events to get to know more about medical innovations within the healthcare sector. As these visits allowed for the creation of a clear overview of current innovations relevant to a consultation.

It must be said, however, that the products and concepts shown at these conventions are closer to being realized than they are future ideas. Most of the ideas presented already exist, or they are in the final stages of their development.

Concluding, it can be said that most of current medical innovations are focused at implementing digital practices into the world of medicine. This is a good thing as healthcare is currently years behind compared to different industries. Yet, at the same time, there are no truly new or disruptive technologies identified which may change the way a consultation is facilitated.

Research

Field research





3.2 User research

This section will discuss expert interviews which have been done to gather information regarding the future of the consulting room. For this research, experts are defined as anyone who has a professional connection with the consulting room or a consultation. In total, a number of 14 semi structured interviews has been executed.

The information and insights gathered from these interviews are used in the chapter ideation to help define a future vision and design brief, and to create the future patient journey of 2030.

3.2.1 Introduction

To make sure all aspects of the consulting room are taken into account when designing a new one, a large number of stakeholders of the consulting room have been interviewed (Appendix 2). The people who have been interviewed can be found in image 20.



3.2.2 Method

As all interviews were semi-structured and discussing the same subject, a general interviewguide was created, which served as the outline for all interviews.

To make sure the guides were appropriate for each interviewee, a separate interviewguide was created based upon the general guide. An example of these individual guides can be found in appendix 2. As can be seen from the interviewguide, there were general questions for all participants, but there were also questions aimed more at their professional relation to the consultation room. This was done to gather as much relevant information per interview, by discussing a wide range of subjects with people with knowledge concerning those topics.

Besides the interview questions, the participants are also asked to fill in the goals of the consulting room on a bullseye, appendix 3. To do this, first, the goals of the consulting room as stated by Haes and Bensing (2008) are simplified even further towards the following three purposes:

image 20 An overview of the stakeholders interviewed during the expert interviews.



1. *Transfer of medical information*
 - a. *Gathering information*
 - b. *Information provision*
2. *Interventions/clinical reasoning*
 - a. *Decision making*
 - b. *Enabling disease and treatment-related behavior*
3. *Empathic care*
 - a. *Fostering the relationship*
 - b. *Responding to emotions*

These three goals were then placed on a bulls-eye with four quadrants, each goal got its own quadrant, and the fourth was left open for a new goal that might come up.

During the interviews, the participants are each asked to write down the goals of a consultation according to them on sticky notes, without getting to see the bulls-eye.

Once they cannot come up with any more goals, the bulls-eye is shown and they have to place their goals in the category they think is most appropriate. If there is a goal which does not seem to fit any of the given categories it should be placed in the open quadrant.

3.2.3 Results

This section will discuss the highlights from the interviews. An overview of the most interesting insights gained from the interview can be found in image 21. The different fields of interest (Fol's) identified are presented below. For a full overview of the insights gathered from these expert interviews see appendix 7.

After the general overview of the interview insights is discussed an overview of the most important insights gathered per interviewee is shown. Finally, the goals of the consulting room as described by the interviewees will be discussed in general.

The different fields of interest identified from these expert interviews are:

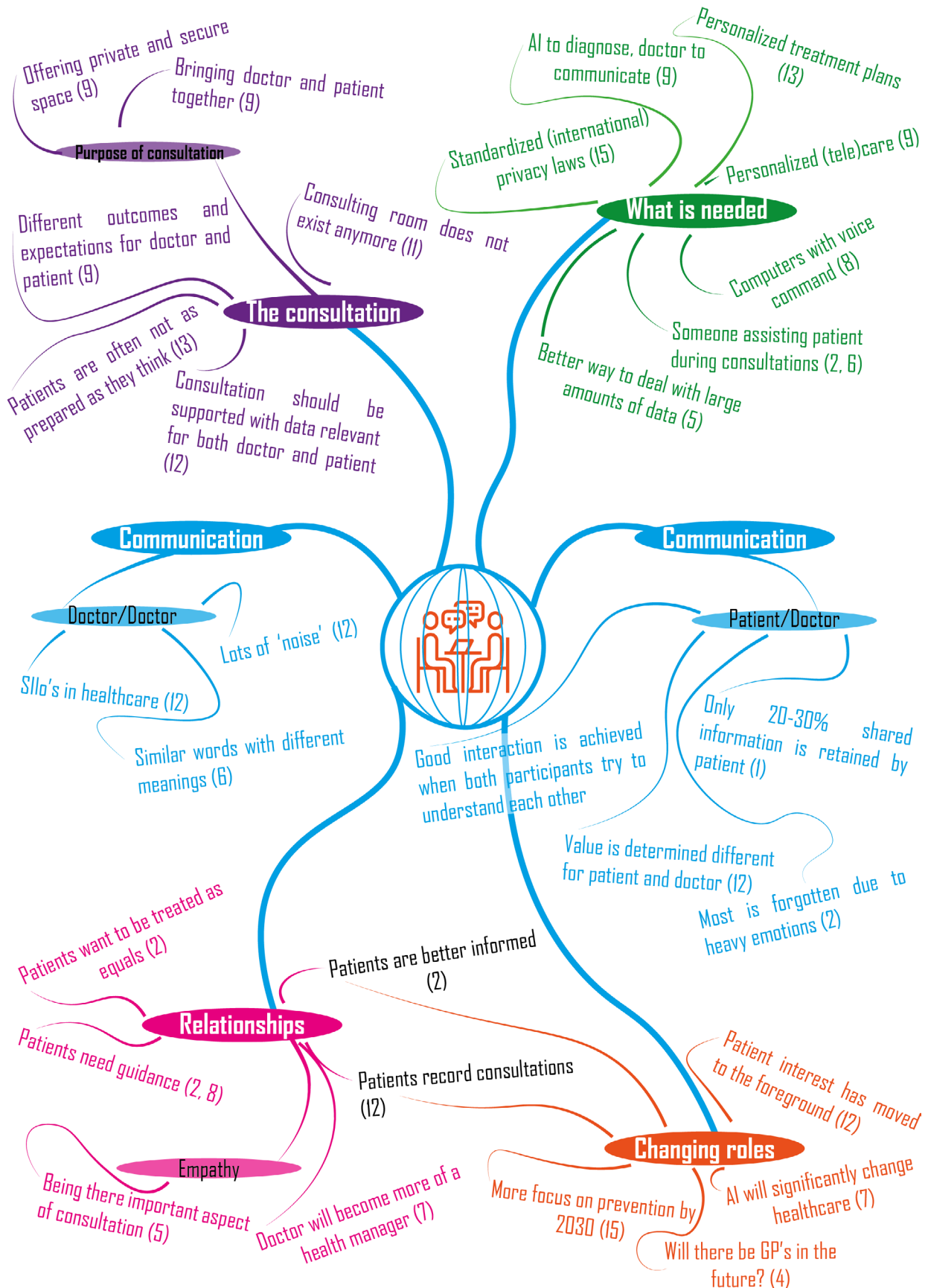
- *The consultation*
- *What is needed (to improve the consultation)*
- *Communication*
 - a *Doctor/doctor*
 - a *Doctor/Patient*
- *Relationships and Changing roles*

On the following pages, these Fol's and what they represent will be discussed in short.

image 21 *Overview of the most interesting insights gathered and grouped in specific fields of interest. The numbers after each inside indicate from which of the interviews the statement was taken.*



Research Expert interviews





The consultation

This Fol describes what makes up a consultation, what it is used for and weaknesses of consultations. The purpose of the consultation is to bring doctor and patient together, and offer them a private and protected space to focus on helping the patient. It is, however, no longer required to do this in a physical space, making consulting 'room' an outdated term.

Inside consultations it often happens that patients have different expectations from their doctors. This can in part be explained that patients often are not as prepared as they think.

With better preparation from patients (guided by doctors) it will become possible to align expectations of both stakeholders of the consultation. At the same time, it is important to support the consultation with data which is relevant and meaningful to both doctor and patient. A doctor can give their patient values from performed tests, but most patients do not have the medical knowledge to understand what those values mean. Therefore, it is best that data shared with patients can have meaning to them.

What is needed (to improve the consultation)?

The insights in this Fol are things the interviewed experts would like to see in the future, to help improve consultations and/or medical practice in general. The statements given here are used in the development of the timeline for the future consultation.

Communication

Communication can be divided into two separate types of communication. The first type of communication relevant to consultations, is of course, communication between doctor and patient.

That's (not) MY patient!

Communication between doctor and patient

Currently most patients forget approximately 70% of the consultation within an hour after leaving. Most of this forgetfulness comes from the fact that these patients have to deal with heavy emotions and a large amount of information in a relative short time.

Another issue of communication during consultations is the fact that value is determined different for both participants. For example, when a doctor is finally able to diagnose a patient, the doctor may feel like significant steps have been made, which of course is true. But, if this would mean the patient is diagnosed with a severe condition, the patient will probably not see the diagnosis as a step forward. Therefore, it is important that patient and doctor make an effort to understand each other.

Communication between multiple doctors

The different departments in hospitals seem to work in Silo's, meaning each department focusses on their patients, and only their patients, without proper communication with different departments when this is necessary. The terms "that's MY patient!", and, "that's NOT my patient!", were used by the interviewees to describe how doctors claimed or refused patients based on the fact that the patients had conditions that made them fall under the care of their specific department or not. Interdisciplinary teams can be a way to share responsibility for patients that fall under the care multiple or no specific department.

The different disciplines also use similar words which have different meaning. To avoid the chance of miscommunication it is therefore important to have one universal medical language.

Finally, there has been an increase in the amount of 'noise', distracting, non-relevant information, in communication. This makes it harder for medical personnel to focus on the important information and perform their job well.



Relationships and changing roles.

The final two Fol's have been grouped together in their description as they share some similar insights. First the changing roles in healthcare will be discussed, after which the relationships surrounding consultations will be discussed.

Will AI replace GP's?

AI has already proven that it can be better at repetitive tasks than humans (Steadman, 2017). An this also raises the question if 'AI will be able to replace actual general practitioners?'. The answer is no. At least, not for a very long time. Doctors have the ability to communicate in an empathic manner, that AI is not able to yet. This ability is an important aspect of healthcare, because there are a lot of things, such as the way someone moves, talks or even smells, that can tell a lot about their condition, how they are feeling, and most importantly, how to act on that. Besides, most doctors still prefer to see their patients face-to-face, if they want to be able to use their gut-feeling, or intuition, which can also guide them in the right direction.

In the past couple of years patient interest has moved to the foreground. This means that patients are getting more involved in their own healing process. Some even record their consultations to be able to listen back to them later, to make sure they do not forget anything. At the same time, they get informed better and they get to make more decisions about their own treatment.

As patients get more control over their own health, they feel more responsible and try harder not to get sick. This will lead to people focusing more on preventing getting sick as well.

With the role of patients inside the consultation changing, the relationship inside the consultation will also change. As patients get to know more, they want to be treated more as equals by their doctors.

With patients being able to find medical information online, they will need guidance. They will need to be shown what information is reliable so they do not have to worry for not reason. This also means that the role of the doctor will need to change. Doctors will get a more managing role, guiding patients as they find their own way in trying to stay healthy, or to at least live in a way where they get to decide how their treatment goes.

3.2.4 Conclusion of the expert interviews

Through these expert interviews a lot of valuable information is gathered which will be used during the ideation to come up with new ways a consultation can be set up.

For now, the most interesting insights per interviewee are gathered in an overview shown on the next page image 22. This visual not only shows the insights, but it also shows four categories in which the different interviewed experts can be grouped. The groups identified are:

1. Social/empathic

The first and most present group of subjects discussed. These are the people who focus on social and empathic aspects such as caring for patients, making sure the interaction during a consultation goes as fluently as possible.

The most interesting insight shared by all interviewees from this group is that:

"The conversation during a consultation is that what should be focused on. Doctor and patient have different expectations for a consultation and it is important they try to understand each other."



2. *Technical*

The technical group is more focused on technical innovations and new ways of practicing medicine, while still holding the patient in high value.

The most interesting finding from doing these interviews was:

There are different groups working on innovations to improve healthcare. Clinical technicians are learning to practice medicine in a more technical manner, MedTech companies provide medical and consumer products which can be used to support patients or gather data outside a consultation. Interaction designers look at the best way to improve communication during a consultation as that seems to be the most important aspect of a consultation.

3. *Financial*

The financial subjects discussed during the expert interviews can be found in this group. These are the people you need to talk to when you are thinking about the future expenses of the healthcare sector to find the best way to lower the costs for everyone.

The most important finding from this group was:

To keep medical expenses as low as possible it is necessary to cooperate with other healthcare instances to be able to share costs and invest in innovations together with these other health institutions.

4. *Regulation*

With the final group, regulation, the topics discussed were more about the regulations needed for a consultation to be safe for both doctor and patient. It is thought to be necessary that new laws will be created which regulate innovations within the healthcare sector. Like the way medical data is shared, but also if, and how it may be used as big data, so it can be used by A.I. as learning material.

The most important finding done in this group was that:

If AI will be useful in healthcare for data analyzation all depends on laws on privacy and data sharing. It is therefore necessary a conversation is started discussing the possibilities and limitations of AI, to be able to draw up proper laws, which allow for the use of AI whilst not hindering the data's owner or medical personnel in their work.

These four groups which have been identified indicate the different aspects of the consultation which need to be taken into account.

The interviewees in the *social/empathic* group know about the core of consultations and what these are all about. Offering a place where medicine can be practiced in an empathic way, allowing patients a way for them to start understanding conditions they might have to deal with,

through the aid and guidance of a doctor.

Participants in the *technical* group are the ones to talk to when thinking about possible innovations and changes that may come to the healthcare system. They will have to assess if and when certain techniques will be feasible to put into use.

The *financial* group should be addressed when looking into ways on how to finance the transition from the current healthcare system to a future healthcare system, where healthcare is mostly focused on prevention and where patients decide how they would like to be treated. This is necessary as revenue streams in healthcare will change and expenses are still rising. The proposed way to do this is by looking into possible cooperation with other health instances.

Experts in the group *regulations* should decide what direction, not only the Erasmus MC, but healthcare as a whole should go to. Education should decide how to teach doctors and prepare them for an ever-changing medical future. Privacy still remains an issue, this should be addressed as well. If this is not done, current laws may complicate innovation in healthcare, as data might be (too) hard to come by.



3.2.5 The goals of the consultation

The goals of the consulting room image 23 were confirmed with the help of the bulls-eye method as described earlier. All the answers given by the participants could be traced back to one of three themes which are:

1. *Transfer of (medical) information*

One of the main purposes of the consulting room is to provide a space where patients feel secure and where they can talk privately with their doctor. They have to feel so secure that they are willing to share very intimate information with their caretaker, even when they are not feeling right.

For doctors the transfer of medical information is important because they need to receive information from their patient to be able to assist them, and at the same time they need to be able to transfer information in a comprehensive way, so their patients can understand what kind of disease, conditions or consequences they are facing.

If the sharing of information is not done properly inside a consulting room, it will become significantly harder for a doctor to help its patients. For patients it is likely to feel like a waste of time when they can't seem to connect with their doctor.

Insights Gathered from expert interviews



image 22 The most important insights gathered from the expert interviews, each panel represents an interview with someone with that profession/role.



2. *Interventions/clinical reasoning*

The second *raison d'être* for the consulting room is the possibility to do medical interventions. Medical actions only a doctor can do, because of his experience and expertise.

This is done, for example, by reasoning as to why a patient might have a certain disease, which comes down to clinical reasoning. Or it can be an action as simple as removing a wart, which is a medical intervention. Interventions inside the consulting room are often relatively simple actions, compared to the interventions done in a surgical room.

3. *Empathic care*

Empathic care can be defined as the human aspect of care. Computers are already able to diagnose some diseases better than actual people. But no computer can understand a human better than another human can.

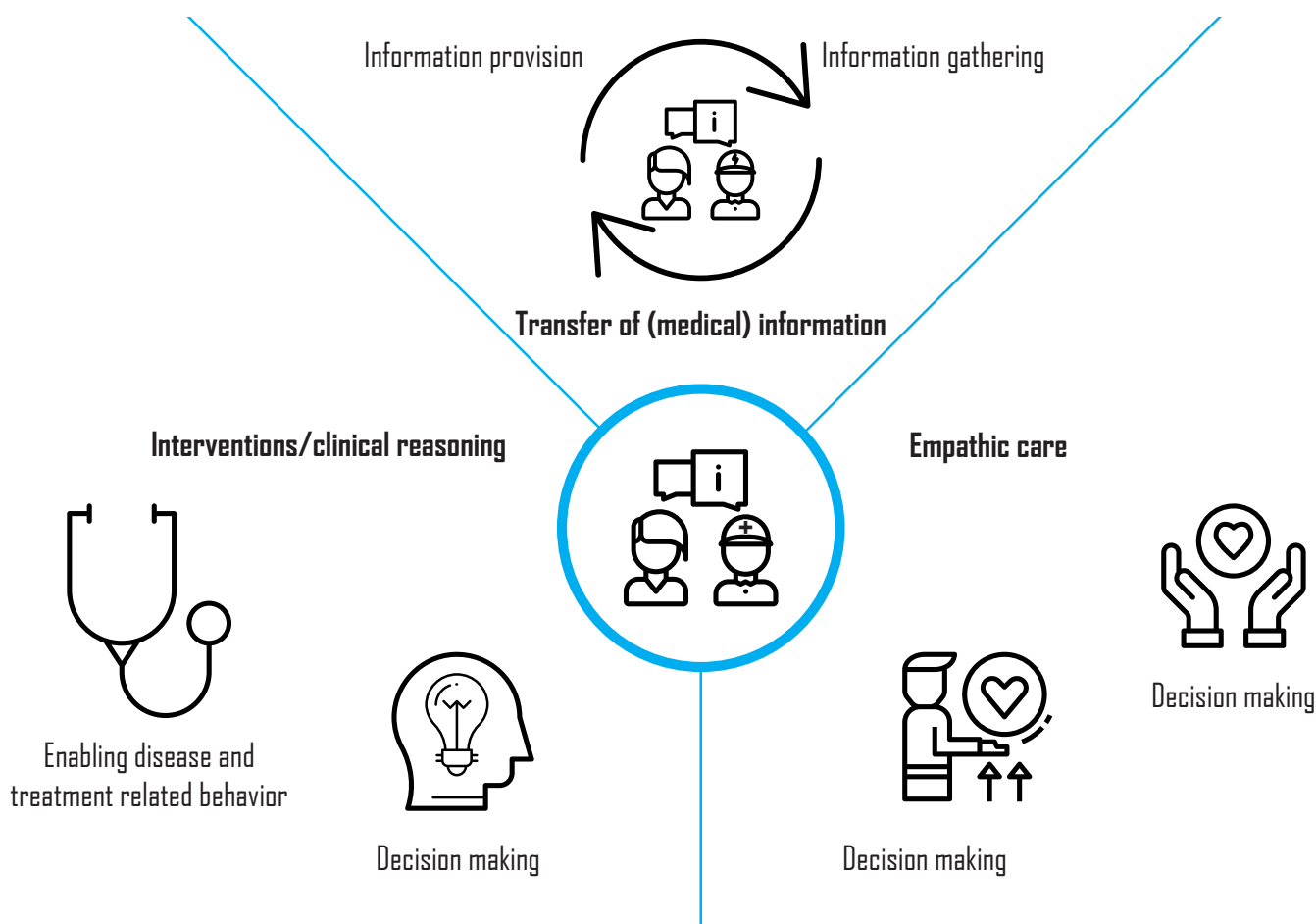


image 23 Overview of the goals of the consulting room



Research

Expert interviews



3.3 Delphi study

The following section will discuss the Delphi study. A Delphi study is a research method used in future strategy studies (Loo, 2002) and it is also often used in healthcare settings as it is seen as a reliable means to reach consensus on clinical problems (Eubank, Mohtadi, Lafave, Wiley, Bois, Boorman, & Sheps, (2016)).

The aim of the study is to collect information about the current consultation (rounds 1-3), based on which a patient journey can be created for the year 2030. And to check the validity of this patient journey in the final round of the Delphi study (round 4).

This project was done in cooperation with A. van Vliet, a Medicine student at the Erasmus MC, he has written a report regarding the Delphi study as well. This report can be found in appendix 8.

3.3.1 Method

Traditionally Delphi studies are a quantitative method used to generate consensus about certain topics. This is done by asking groups multiple rounds of questions, where, after each round, the answers are summarized and sent out to the groups again. Finally, the goal is to reach consensus by picking up on common trends and inspecting outliers (Macfarlan, n.d.). For this project, the traditional construction of the Delphi method was modified. The result is shown in image 24 and will be explained in detail.

Delphi round 1

The aim of this round is to create an overview of consultations. The creation of this overview is done during a co-creation session in two ways. First, a timeline of a consultation is created with the help of a generative tool (appendix G). Second, statements about the consultation were collected during this co-creation session.

The timeline created is used as a basis for the future patient journey of a consultation in 2030. The statements collected serve as a basis for the second round of the study.

Delphi round 2 & 3

Delphi rounds two and three are two online surveys which test the statements collected in Delphi round 1.

The goal of these surveys is to reach consensus about the future of healthcare with a group of (future) doctors and (future) patients. 'Future doctors' in this case being medicine students and future patients being people who are not (yet) sick.

In round 2, a survey is sent out with the statements about healthcare.

After the results of the first survey are gathered, the statements that reached consensus are taken out of the survey, while the ones that do not reach consensus are adapted based on feedback from the participants of the survey in such a way, that they are more likely to reach consensus.

Once all statements are revised, the survey is sent out once more, initiating Delphi round 3. The statements that reach consensus in either of the surveys are then used to design the future patient journey which will be presented at the end of this chapter.

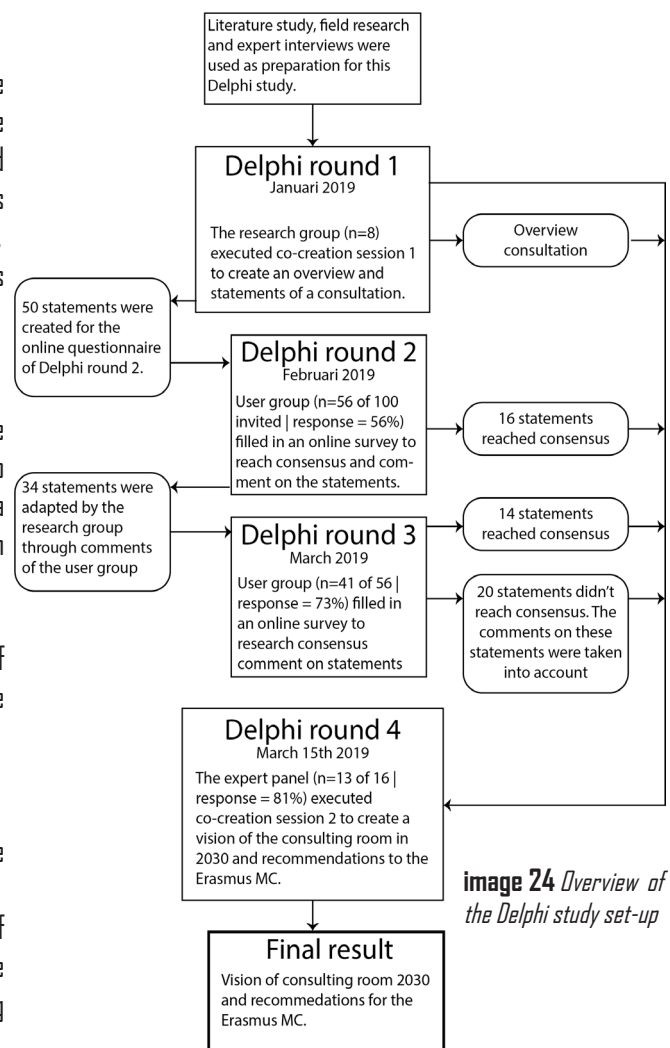


image 24 Overview of the Delphi study set-up



Future patient journey

In between Delphi rounds 3 and 4, the future patient journey is designed. Based upon insights gathered in the analysis and research phase of this project.

The fourth round of the Delphi study will be discussed in the following chapter. Next, the results of Delphi rounds 1 through 3 will be presented, on which the future patient journey is based.

In between Delphi rounds 3 and 4, the future patient journey is designed. Based upon insights gathered in the analysis and research phase of this project.

To create this journey, first, a vision (statement) and then a design brief needs to be created.

A vision statement is required to provide direction to all stakeholders related to that which the statement relates to (Schooley, 2019). In this case, the vision statement relates to the consultation, and it should therefore provide direction to all stakeholders of the consulting room, which are the users (e.g. doctor & patient), but others, such as medical professionals, healthcare institutions, and MedTech companies as well.

A 'Design Brief', is a description of a possible solution which gives guidance as to what should be created to solve a presented problem. In this project, the design brief is created not to solve a problem, but to look for possibilities on how to innovate consultations (Chapman, 2014).

The design brief leads to a set of rules and regulations to keep in mind when innovating consultations. Besides these rules and regulations, there are also four search areas identified. The search areas are topics based on similar themed clusters of insights gathered in the previous chapters and they present themes around which relevant improvements for consultations might be found.

Finally, everything created here, the vision, design brief, search areas, and rules and regulations are used to come up with solutions to smaller problems which are eventually put together in the future patient journey presented in the results section of this chapter.

The fourth round of the Delphi study will be discussed in the following chapter. Next, the results of Delphi rounds 1 through 3 will be presented, on which the future patient journey is based.



3.3.2 Results

Delphi round 1 | co-creation session

This co-creation session was held with 5 participants, of which two are doctors of internal medicine. With help of a generative tool (appendix 6), the timeline of a consultation in general for 2019 is created (image 25). This timeline gives an overview of the different actions are performed during consultations.

Overview Timeline Consultation 2019

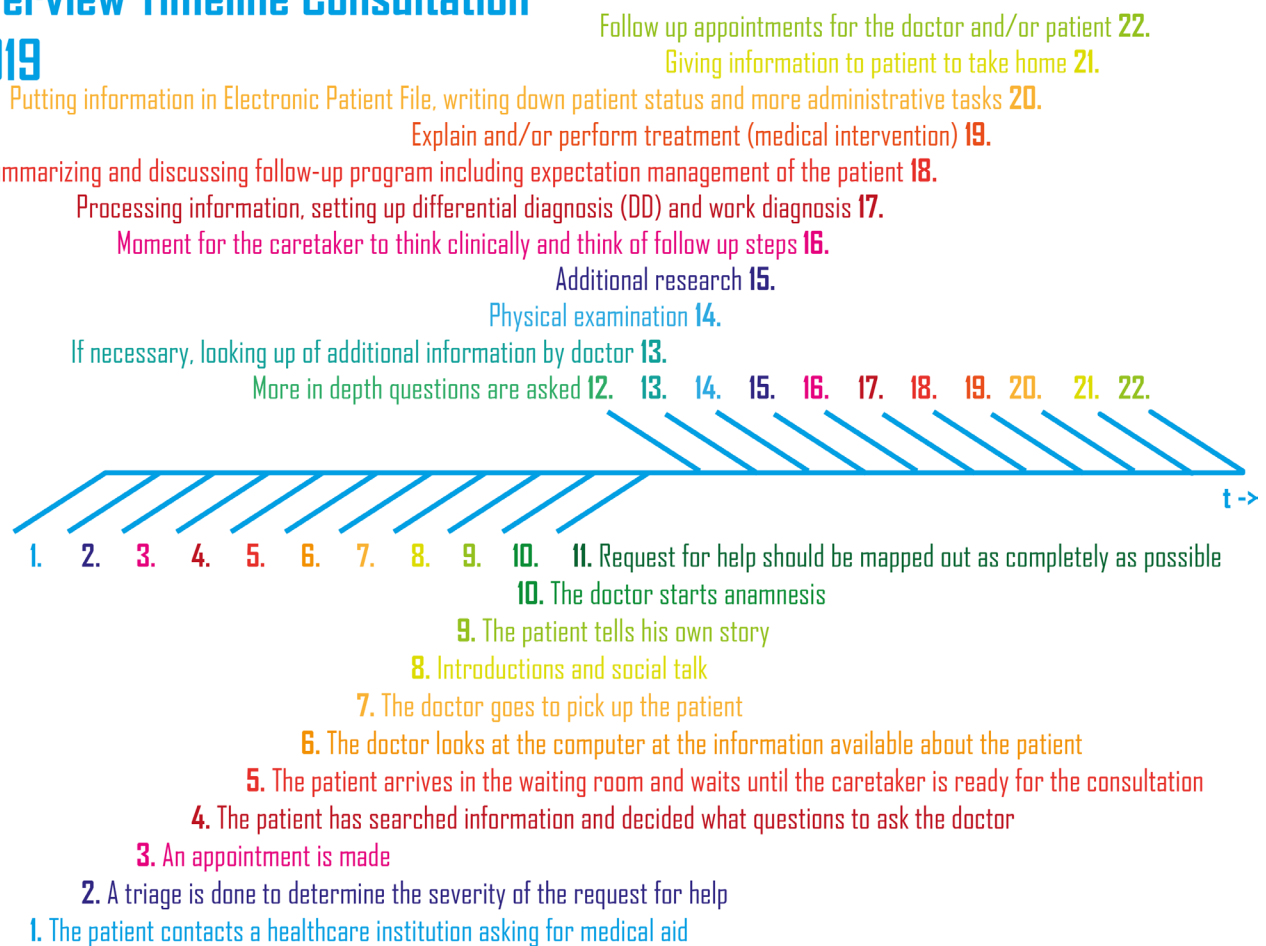


image 25 Visual of the timeline of a consultation, created during the first round of the Delphi study

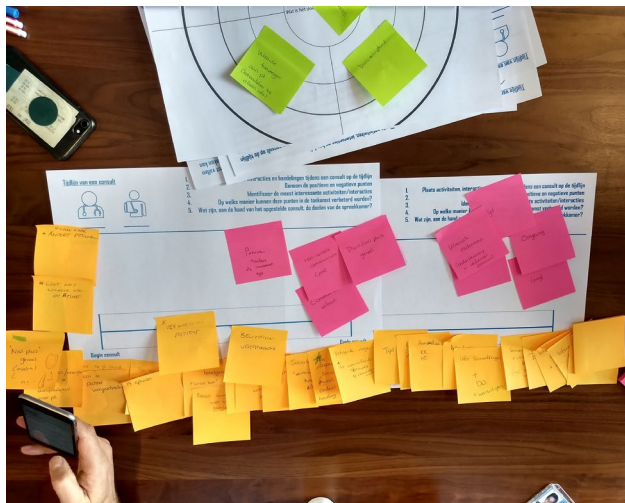


image 26 The end result of Delphi round 1. A timeline of a consultation in 2019 and the goals of the consulting room.



image 27 Set up of the co-creation session of Delphi round 1 with the research group

Delphi round 2 & 3 – Online Survey

There was a total of 56 respondents for the first questionnaire, and 47 of the 56 answered the second survey as well.

In total, 30 of the statements reached consensus. These statements can be found below. For the statements that did not reach consensus, the feedback given by participants was taken into account when designing the future patient journey.

Statements which reached consensus

1. Preparation of consultation

- a. Care institutions should facilitate information sources about care problems such as thuisarts.nl in order to get the correct medical information to patients and to prevent unnecessary worries.
- b. The electronic patient file enables the physician to get a good overview of the patient.
- c. The medical consultation starts at a different time for the patient than the physician.

2. Trust during medical consultation

- a. It is important for the patient that the physician acts professionally.
- b. Physicians and patients have an equal influence on the relationship of trust.
- c. A physician is professional when information is searched on the internet during the medical consultation when there is transparency.
- d. Social talk can be useful during a medical consultation to improve trust, even if this depends on the type of patient and the physician's assessment.
- e. The physician's retrieval of the patient from the waiting room contributes to the medical consultation.

3. Requirements during medical consultation

- a. At the end of a medical consultation, the follow-up steps given by the physician must be clear to the patient.
- b. The physician must guide the patient through the conversation.
- c. Identifying the reason for the patient's arrival is the most important during a medical consultation.
- d. The treatment plan is determined by physician and patient together.
- e. A medical consultation in a physical space is essential to observe the patient's non-verbal communication and to be able to take it into account during the medical consultation.

Research

Delphi study

4. Time-management during medical consultation

- a. It is more important that a physician completes a medical consultation well than that it starts a new medical consultation on time.
- b. The physician must have enough time to determine the next steps for the patient after the medical consultation.
- c. After the medical consultation, a patient should receive an overview of what was discussed during the medical consultation with the possibility of additional information.

5. Completion of medical consultation

- a. A medical consultation is successful when a patient feels helped and heard.
- b. The patient and physician come together in the medical consultation room to determine the treatment process that the patient will enter based on a possible diagnosis and subsequent treatments.
- c. Physician and patient are both responsible for the patient's diagnostics treatments.

6. Medical consultation in a physical space

- a. The computer must be replaced by artificial intelligence, so administrative tasks of the physician can be taken over, placing the conversation between doctor and patient central.
- b. The medical consultation room is designed to facilitate the physician in his work.
- c. Everything a physical medical consultation room can offer for a medical consultation can also be digitally facilitated. (High disagreement, but still consensus on the fact that most people disagree).

7. Equipment during consultations

- a. Implementation of innovations within a medical consultation must lead to a lower workload for the doctor in order to be able to focus on the conversation with the patient.

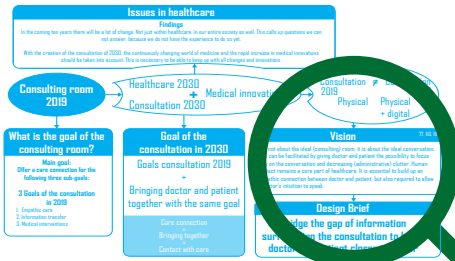
8. Communication of information surrounding the consultation

- a. When patients want to search information about health, there must be a possibility to be assisted with approved guidelines for medical information.
- b. Patients must also be able to receive medical information outside the medical consultation without the doctor being unnecessarily burdened.
- c. Patients should have the opportunity to see their estimated waiting time before the medical consultation.
- d. A summary must be provided by a device in the medical consultation room, so that the patient and doctor have an overview of what has been discussed afterwards.
- e. Patients must have continuous access to their medical data.

9. Healthcare in the future

- a. In the future, the doctor will be replaced by a form of artificial intelligence. (High disagreement, but still consensus on the fact that most people disagree).

The statements shown here have all reached consensus and they are used in the development of the future patient journey.



Future Patient journey - Vision and Design Brief

Before the future patient journey could be created, first a vision had to be formulated. After multiple brainstorm and clustering sessions, an infographic was created which shows the differences in consultations between 2019 and 2030. It starts of with a consulting room, which has the main purpose of offering a connection with healthcare for patients. Offering (health)care during consultations is done by providing one of the three identified

sub goals of consultations: Offering empathic care, medical interventions and transferring (medical) information.

The insights gathered about upcoming changes in healthcare, medical innovations and consultations are then combined to identify the goals of consultations in 2030. There are also some issues identified which have more to do with healthcare in general than consultations. Therefore, they are mentioned, but they will not be discussed further.

The goals of consultations are estimated to remain to same, although, gathered insights suggest that another goal should be added. This goal would be: 'to bring doctor and patient together with the same goal'. As there is currently a mismatch between what doctors and patients expect from consultations.

Another change which has been identified, is that consultations are no longer necessarily given in a physical room where both doctor and patient are present. There is, of course, already the possibility to do video consultations, but it is expected that these will becoming even more common in the future.

With these ideas in mind, the vision for the consultation of 2030 is defined as follows:

It is not about the ideal (consulting) room, it is about the ideal conversation. This can be facilitated by giving doctor and patient the possibility to focus fully on the conversation, by decreasing (administrative) clutter. Human contact remains a core part of healthcare. It is essential to build an empathic connection between doctor and patient, and it is required to allow a doctor's gut feeling, or intuition, to speak.

With the Vision for consultations in 2030 created, a design brief can be identified.

Vision

It is not about the ideal (consulting) room, it is about the ideal conversation. This can be facilitated by giving doctor and patient the possibility to focus fully on the conversation and decreasing (administrative) clutter. Human contact remains a core part of healthcare. It is essential to build up an empathic connection between doctor and patient, but also required to allow a doctor's intuition to speak.

image 28 Small overview of the infographic showing the vision enlarged, for full size image, see appendix 13

Analysis

Literature study

The design brief is defined by clustering all gathered insights and brainstorming together with A. van Vliet, about how the different clusters can be used to reach the vision created earlier.

During one of these brainstorming sessions, it was identified that there is a lot of miscommunication between doctors and patients, which makes improving communication between the two seem like the best way to improve consultations as well. This has led to the design brief shown below, based off of the clusters presented in appendix 9. The design brief has also been put into an infographic (image 29) which offers more explanation on the different identified search areas.

The search areas are used to find new ways to improve consultations, which are then implemented in the future patient journey. The design brief can be used later on to validate if the created patient journey fits the vision of healthcare in 2030. Validation is done in the fourth round of the Delphi study, which will be discussed in the next chapter.

Design Brief

Bridge the gap of information surrounding the consultation to bring doctor and patient closer together

Distinctive feature: Bringing doctor and patient closer together.

Category description: This is regarding the complete consultation. From the moment the patient starts collecting information, until after the doctor is done with his/her administrative tasks regarding the consultation

Target group: The target groups are both doctor and patient. It is about the communication between these two stakeholders, yet, at the same time, it is also about improving communication between doctors.

Improvement: By bridging the gap of information between doctor and patient, time management can be much more efficient during consultations. The doctor gets more job satisfaction, the patient feels heard, and the bond of trust, along with empathy can be built much faster.

Privacy

Look at the steps someone takes to become and/or stay healthy

Turn it around

A.I. seems to be an essential part of future medical innovation. Yet, for this technology to work properly, a lot of private information is required. How to deal with this challenge?

Turn it around?

What will happen when we start to look at health differently? Medical data is sensitive because bad health is seen as negative, yet, we all have to deal with it from time to time.

Rules and regulation

- Rules and regulations for healthcare in 2030
- Rules and regulations for consultations in 2030

Most important findings

- Investments in healthcare, improvements and medical innovation can only succeed through cooperation (Shared savings).
- Patients can collect tremendous amounts of data. Yet, it is the government that must decide how to handle this data. This has to be done for medical institutions, as well as for MedTech companies.
- The government should take a leading role with regulations regarding healthcare and integration of medical innovations and medtech companies. Innovation is going faster and faster, but it is still important to consider possible (negative) consequences.

Design Brief

Search area

Fair Medicine

Organisations that create costs in healthcare should cooperate to create a platform to develop and test cheaper innovative techniques.

Care platform

A platform where all parties inside the medical sector, including medtech companies, come together to find the best, cheapest and most innovative solutions.

Result

Develop a platform to ease cooperation between healthcare institutions.

Pre- en Post-consult

Healthcare whilst the patient stays at home.

Better care connections

With the help of applications and products like: Thuisarts.nl, CareBnB, Alexa and care robots, the connection between patient and care can be nurtured even better.

Result

A.I. as new care connection
Patient becomes own healer.

During the consultation

Applications which can be used during the consultation.

Improved communication

Data storage and -transfer before, during and after the consultation is often inefficient. Improve communication through A.I., visual/textless data storage and personalized communication.

Result

- EPF/Digital Twin as a hologram/visualisation.
- Visualisations through holograms.
- Set up and explain treatment plan visually.

Technological innovations

Technologies which are being introduced can't pressure medical personnel any more than they already are.

Purpose oriented innovation

Innovation is only helpful if it supports the user. Try to find innovations which serve a purpose.

Result

- A.I. as doctors assistant.
- A.I. als triage-system
- A.I. as hub for patients.

Potential solution



Patient Journey 2030

From the information gathered during the analysis and research phase, the future patient journey (image 30) has been created. The journey shown here is a concept which is validated in the fourth round of the Delphi study. It will be introduced here, however, it will be discussed more in detail in the next chapter.

In short, the following can be said about the patient journey of a consultation in 2030:

A new participant is introduced to consultations, the digital medical coach, which should be a form of AI. This digital coach serves as a means of communication between patients and the medical world, as there is a gap in medical knowledge and vocabulary.

The digital coach can be used by patients outside of consultations to look up medical information (step 2-3), to see if they need to contact a healthcare professional (Step 5). Once the decision is made what professional a patient should see, several options of contacting this professional are presented.

In this example, the decision is made to make an appointment for a consultation in a physical consulting room (step 5). Before the actual consultation, both doctor and patient get to prepare (step 6 & 7). The doctor gets informed about the condition of the patient through the digital coach and the patient gets the option to do additional medical research to collect all necessary data which might be needed during the consultation.

Once the consultation starts, the patient is collected from the consulting room by their doctor (step 8), this action is necessary to present the doctor as empathic, and to make it easier to build a bond of trust.

During the consultation (step 9) there will be a 'tablet table', and by 2030 preferably, a 'hologram table'. The idea behind these types of tables is that they can be used to replace computers inside consulting rooms.

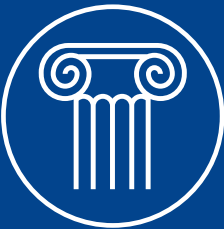
Tablet-/hologram tables offer the ability to visualize information shared during consultations. This makes it easier for doctor and patient to communicate, as they have a tool which can be used to bridge the difference in medical knowledge and vocabulary.

To prevent patients from forgetting information shared during consultations, the tablet table should also have the ability to record consultations and summarize the most important parts of the consultation, so patients can listen back to information they might have missed or forgotten at home (step 10).

To make sure, doctor and patient can focus on the actual consultation, the digital coach will take a more passive role, by taking care of all visualizations and recording of the consultation.

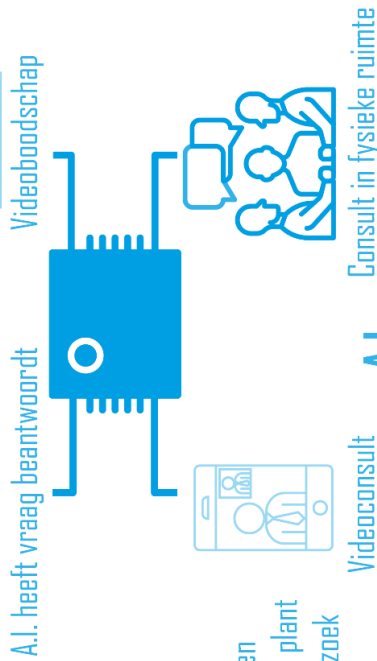
Once the consultation has ended, the coach will make a new appointment, based on the outcome of the consultation. (Step 11)

At home, patients can collect medical data with wearables, so they can monitor their own health and get alerted when they need to see a doctor (step 12).



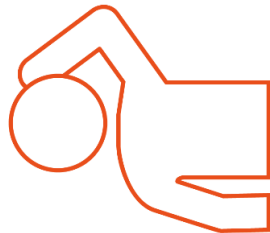
Tijdelijk Consult 2030

Patient
Arts
A.I.



3. A.I. probeert hulpvraag zo goed mogelijk te beantwoorden

4. A.I. verzamelt en analyseert data en plant aanvullend onderzoek



1. Patient heeft last van klachten

2. Patient start A.I. om oorzaak te detecteren

Het gesprek wordt significant beïnvloed door A.I.

- Patient wordt eigen heilmeester
- Dataverzameling vindt buiten het consult plaats
- Het consult kan gebruikt worden om een empathische lading aan het consult te geven
- Er kan gebruik gemaakt worden van een 'Hologram' tafel om een visueel behandelplan op te stellen en aandoeningen te communiceren



9. Arts en patient kijken samen naar het probleem



12. Patient komt thuis met A.I.



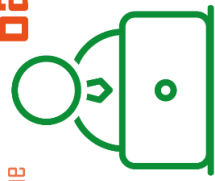
11. Nieuwe afspraak wordt ingepland



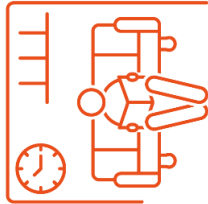
8. Arts haalt patient op uit wachtkamer



7. Patient vult online vragenlijst in



6a. Patient breed wachtkamer



5. Triageert door vragenlijst af te werken

- Identificeerd hulpvraag
- Bepaalt gewenste soort zorgconnectie
- Bepaalt vervolgstappen

6b. Arts bereid zich voor op het consult op basis van informatie over patient van A.I.

10. Patient krijgt overzicht van het consult mee naar huis



3.3.3 Conclusion Delphi study

The Delphi research was an extensive study which has led to a number of insights which have led to the future patient journey, which was then validated through this research as well.

The first round was used to determine the current state of healthcare and consultations through a co-creation session.

The following two rounds consisted of two online surveys which have led to consensus about the future of healthcare and consultations with 30 statements.

With Delphi round 3 concluded, and the future patient journey developed it can be validated, this will be discussed in more detail in the following chapter.

Summary of the research chapter

Field Study

The visits to DDW and Medica, gave an overview of new possibilities in healthcare and current innovations. DDW was more innovative compared to Medica, in the sense that the products shown at DDW were often very conceptual. At Medica, however, there were more products which are ready to be sold to medical professionals.

Visiting these two events did not lead to new insights on medical technologies. Still, it offered a good overview of the current possibilities and in which direction healthcare seems to be heading. When looking back at the two visits in relation to the future of healthcare it can be said that:

New ways to practice medicine are already available and developments are going so fast, it is hard to keep up with them. Most of these developments seem to be separate solutions to different parts of a, still undefined, problem. Therefore, it is logical to think that identifying this underlying problem is key, to be able to come to a problem which can be used to improve healthcare and consultations in general.

Expert interviews

Through the expert interviews, different areas of expertise related to consultations have been identified. These areas are:

- Social/Empathic
- Technical
- Financial
- Regulations

Summary of the research chapter

All of the experts interviewed fit into one, or more, of these categories. These categories can be used to help create a roadmap to reach the vision for the consultation of 2030 in the chapter vision. The way this would be applied looks like this:

1. Regulations are needed to be able to determine what is possible and what is not.
2. Technical innovations allow for the changing of current consultations into consultations which are still relevant in 2030.
3. Due to the technical innovations, there is room to innovate the social and empathic aspects of consultations
4. Financial implications should not lead, but follow the changes listed above. As money is a means, as opposed to a goal in healthcare, it is wise to come up with new ways to do a consultation before looking at how money can be made.

Delphi study

Statements with consensus regarding healthcare in 2030

Preparing consultations

- Care institutions should facilitate information sources about care problems such as thisarts.nl in order to get the correct medical information to patients and to prevent unnecessary worries.
- The electronic patient file enables the physician to get a good overview of the patient.
- The medical consultation starts at a different time for the patient than the physician.

Trust during consultations

- It is important for the patient that the physician acts professionally.
- Physicians and patients have an equal influence on the relationship of trust.
- A physician is professional when information is searched on the internet during the medical consultation when there is transparency.
- Social talk can be useful during a medical consultation to improve trust, even if this depends on the type of patient and the physician's assessment.
- The physician's retrieval of the patient from the waiting room contributes to the medical consultation.

Consultations in physical space

- The computer must be replaced by artificial intelligence, so administrative tasks of the physician can be taken over, placing the conversation between doctor and patient central.
- The medical consultation room is designed to facilitate the physician in his work.
- Everything a physical medical consultation room can offer for a medical consultation can also be digitally facilitated. **(High disagreement)**

Analysis

Literature study

Summary of research chapter

Prerequisites for a proper consultation

- At the end of a medical consultation, the follow-up steps given by the physician must be clear to the patient.
- The physician must guide the patient through the conversation.
- Identifying the reason for the patient's arrival is the most important during a medical consultation.
- The treatment plan is determined by physician and patient together.
- A medical consultation in a physical space is essential to observe the patient's non-verbal communication and to be able to take it into account during the medical consultation.

Time management during medical consultations

- It is more important that a physician completes a medical consultation well than that it starts a new medical consultation on time.
- The physician must have enough time to determine the next steps for the patient after the medical consultation.
- After the medical consultation, a patient should receive an overview of what was discussed during the medical consultation with the possibility of additional information.

Rounding up consultations

- A medical consultation is successful when a patient feels helped and heard.
- The patient and physician come together in the medical consultation room to determine the treatment process that the patient will enter based on a possible diagnosis and subsequent treatments.
- Physician and patient are both responsible for the patient's diagnostics treatments.

Equipment in the consulting room

- Implementation of innovations within a medical consultation must lead to a lower workload for the doctor in order to be able to focus on the conversation with the patient.

Information provision of the medical consultation

- When patients want to search information about health, there must be a possibility to be assisted with approved guidelines for medical information.
- Patients must also be able to receive medical information outside the medical consultation without the doctor being unnecessarily burdened.
- Patients should have the opportunity to see their estimated waiting time before the medical consultation.
- A summary must be provided by a device in the medical consultation room, so that the patient and doctor have an overview of what has been discussed afterwards.
- Patients must have continuous access to their medical data.

Summary of research chapter

Healthcare of the future

- In the future, the doctor will be replaced by a form of artificial intelligence. **(High disagreement)**

Conclusion of the research chapter

Goals of the consultation

The goals of the consultation have been defined as:

- Transfer of (medical) information
- Interventions/clinical reasoning
- Empathic care

Future patient journey

The future patient journey introduces a digital medical coach and tablet table. The goal of these additions to the consultation is to bridge the gap in medical knowledge and vocabulary between doctor and patient.

4. Future patient journey

Introduction

Method

Round 1

Round 2

Round 3

Round 4

Results

Conclusion



Introduction

This chapter will discuss the validating process of the future patient journey. With the goal to answer one of the research questions. After a short introduction, explaining why it is necessary to validate the future patient journey, the method will be explained.

The results section presents the adjusted steps which came as a result of the validating session. They are based on remarks made by attendees, increasing their medical relevance.

Finally, the conclusion will state how the reader should look at this future patient journey. It is a possible future, but we are not there yet. Whichever way we might go in the future, when improving consultations, the focus should lie on improving the interaction between doctor and patient.

Validating the patient journey

Delphi round 4



4.1 Introduction

With the research and analysis phase completed and a concept for a future patient journey created, it is now time to validate the new patient journey, to see if it matches the design brief created earlier.

Validation of the patient journey is necessary, because it is based upon insights gathered from (medical) professionals, and it is valuable to check if these insights have been translated into proper solutions.

The validation is done in the fourth round of the Delphi study. For this meeting, all interviewees from the expert interviews were invited to share their opinion.

The feedback collected during this session is then translated into the final patient journey, which is being used to answer the third research question of this report:

'What will a consultation look like in 2030?'

This chapter will go into depth on what consultations should eventually look like, a quick overview can be found in chapter vision 2030.

Stap # : 9 Titel : Kunstmatige intelligentie binnen het consult Omschrijving: Het consult vindt plaats met arts en patient. Ondersteund door de gezondheidscoach. Met behulp van een hologramtafel worden de klachten van de patient uitgelegd, het behandelplan wordt samengesteld, en het consult wordt opgenomen en samengevat.				
Regels: <ul style="list-style-type: none"> Schrijf de reden voor het ondernemen van een stap per persoon of coach op (Reden?), Motivaties (Waarom?) en resultaten voor de betrokken personages op de corresponderende kleur past its, en plak deze in de juiste kolom. Benoem, indien mogelijk, 3 positieve en 3 negatieve punten aan de hand van het tot nu toe opgestelde blad Verzin 1 tot 3 aanpassingen om aangekaarte voordelen te benutten en/of verzin 1-3 aanpassingen om aangekaarte nadelen te verhelpen 				
Wat doet de...	Waarom?	Resultaat:	Commentaar:	Aanpassingen?
Patient Arts Gezondheidscoach	Patient Arts Gezondheidscoach	Patient Arts Gezondheidscoach	Patient Arts Gezondheidscoach	Patient Arts Gezondheidscoach

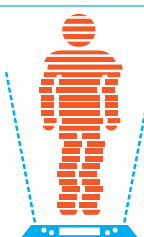


image 31 Generative tool used by the participants to validate the different steps of the future patient journey



Validating the patient journey

Delphi round 4

4.2 Method

A week before the fourth round of the Delphi study, all participants are sent an overview with insights gathered up until that point, so they can get an understanding of upcoming innovations and changes in healthcare (appendix 10-13).

The session itself kicks-off with a presentation summarizing the findings of preliminary research and presenting the future patient journey and explaining the validation process.

To validate, the attendees are asked to split into multiple groups of three, where each group member takes one of three roles: Patient, Doctor or Digital coach. When the roles are divided amongst the group members, each group gets steps of the patient journey to validate. With the help of a generative tool (image 31), the participants had to describe the following in order:

1. Who does what?
2. Why does that person/coach do that?
3. What is the result of that action?
4. Do you have any comments?
5. Do you have any suggested adjustments?

Once all the groups have validated each of their assigned steps, they have to present their steps to all, so they can explain their reasoning and others can give feedback.

The steps described by the groups and the feedback gathered during the final round of presentation is then used to improve the future patient journey, to represent a validated way a future consultation might look like.

The insights gathered during this session will be presented in the following section, results. The final patient journey can be found in the following chapter, vision 2030.



image 32 the images on this page are all pictures taken during the fourth round of the Delphi research



image 33



image 34

Validating the patient journey

Delphi round 4



4.3 Results

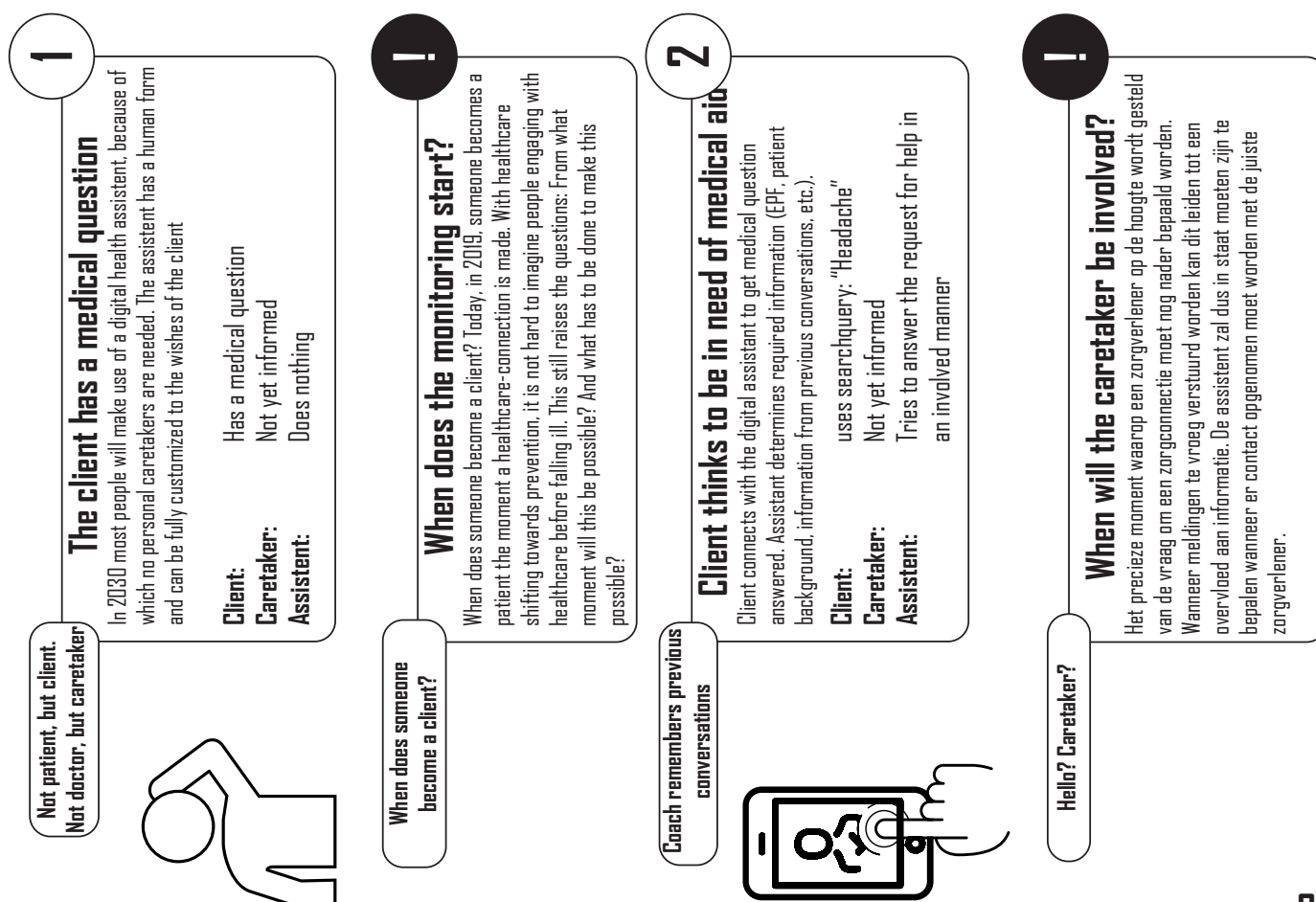
For this session, there were 15 people present, healthcare professionals, members of the patients' council and coaches. All of them were filled with enthusiasm during the presentation, making it hard to finish, as it sparked multiple discussions of the possibilities and implications the future and innovation hold for healthcare.

After a short while however, the discussions were brought to an end, and once the presentation was concluded, it was time to validate.

During the validating process, the participants were mostly working together in their own groups, discussing what they might do as a certain person and what that might mean for the consultation. image 32-image 34 show the participants filling in the steps, all described steps can be found in below and on the following pages.

Once all groups were done validating, they described their steps to each other. This, once again, sparked some interesting discussions. On the following pages the steps are described in the numbered boxes. The boxes with an exclamation mark express concern or raise a question which arose during the discussion of that specific step during the session.

The validation was succesful, as during the final discussion multiple attendees were able to connect different statements made in the design brief, such as 'textless datatransfer' or 'AI as a new care connection' to situations that might occur. Their enthusiasm showed the ideas presented resonated with the group, which is a good sign, as most of them are healthcare professionals





Validating the patient journey

Delphi round 4

3

Assistant tries to answer question

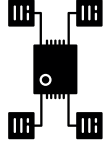
When the assistant has gathered the initial data, a dialogue is started to determine the severeness of the problem and to determine the proper healthcare-connection based on that outcome.

Client: Answers questions
Caretaker: Receives notification from assistant about client with pressing need for care.
Assistant: Keeps on asking, contacts caretaker.



Coach assisteert le lijn

Data as currency



5

Triage determines required connection

The assistant determines the proper type of connection with healthcare for the client through a triage. Once the right type of connection is identified, the client can decide to contact this connection if he feels like it.

Client: "In exchange for a lot of data"
 Determines if he agrees with the identified connection and decides upon the way of communication

Caretaker: Assists client and assistant in 'grey-areas'

Assistant: Presents options for connecting with care

Steps

1. Request solved by selfhelp or information provided by assistant
2. Videomessage
3. Videoconsult
4. Physical consult
5. Advice to look for paramedical aid

If necessary:

Follow-up research and questionnaire

The questionnaire

After the client agrees upon the presented connection he is sent a follow-up questionnaire. Based on the amnesis performed by the assistant. Besides the questionnaire, the client has room to prepare questions for the caretaker.

Client: Answer questionnaire/prepare questions
Caretaker: Consult anamnesis of assistant
Assistant: Interpret answers client/tips for client



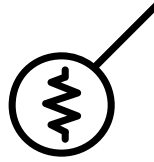
4

Assistant collects and analyzes data

The moment the client decides to contact the selected healthcare-connection. The assistant will analyze all gathered data. Based on this analyses, follow-up research (e.g. blood tests, etc.) is suggested which the client can take before the consultation takes place.

Client: Provides information
Caretaker: Prepares data in AI
Assistant: Analyses, gives first impressions, suggests follow-up research

Assistant can be used for things like: Donor, religious preferences and end of life decisions



!

What if a client doesn't take advice?

After the assistant has answered the request for help to the best of its capabilities, the client has to decide what to do with the given advice. A decision can be made to medicalise or to deny medical aid. This raises ethical questions. How far can the assistant go? What should a caretaker do with someone who refuses care?

How to counter 'head-in-the-sand' policies?

!

Invest in research towards AI in healthcare

To have this system function properly, it is essential that the AI which is going to be used works flawlessly. To achieve this, subsidy for research is needed. If this system does not function or get tested properly, it can lead to significant problems in the future.

Invest in the future

How to prevent overmedicalization?

What if the client wants something else?

What if the recommendations does not comply with the wishes of the client? Does the caretaker have a say when a client wants to come by for the fifth time this week? There can also be clients who refuse aid, even when this endangers their wellbeing. How do caretaker and assistant deal with this?

Validating the patient journey

Delphi round 4



6

Textless datatransmission

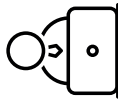
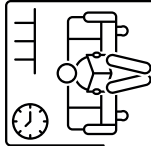
Preparation

Before the start of the consultation the patients receives information on how to prepare. Information will mostly be communicated in a visual way. Meanwhile the assistant presents the caretaker with information about the client.

Client: Waiting worried, yet provided w/ information

Caretaker: Distills analyse en treatment plan based on input assistant

Assistant: Asks client additional questions



!

Communicate with the same vocabulary

Why communicate visually?

There is often a significant gap in medical knowledge and use of language between caretaker and client. This gap can obstruct communication between the two parties. By making most of the communication visual through the use of images, videos and animations this gap can be bridged. The visualisations will therefore have to function as a tool to aid in the explanation of medical concepts and ideas.

7

Empathy is a prerequisite for a good consultation

Welcome

The consultation should not become to technological. Through the information provided beforehand, the caretaker is already aware of the situation of the client. The consultation self will therefore mostly be used for in-depth questions. To reach this point the caretaker will have to give a short summary to confirm the provided data is correct and complete.

Client: Greetings and express worries

Zorgverlener: Welcome in an empathic way

Coach: Preparation of the consultation



!

The consultation is the point in care where trust and empathy come to fruition

A caretaker who can understand you

In a world that seems to become increasingly digital, a physical consult can offer the trust people need. Artificial Intelligence is currently still unable to be truly empathic. That is where the caretaker comes into play. The caretaker is able to interpret medical data for the client and communicate it in an empathic way.

8

Assistant assists 1st line

The assistant during the consultation

The assistant ensures there are videos ready for the caretaker to assist in explanation. At the same time a checklist to see if all subjects have been discussed will be provided. Both caretaker and client look together for a treatment plan which best suits the client. This is all summarized in the Personal Health Environment (PHE).

This all takes place with the help of a tablet-/hologram-table. This is a table which can be used intuitively to visualize whatever is needed, negating the need for a computer in the consulting room.

Making use of visualisations can also help in communicating with low literate people, or people who do not completely understand the Dutch language

Client: Provides information, asks questions

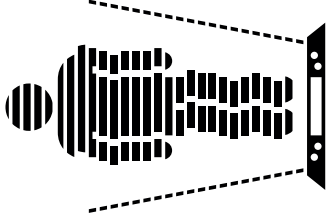
Caretaker: Enter system with client and discuss

Assistant: Visual and textual aid,

Monitor if all subjects have been discussed

Record consultation

Keep track of medical status



It's about working together

Looking for the best treatment together

The idea which is presented here is the tableidtable (and by 2030 hopefully a hologramtable). The tableidtable is actually a table, where the tab is a giant touchscreen on which caretaker and client can look at the patients file together.

The table can be used to show visualisations to help in the explanation of medical conditions and other subjects. Besides that, the table can also be used to create a treatmentplan. The overview generated by this can be taken home (digitally) by the client.

Is the system reliable enough?

What about privacy?

To make this system function properly, clients will have to share a lot of their personal data. This data must be well protected, and clients need to be able to trust on the fact that their data can't be viewed by other without consent of the client.



Validating the patient journey

Delphi round 4

9

Finalizing the consultation

The assistant generates an evidence-based summary. Which serves as support for communication between caretaker and client. At the end of the consultation it should be checked if the summary is correct and complete, so the client can take a summary video home. During the finale stages of the consultation, the assistant will make a new appointment based on the calendars of both caretaker and client, if requested

Client: Wants video of consultation
Caretaker: Checks if summary matches consultation
Assistant: Only gives information if requested by client or caretaker.
 Makes new appointment

10

Assistant at home

During consultation, caretaker and client have to determine what data to collect outside of the consultation. Here it is important that it is specified within the digital assistant when a caretaker should be warned, to prevent a data overflow. Because clients are able to gather a lot of medical data by themselves as well, it is important to show the values in a visual way in stead of just numbers. That way clients will be able to interpret their own data by themselves

Client: Trusts assistant
Caretaker: Efficient and guided approach of client
Assistant: Determine urgency
 Localize nearest care connection

!

How can the client understand this data?

It is highly unlikely a client has the medical knowledge to interpret all medical data generated. To make this data more understandable, 'Fuzzy Logic' can be used. By obtaining from using precise numbers, and instead using color coding, a client does not have to worry for nothing by not understanding numbers. Through the use of colors it will be much easier to see if a value is good or not.

!

Who gets notified?

Who gets a notification when a value is exceeded? The client who doesn't know what to do? Or the already busy caretaker? The assistant needs to be able to properly determine who should receive a notification and at what moment.

4.4 Conclusion

The validating session has significantly improved the final patient journey. It has become shorter, more streamlined and structured.

During the presentation it soon became clear, the ideas presented to the participants resonated with them. Which is important, as most of the people present are healthcare professionals, who all have more knowledge about the feasibility of innovations in healthcare due to their experience.

It needs to be said, however, that the future patient journey, which is presented here, is just one of many possibilities. Depending on what the future may bring, things might work out different. What remains a crucial aspect of consultations is the interaction between doctor and patient.

Especially in a future which seems to be ruled by digital innovations consultations with actual doctors will, at least, maintain their value. AI is still a long way from picking up on all signals a person is sending out, and it is certainly not yet able to communicate in an empathic way. So, whatever the future holds, when innovating consultations, focus on improving the interaction between doctor and patient, because the interaction serves the three main goals of the consultation.

The following and final chapter will attempt to answer the research questions by presenting the final patient journey, validated in this chapter, and a roadmap, a strategic mapping of what steps need to be taken to be able to realize this patient journey.

Validating the patient journey

Summary Delphi round 4



Summary of the Delphi research chapter

Most important findings Timeline 2030 (Round 4)

- Invest in research towards AI in healthcare
- Not doctor, but caretaker.
- Not patient, but client
- Not Digital coach, but digital assistant
- Digital assistant remembers previous conversations with client
- Digital Assistant helps first line of medical care
- The assistant can also be used for difficult life choices (donor, religious preferences, end-of-life decisions)
- Data as currency
- Textless datatransfer
- Communicate with a similar vocabulary
- The consultation is the point in care where trust and empathy come to fruition
- It's about working together
- Caretaker is required to interpret data in an empathic way
- Empathy is a prerequisite for a good consultation
- Consultations will be recorded and summarized by the assistant
- Use fuzzy logic to make the data presented comprehensible for the client

Most important questions Timeline 2030 (Round 4)

- When does someone become a client?
- When will the caretaker be involved?
- How to counter 'head-in-the-sand' behavior?
- How to prevent overmedicalization?
- Is the presented system reliable enough?
- Who gets notified at what moments?



5. Vision 2030

Introduction

Roadmap

Client Journey

Conclusion



Introduction

This chapter will be the final real chapter of this report. The aim of this chapter is to answer the research questions set up in the second chapter. The research questions which need to be answered are:

1. *What will healthcare look like in the year 2030?*
2. *What technologies are currently in development that will be useful during consultation in 2030?*
3. *What will a consultation look like in 2030?*

To answer these questions, all information and insights gathered earlier in this report have been synthesized into a number of concepts and visualizations. The first two research questions will be answered through the creation of a roadmap which shows medical, technical, social and more types of developments over time, from this year, 2019, up to the year 2030.

The third research question will be answered by the visualization of the final client journey, which was finalized after the fourth round of the Delphi study.



5.1 Roadmap

5.1.1 Introduction

To get a complete overview of what needs to be done, changed and innovated upon, a roadmap has been created from 2019 to the year 2030. The roadmap will present an overview of a number of factors placed on a timescale. These technologies and changes will need to take place in a certain order to be able to reach the set up client journey by 2030 (This journey can be found in the next section).

With this roadmap, it will be possible to sketch a vision of what healthcare might look like in 2030, answering the first research question:

“What will healthcare look like in 2030?”

At the same time, the roadmap will provide an overview of technologies currently in development which might be used to improve consultations by 2030, answering the research question:

“What technologies are currently in development that will be useful during consultation in 2030?”

The roadmap can be used by the Erasmus MC to prioritise what they should look into first when preparing the consultation for the year 2030.

5.1.2 Method

The roadmap is designed according to the futures method “three horizons” (Curry & Hodgson, 2008) with a design driven approach for visualizing roadmaps as described by Kerr and Phaal (2015).

The futures method is created to communicate possible future scenario’s in a strategic manner. For this method to work 3 horizons need to be defined.

1st Horizon – The first horizon is the current system which is being used, which loses its’ compatibility over time as the external environment around it changes.

3rd Horizon – The third horizon shows ideas and arguments about the future, which are currently not prevalent, although they hold potential to significantly disrupt the system as it is in the first horizon.

2nd Horizon – This is the moment in time where the first and third horizon come together. This space is often unstable, as different ideas are proposed to develop, which may lead to alternate outcomes.

-(Curry and Hodgson, 2008)

As can be seen from the structure of the “three horizons” method, it is necessary to start a roadmap of with the current system (the first horizon). An overview of what it is like now. Next the third horizon needs to be created, a possible future based on ideas and innovations that are showing potential in the first horizon. Finally, the second horizon can be created. This is the transitional moment between the first and second horizon, so there is still a lot that might change.

The overview created with the help of the “three horizons” futures method is then visualized in a way which shows the different components and relations between those components.



Vision 2030 Roadmap

5.1.3 Results

The roadmap is created by looking at all the changes coming to the medical world found during the analysis and research phase. As it is difficult to determine when a technology will be ready to be taken into use, the times for these innovations to be taken to market have been estimated based on similar recently released technologies.

The roadmap is split up into four components to make it. The components in which the necessary innovations will be placed are:

1. Technological innovations
2. Social-cultural changes
3. Changes in medical
4. Changes in consultations

As can be seen in the roadmap shown in image 35, this order has been chosen deliberately, to show that change should be instigated from technological innovations and medical practices. These changes will then lead to shifts in (medical) society and culture, and finally, the improvements of the consultation, which can be built upon the previous components.

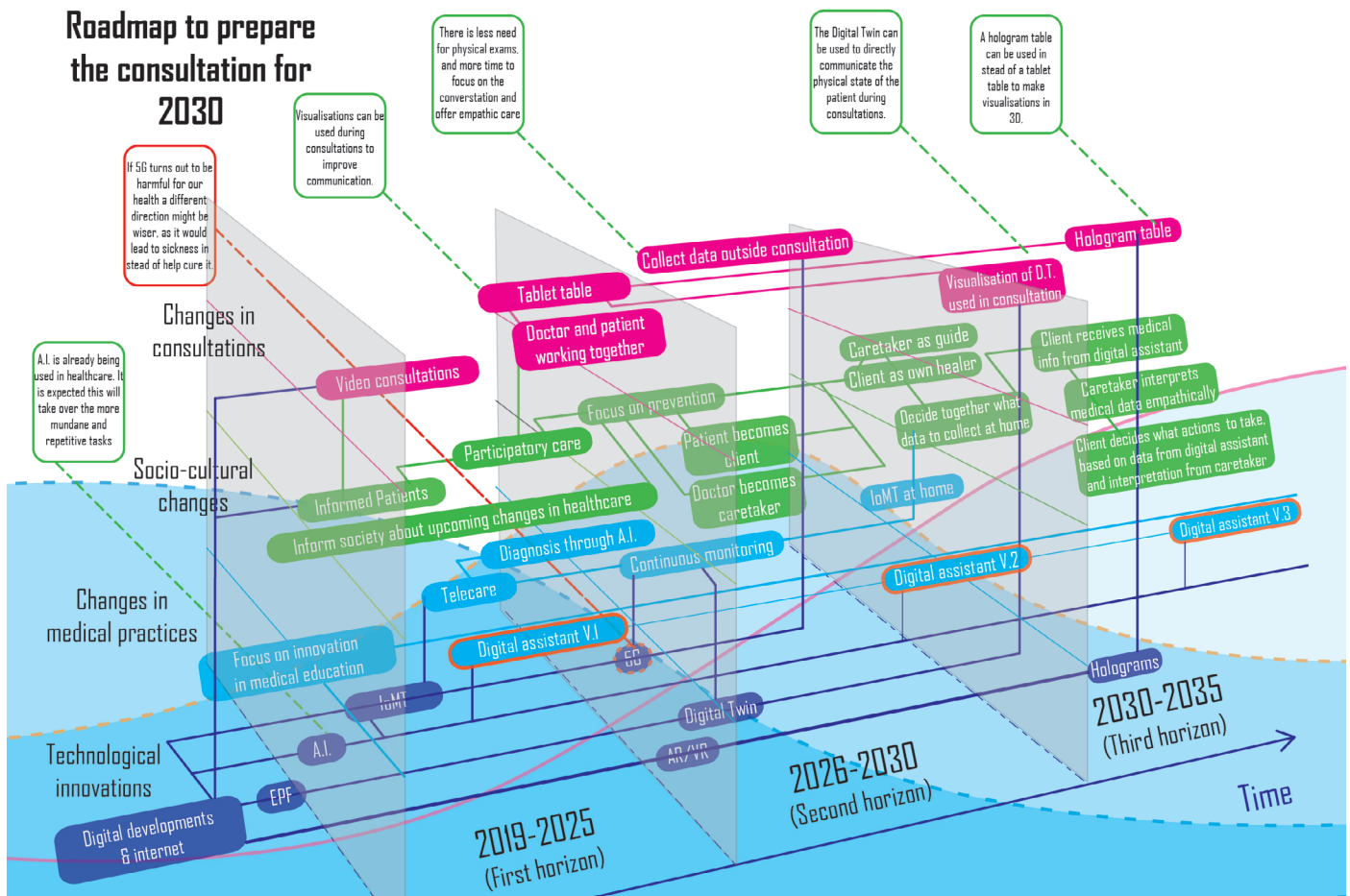


image 35 Roadmap showing how to improve healthcare in the coming years. Almost all innovations are allowed through digital developments and the internet. Each horizon represents a period of time during which developments placed in that horizon are expected to be ready for implementation in healthcare.



The following section will discuss the different components per horizon.

I. Horizon 1 (2019-2025)

This horizon shows current developments and shows steps which need to be taken to reach the intended future, presented in the third horizon.



a. Technological innovations

- I. Currently, the innovation causing the most disruptive change in the healthcare system is digital development and the internet along with it. Most other innovations in healthcare will be a development of digital technologies or web-based applications or apps.
- II. The Electronic Patient File, EPF, is a great example of this. It is a digital version of the paper patient file. There is, however, still room for this to develop further, as it is almost a direct copy of the traditional paper file, and it does not yet make full use of all possibilities offered, by the fact that it is currently a digital document.
- III. AI is a digital development which can also be put to good use in healthcare. Currently, it is already being used to assist medical staff with mundane tasks, but it can also already be used to help diagnose cancer in patients. It will, however, still take a long time before AI will take over actual doctors.
- IV. The Internet of Medical Things, IoMT, is also already being developed. This network of medical devices connected to the internet can help offering remote care. Data gathered through these devices can be monitored by both patient and caretaker, regardless of their location.

b. Changes in medical practices

- I. To prepare healthcare professionals for upcoming changes there should be more focus on innovation during medical education. However, as innovation is something that is ongoing, it is also important to bring contemporary doctors up to speed on what changes might be coming and how this will influence their work. This way, they can be prepared, and a proper way to introduce new technologies can be discussed and prepared.
- II. Now that AI is getting a more prominent role in healthcare, it is important to look into its' possibilities. A digital medical assistant seems to be a way to relieve stress from doctors and give patients more medical knowledge. During the first horizon, a pilot version of the digital assistant should be developed and tested. The aim of this digital assistant is to have it function as a tool to improve communication between doctor and patient. This can be done by using different ways to communicate (visual instead of textual) or by offering patients guided access to medical data.
- III. With the development of the IoMT, Telecare is likely to take a more prominent role in healthcare. With medical devices able to monitor patients at any time and place, much more and more reliable data can be collected compared to traditional methods.
- IV. With the increased use of Telecare, and further developments, it is also likely that AI will be used more and more to help diagnose patients, as they can process more data quicker than doctors.



c. Socio cultural changes

- I. It is necessary to inform society about the upcoming changes in healthcare. It will be expected of patients that they will be more self-sufficient, which will become possible with the help of tools such as the digital assistant.
- II. Informing patients about the upcoming changes also fits in with the cultural change that patients are becoming more informed. By showing patients that you are willing to guide them, they will feel more confident, which will make them more likely to adapt to a future where they have to make their own health related decisions.
- III. With a more informed society, care can also become more participatory. The concept shown at the DDW, CareBnB, is an example of a form participatory care might take in the future. Besides, with people taking care of each other, less people will have to go to hospitals, lowering the total cost of healthcare.

d. Changes in consultations

- I. One of the first significant changes in consultations since the introduction of the computer in the consulting room, is the possibility to do video consultations. This type of consultations, are consultations where doctors are consulted over a distance with the help of a video calling app.
- II. With patients getting more informed, it is likely that patient and doctor are starting to work together more and more.
- III. To facilitate doctor and patient working together, the tablet table should be introduced inside the consulting room. The tablet table is a table with a touchscreen as top. Here both doctor and patient can sit next to each other to have one of them explain a certain condition to the other, or to create a treatment plan together.

2. Horizon 2 (2026-2030)

- I. The second horizon shows a period in time where a lot might change. If innovations in this horizon are dismissed or not working, it may become impossible to reach the third horizon, and alternatives should be considered.



a. Technological innovations

- I. If AR and VR (augmented reality and virtual reality), are developed further in the future, they have the possibility make video consultations even more realistic. Patients would have to visit the hospital even less, because they would not need to see their doctor physically, unless a physical exam is needed of course.
- II. The digital twin is an evolution of the EPD. It is said it should be a real time representation of someone's physical values in a digital form. The digital twin can be used as a more intuitive patient file, which is dominantly visual instead of textual, as was the EPF.
- III. 5G is said to offer the bandwidth necessary to broadcast all medical data once most of society starts wearing medical devices. There are, however, people stating that 5G is hazardous to our health and it should be banned. It is therefore, important that the health risks of 5G are weighed against the benefits of the IoMT, as it seems wrong to use healthcare devices which make their users sicker than they already are.



b. Changes in medical practices

- I. The combination of Telecare, combined with the digital twin and 5G offers the possibility to start continuous monitoring. Continuously collecting the patients' data wherever they are and visualizing it real time in the digital twin. It is however, suggested to start of this type of monitoring only after doctor and patient have discussed this, to prevent overmedicalization.
- II.
 - o At the end of the second horizon, the initial digital assistant, created during the first horizon, can be slowly implemented. During this phase, new functions to add to the assistant should be developed and tested, so they can be implemented during the third horizon. The functions which need to be developed for the third horizon are: guiding patients to the proper medical information, the ability to triage patients, the ability to diagnose patients (preliminary), the possibility to connect patients to the proper care provider.

c. Socio cultural changes

- I. With patients being more informed and working together with doctors in the second horizon, there is room to shift the focus of healthcare towards prevention. A patient who takes an active role in taking care of their own health is better off preventing disease than curing it.
- II. With the focus of healthcare shifting towards prevention, being sick, or a patient, is not necessarily a reason to go the hospital. Therefore, the term patient should be changed to client.
- III. At the other hand, medical professionals who care for these clients do not have to be doctors. As the relationship between client and doctor is changing, the name of doctor should be changed to caretaker, to express a more equal relationship.

d. Changes in consultations

- I. With 5G and the ability to monitor clients continuously, it will become possible to collect medical data outside of consultations. This can lead to a decrease in medical consultations, as both caretaker and client are aware of the medical condition of the client. When the health of the client starts to decrease, the digital assistant can be consulted to find ways to prevent illness. If the clients' health is still failing, a caretaker will be contacted for a full-on diagnosis.

3. Horizon 3

This is what the intended future of healthcare should look like and what developments will take place there to improve consultations.

a. Technological innovations

- I. By this time, it is hoped that holograms will have developed in such a way that they can be used to make lifelike images. In consultations, holograms could be used to expand video consultations, or they could be used in the tablet table to create actual 3D images.



b. Changes in medical practices

- I. With the possibility to monitor continuously, it is expected that clients start doing this even without the suggestion of healthcare professionals. By this time, either the devices clients use must be so reliable, the data they generate can be trusted by caretakers, or, there should be a standard of what types of devices are reliable enough for clients to monitor their health.
- II. During the third horizon, several iterations of the digital assistant need to be developed tested and put to use, so that by the end of the third horizon, around 2035, the digital assistant is an application which can be used by patients to assist them when they are in need of care.



c. **Socio cultural changes**

- I. By this time, clients should be informed in such a way that they know where to find the necessary medical information and how to make decisions. This will change the relationship between client and caretaker even further. As the client becomes its own healer, and the caretaker becomes a guide.
- II. This change in relationship will change the consultation into a moment where empathic care is offered and where is decided what data needs to be collected by the client to stay or become healthy (again).
- III. At home, the client then receives medical data from its' digital assistant.
- IV. At the hospital, the caretaker receives this data as well, and interprets it in such a way that he/she is able to communicate the potential consequences of the findings in an empathic way.

d. **Changes in consultations**

- I. With the introduction of the digital twin, and continuous monitoring, A real-life visualization of the clients' physical state can be used during consultations. This visualization can serve as a means of communication, for both doctor and patient to explain things, like a certain feeling, or how an infection might spread.
- II. The hologram table is an evolution of the tablet table, which was introduced in the first horizon. This table can of course only be introduced once holograms are actually feasible to make.

This roadmap shows the way to a future where patients are no longer patients but clients. Clients with a digital assistant which can assist them in preventing to get sick, finding the required medical information, and connecting them to the needed caretaker at the right time.

in the next section it will be explained how the roadmap has created a vision of the future of healthcare.

Answering the first research question, what will healthcare look like in the year 2030?

Throughout this project a lot of information has been gathered on how healthcare might change into the future. The roadmap (image xx) is a visualization of the most remarkable developments identified, which are currently in development, or might be developed, in the future. The roadmap not only shows the way on how to prepare consultations for the future, it also shows the changes needed in healthcare in general.

The following can be said about what healthcare will look like in 2030:

Patients have become clients, as they are already paying attention to their health in attempt to prevent getting sick. When they have any medical questions, clients can consult their digital medical assistant, which is an app on their personal device, which would be a smartphone in the current day and age. When the assistant is unable to provide the required aid to the patient, or more personal care is required, the patient is free to contact their caretaker, their former doctor. Together with their caretaker, clients can take a look at their medical data, provided by the digital assistant. Here, the conversation will primarily focus on the way the client should interpret this data and communicate it in an empathic way. As information about what to do with certain conditions or in certain situations can often be found online, there is less need to discuss that, and more time to focus on what consequences certain results may have on their life, and how to properly deal with that.

In short it can be said that in 2030, healthcare will be changed in such a way that:

Clients are their own healers who are guided by caretakers. The digital medical assistant is embedded in the clients' personal life, to always have access to verified medical information, tailored to the clients' needs.



Answering the second research question - What technologies are currently in development that might benefit consultations?

Innovations which are most likely to change healthcare are mainly products or services with a digital component, such as wearables, which are part of the IoMT, but AI will also play a major role in the advancements in healthcare.

New imaging techniques are good to have, to improve communication between client and caretaker. Although, at the same time, the visualization techniques that are currently available can already be used to improve communication between client and caretaker.

5G networks will be set up in the Netherlands, so they can be used, for mobile networks, but also to connect clients to the IoMT and to monitor their health. Since there are people claiming that the frequencies used in the 5G network are hazardous to our health, the use of wearables which are connected through 5G needs to be seriously evaluated, as placing devices that use 5G on our bodies might only make us more sick.

The following can be said about technologies that are currently in development that will be useful during consultation in 2030:

To reach a future where patients can become clients who are guided by their doctors who are now caretakers, time and effort should be put into researching digital developments and trends. The focus with this should lie with medical devices that can be connected to the IoMT, and AI. Research into the possible health risks of 5G is also suggested to avoid possible mistakes.

The future patient journey, presented in the previous chapter, is an example of what consultations might entail by 2030. On the following pages, the steps are explained in more detail.



Vision 2030

Future patient journey

5.2 The future patient journey

5.2.1 introduction

This section will discuss the future patient journey, presented in the previous chapter, in detail. First the visualization will be presented, after which the different steps and feedback gathered in Delphi round 4 are presented. Next, the third research question of this paper will be answered with the help of the future patient journey.

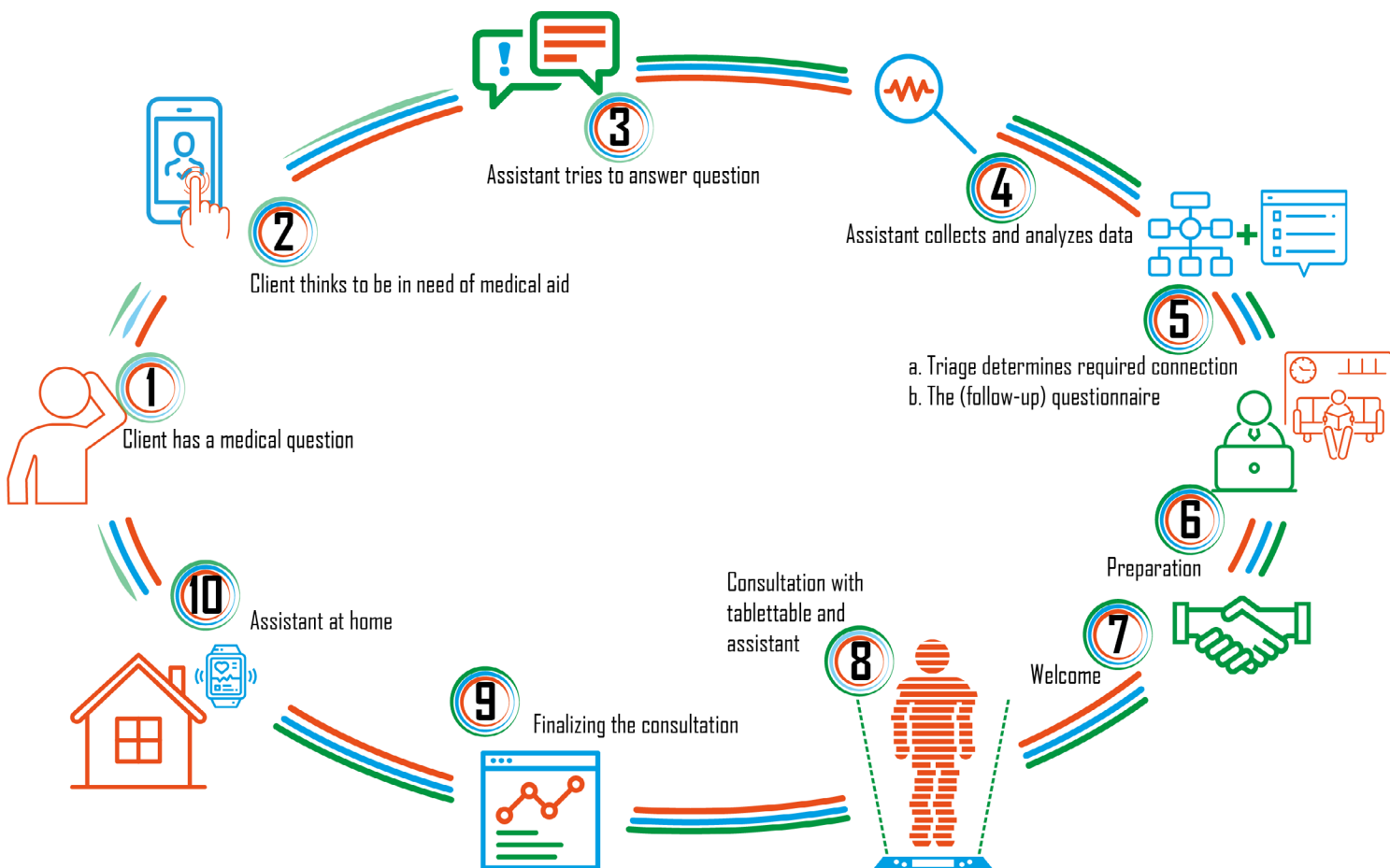


image 36 Visual representation of the patient journey of 2030

5.2.2 Results

image 36 shows a visual representation of the future patient journey. As clients have become their own main healer in 2030, they are placed in the center of this cycle. The caretaker is placed at the outer edge, so the digital medical assistant can be seen as a bridge for communication between client and caretaker.

With the introduction of digital medical assistants, consultations of the future will have three participants, or 'stakeholders', the client, the caretaker and the digital medical assistant.

Consultations start at a different moment for each of these three stakeholders. For the client, it starts when they have a medical question (step 1). The assistant gets involved once the client thinks to be in need of actual medical aid, and starts the assistant on their personal device (step 2). The caretaker gets involved once the assistant sends out a notification that the client might be in need of care (step 3). However, this is still just a notification.

Vision 2030

Future patient journey



Only when the client decides to actually contact a caretaker, the caretaker is informed (step 4).

Triaging the patient is mostly done by the assistant. However, if there are any grey areas where the assistant might have trouble drawing the right conclusions, it can be assisted over a distance by a caretaker to make the final decisions (step 5a). Based on the triage, the client can fill in a follow up questionnaire inside the app of their digital assistant, which can help them prepare for their planned consultation (step 5b).

there are multiple ways for clients to contact their caretaker. They can: ask for a physical consultation, video consultation, send a (video) message (if there is a question which can not be answered by the assistant, that is no pressing matter), or decline contact (in cases where care is no longer needed for example).

During the preparation phase (step 6), the client will be worried, but they are provided with information, while their caretaker is taking a closer look at their medical data to identify the problem. Once the doctor is ready to see the patient, they will pick them up from the waiting room themselves, at the start of a physical consultation (step 7).

During the consultation (step 8), the client's digital assistant can be plugged in to the tablet table, so everything discussed, created and shared during that consultation, is immediately uploaded to the client's digital assistant. Besides functioning as a recording device, the tablet table serves as a means of communication, where client and caretaker can talk in the same (visual) language, which requires little to none medical expertise. This will improve communication inside consultations and add value.

At the end of the consultation (step 9), client and caretaker check if the recorded summary, created by the digital assistant is correct. The patient will probably want some kind of recording of the consultation so they can look it back later. This recording will be already uploaded to their digital assistant, so there is no need to worry about that.

At home (step 10), it should be possible to connect the digital assistant to other medical wearable devices. This way, clients do not have to focus on their health all the time, as they are being monitored by their personal digital assistant. Only when the wearables measure values which might indicate dangers to the clients' health, will the client be warned. Clients can still go to consultations with their caretakers, although, these will more often become regular check ups to stay of good health, in stead of trying to cure a disease they have already caught.

Every time the client gets another medical question, the cycle starts again at step 1.

Answering the third research question - What will a consultation look like in 2030?

At a first glance, there might not seem to be any significant changes to future consultations. However, what this report has done, is create a core framework of what a consultation should entail by 2030. The future patient journey is an example of what an actual consultation might look like once it is built upon this framework.

The core elements which need to be part of future consultations are listed below, with along with their origin.

- I. Most important aspect of consultations is the interaction between client and caretaker. Therefore, the best way to improve consultations, is to focus on improving interaction. (conclusion expert interviews)
 - I. A way to allow client and caretaker to focus more on the interaction, is by replacing the computer in consulting rooms, as it takes up a lot of attention. In the presented patient journey, the pc is replaced by a tablet table which can be used cooperatively by caretaker and client to communicate throughout the consultation. (Delphi study)



Vision 2030

Future patient journey

- II. Another way to improve interaction within consultations, is to have both parties properly prepare beforehand. The caretaker already does this, clients, however, could use guidance in preparing for consultations (Expert interviews). The digital assistant could aid clients, in preparing for their consultation, by suggesting relevant questions and setting the right expectations.
 - III. Finally, it is expected that the relationship between client and caretaker will change. Shifting towards a more equal relationship, clients will become their own healers who are guided by their caretakers (literature research). This shifting relationship can, again, be supported by the introduction of a digital assistant, which can guide clients to the proper medical information.
2. Technological innovations offer numerous ways to alter consultations, however, these alterations are not necessarily beneficial for consultations. Therefore, the most impactful innovations that might have a positive impact on healthcare will be presented below
- I. With AI becoming a more common phenomenon nowadays, it is expected that it will gain even more applications in the coming ten years. One of the most impactful ideas will be AI in the form of a digital medical assistant which can be used to communicate medical data between client and caretaker. This allows for (in)direct communication outside of the consultation, leaving more time inside consultations to focus on the things that are really important (literature research).
 - II. Next to AI, the IoMT will also play a significant role in the changes coming to consultations. Devices connected to the IoMT can be used to continuously collect medical data which can be used inside consultations. (literature research)
 - III. To have IoMT reach its' full potential, 5G is needed, to process the large amounts of data. There are people who raise concerns about possible health risks, which should be researched when looking into the use of wearables for monitoring patients (literature research).

Future consultations should adhere to the vision introduced in the research chapter. The design brief is a way to reach this vision, which has been used to create the, now validated, future patient journey. Because the presented journey adheres to the vision created for consultations in 2030, it is regarded as a realistic vision of future consultations.

In short it can be said that future consultations will become a moment where clients will discuss personal matters regarding their health, with their caretaker. For more general questions they can consult their digital medical assistant.

To allow for the most efficient use of time in consultations, clients are prepared with the help of their assistant, and caretakers get medical data from their clients' assistant.

Due to a shift in relationship, because clients have access to more medical information and data, clients and caretakers are now able to communicate on the same level with the help of a tablet- or hologram table.

Once a consultation is concluded, clients should get a(n) (digital) overview of the consultation, so they can look back at the information that was shared and they might have forgotten.

At home, clients will still be able to monitor their own health through the IoMT. This way, when they go in to talk with their caretaker for another consultation, they will have a reliable overview of their own medical data, over a longer period of time.



5.3 Final conclusion

The goal of this project was to design a consulting room for the Erasmus MC in the year 2030. After initial research, the conclusion was drawn that designing a consulting room which needs to be put in use is more or less pointless, as there are too many uncertain factors, which might change what the ideal consulting room should look like by 2030.

Instead, the decision was made to redesign the consultation as a whole. Letting go of the idea of a physical room allows for a much more holistic approach, where multiple aspects of consultations and healthcare are evaluated.

With the insights gained from this holistic research approach, it has become possible to answer the three research questions presented at the beginning of this report.

The first research question was: 'What will healthcare look like in 2030?'

In short this can be answered with the following statement:

"The future of healthcare will be significantly different from healthcare as it is known today. Patients have easier access to medical information, which allows them to take a more active role in their own treatment. This causes the relationships between patients and doctors to change, making them clients and caretakers."

The second research question was: 'What technologies are currently in development that might benefit consultations?'

The most promising innovations for healthcare, currently in development, are AI and the IoMT. These developments hold the potential to take a lot of activities out of consultations, so the consultation itself can focus on the interaction between caretaker and client again.

The answer to the third and final research question: 'What will a consultation look like in 2030?'

Comes from the previous research questions and the future patient journey. The goals of consultations remain the same as they currently are. However, as a lot of activities which are currently being performed during consultations, can also be performed outside of consultations, there will be more room to focus on the interaction between client and caretaker.

To improve consultations even further, Digital Medical Assistants should be introduced that offer as a means of communication between client and caretaker. The assistant is able to offer its' client relevant medical information and it warns caretakers, when a clients' health starts to deteriorate.

A final addition to consultations is the tablet-/hologram table. Another means to improve communication between client and caretaker. With the introduction of a visual communication tool, which is used by both client and caretaker during consultations, communication is improved even further. this fulfills the design brief, created in the research chapter.

It must be said however, that the future envisioned here, is not yet certain. In the coming years a lot might change, innovations might not develop as fast as expected, or faster. Technologies such as 5G might be banned due to health risks.

Therefore, it is important to keep the core elements for improving consultations in mind when thinking about the future of healthcare. As the core elements are built around the three main goals of consultations.

The following pages present a list of recommendations to consider when designing a new consulting room.



Recommendations

Technological innovations

AI

2.2.2 & 3.2.3

Explanation

Put resources into researching the possibilities of Artificial Intelligence to use to communicate with patients. Today, AI is already being used to diagnose cancer patients, but there are way more applications for this technology. Most mundane tasks can be outsourced to AI, this will not take away jobs, but create space for healthcare professionals to focus more on their clients.

Possible applications

AI can be used to create a digital assistant

Possible threats to this technology

AI needs data to function properly. As medical data contains highly sensitive information, regulations are required to protect privacy whilst at the same time offering the possibility to share medical data for the purposes of feeding AI. Otherwise it will be hard for AI to reach its' full potential

The Internet of Medical Things (IoMT)

2.2.2 & 3.1.2.2

Explanation

The Internet of Medical Things, are all medical devices that can be connected to a (global) digital network and their users. Devices connected to the IoMT can be used to continuously monitor patients over a distance, which allows for the creation of a real-time 'digital twin' which represents the physical state of the patient. Especially in combination, the IoMT can become a powerful tool in healthcare.

Possible applications

Continuous monitoring, remote diagnosis, warn clients to prevent them from getting sick

Possible threats to this technology

When the IoMT is to be used by the majority of the population, a new wireless network is required to transmit all generated data, without overloading the network. Currently, network providers are setting up the first 5G wireless networks, to create a system which can transmit more data. There are, however people expressing concerns regarding the health risks of 5G networks. Further research into this matter is required, as it would be morally wrong to monitor patients with devices that would make them even more sick.



Changes in medical practices Focus on innovation in medical education 3.2.3

The current culture in healthcare is still a bit conservative. As numerous innovations and changes are coming to this industry, it is important to prepare healthcare students for the continuous innovation and change they will encounter once they start working as caretakers.

Digital Medical Assistant (DMA) 3.2.4 & 3.2.3 **Explanation**

The digital assistant is an application on the personal device of clients which can assist them with healthcare related issues. The assistant serves as a first connection and communication device between client and healthcare. The aim of the digital medical assistant is to give clients the possibility to become even more informed, so they will be able to take on more responsibility in guarding their own health. Caretakers, on the other hand, should receive fewer physical consultations, as clients can be informed through the DMA.

Possible applications

Use the DMA to perform anamnesis on patients, to triage them, to guide them to the proper caretaker and information.

Possible threats

The biggest threat to the digital medical assistant is probably the willingness of society to accept this new 'role' in healthcare. As, currently, a lot of people still want to talk to an actual human caretaker, who can offer actual empathic care.

Socio-Cultural changes Inform clients about upcoming changes in healthcare 3.2.3 **Explanation**

Healthcare is changing rapidly and not everyone can or will be able to keep up. By informing patients about upcoming changes in consultations they can be prepared. The information should introduce the medical assistant as a new medical tool which can be used by doctor and patient, or, caretaker and client, to communicate.

Possible applications

Ask a consultancy or marketing company to research the best way to inform clients about upcoming changes

Possible threats

The message can be interpreted in the wrong way. A way to minimize the chance of this happening, is to focus specific target groups with their preferred means of communication.



Vision 2030 Recommendations

Focus on prevention 2.2.1

Explanation

Patients who are more involved in their own health, will start to look into ways of preventing getting sick, since staying of good health is easier done than getting better. People who want to prevent getting sick are given the tools, with devices such as wearables, to monitor their own physical state. People monitoring their health this way will probably even go to see their doctor for a check-up. Since people no longer only see their doctor, it is suggested to change the names of doctor and patient, to caretaker (doctor) and client (patient).

Possible threats

Some people really can not care for themselves. They should not be expected to ever become clients, and there should always remain care aimed at actual patients.

Changes in consultations

Doctor and patient working together 3.2.3

Explanation

With better informed patients/clients, who focus on prevention, the relationship between caretaker and client will change. Patient will have more control over their own treatment. During this treatment, consultations can be used by client and caretaker to decide together what the best option of treatment for the client is.

Possible application

Caretakers can show their clients different treatment options through the MDA. This way, clients can compare the different treatment options in depth in their own time. During consultations, the presented treatment are discussed, after which the clients decide which treatment they would prefer.

Possible threats

-

Tablet-/hologram table 4.3

Explanation

The tablet table is a platform which clients and caretakers can use to communicate on a similar level. Through visualizations of treatment plans, mechanics with different conditions, or even a simple timeline. A common can language be created. This is necessary, as there is often a significant gap in medical knowledge and language when doctors and patients are communicating.

Possible application

The tablet table can be used to simplify medical terminology, so explanations are easier understood. This is especially useful when communicating with illiterate or foreign people.

Possible threats

-

6. Concluding

Evaluation

References

Appendices



Introduction

The following chapter contains the concluding sections of this report, which are: the Evaluation, References and Appendices.

The evaluation section will be used to give a personal evaluation, and 10 pointers will be presented for cooperating with medicine students.

References show the references used throughout this report.

The documents found in the appendix are not part of the paper report and they can only be found in the digital version of the report.

6.1 Personal evaluation

Looking back at the start of this project, I can confidently say I have learned and grown a lot. After a study break of 6 months it was at first hard to get back into the 'flow' of studying. Luckily I was working with Andries van Vliet. We were working together regularly, which has helped me to get used to studying again.

Sadly, I have been struggling with my health and energy throughout this project. This has caused me a lot of frustration, anger and sadness. Luckily my coach and mentor are very understanding in this matter, and they have given me the feedback I needed to finish this project despite my personal issues.

Still, these struggles have caused me to lose my motivation throughout the project multiple times. This has made it hard for me from time to time to motivate myself to work on this report, as a lot of the time I did not feel like I was even able to concentrate properly because I was so tired.

When my coach asked me if I would like to have weekly meetings to discuss the progress of my report, I gladly accepted his offer. With someone to show my work to from week to week, I felt like I finally had a reason to do something. I know I have a hard time motivating myself, but when I know there is someone, other than myself, I made a promise to, it will be easier to put myself to work.

His feedback has taught me a lot. With simple drawings he showed me how to properly structure my report, which made it easier to visualize what should be in there and which made it easier to actually do some work.

I have also gotten wonderful advice from my mentor, even though

at first I might have been a bit reluctant. She assisted me in the design aspect of the report. And showed me how to work with visual language, create space and also rest in my document.

Working with a medical student has been great. It was fun to get to know him, and he has shared some wonderful insights which are part of the end result. Working together was inspiring because he was so enthusiastic. He has had a major role in the research process and he introduced relevant ideas which I could have never thought of, because I lack the medical knowledge he owns. This has made me appreciate the power of co-creation even more. It is such a powerful tool to gain, comprehend, and communicate knowledge to the target audience in the right way.

I've had my ups and downs during this project, but now that I have finished this report, I am content. I am happy that I'm done. But if I could, I would do it again, because I am not satisfied. Don't get me wrong, I like the research and how it went. I love the message and the ideas we came up with. But I would like to communicate it better, because I feel that is where I am currently lacking. This will be something for a future project.

For now I can only thank everyone who assisted me during this project and my study time in general.

6.2 10 pointers for cooperating with medicine students

For the larger part of this project, I have had the luxury of working together with a student medicine, A. van Vliet. He introduced me into the world of medicine, and guided me if at anytime I lost my bearings.

- I. As a designer, make use of (generative) tools to acquire tacit knowledge. Medicine students know a lot, although they do not always have the means to communicate their knowledge. Generative tools can help them find new possibilities to do so.
- II. Try interviewing medical professionals together with a medicine student. As medical professionals tend to use a lot of jargon, which will be easier for the medicine student to understand, so the interview can keep on going.
- III. Whenever you have a new idea, present it to your fellow student. When giving feedback, they will automatically implement medical knowledge, which you probably lack. This will make it easier to identify ideas relevant to healthcare.
- IV. There are major differences between our studies, different techniques are used. Ask your fellow student how they would do their research and see if there is a way to combine the medicine and design research (as van Vliet and I did in the Delphi study).
- V. Medicine students work in a different way than designers. Be prepared for this.
- VI. Sometimes, medicine students can be a bit rigid, as they have to follow regulations, this can be a good thing, as it offers structure and grip. However, sometimes it is necessary to have them let go of this rigidity to let them be creative.
- VII. Do random brainstorm sessions where you discuss your combined findings up until that point. By doing this, you can align your points of view and clarify anything that might be unclear.
- VIII. As a designer, you are a guest in the world of healthcare where medicine students are in their element. If you need anything, ask them for the best way to approach this. With their connections it is likely they know someone who can help you.
- IX. Medical students do not use visual presentation tools very often. When working/presenting together, the designer should make the visualizations, but they should be checked by the medicine student.
- X. Especially for this project, it is important to work together with someone who welcomes innovation. As mentioned in the beginning of this section: I've had the luxury of working together with A. van Vliet. He was already interested in the study of Industrial Design Engineering and it showed in his enthusiasm for this project. I am not saying you should have him on your team, but someone like him would make the project way more enjoyable and inspiring.

6.1 References

Al Jazeera English. (2017, December 27). How are robots changing the future of healthcare? | Al Jazeera English [Video file]. Retrieved March 8, 2019, from <https://www.youtube.com/watch?v=-2EckHQhXk>

Bejjani, A. (2019, April 4). AI has the potential to enrich our lives in so many ways – if we use it properly. Retrieved April 16, 2019, from <https://www.weforum.org/agenda/2019/04/dont-be-scared-of-ai-its-going-to-change-humanity-for-the-better/>
Bepaalde vormen van kanker zullen een chronische ziekte worden. (2015, August 10). Retrieved February 3, 2019, from <https://catharinaziekenhuis.nl/pers/nieuws/1096-bepaalde-vormen-van-kanker-zullen-een-chronische-ziekte-worden.html>

Berman, N. (2016, 15 juni). What is Biomanufacturing and How Will it Change the World? Retrieved November 1, 2018, from <https://moneyinc.com/biomanufacturing/>

Björnberg, A., & Phang, A. Y. (2019). Euro Health Consumer Index. Geraadpleegd van <https://healthpowerhouse.com/media/EHCI-2018/EHCI-2018-report.pdf>

Carrie, A. (2019, February 14). Guest Blog: More Than Just Speed: Will 5G Have Increased Data Security? - Treehouse Tech Group [Blog post]. Retrieved March 8, 2019, from <https://treehousetechgroup.com/will-5g-increase-data-security/>

CBS Statline: Zorguitgaven internationaal vergelijkbaar. (2018, May 29). Retrieved March 31, 2019, from <https://opendata.cbs.nl/statline/>

Chapman, C. (2014, December 19). 7 Basics to Create a Good Design Brief. Retrieved March 8, 2019, from <https://www.webdesignerdepot.com/2011/03/7-basics-to-create-a-good-design-brief/>

Chinnock, C. (2018, January 31). Light Field Displays are Coming. Retrieved April 12, 2019, from <https://www.displaydaily.com/article/display-daily/light-field-displays-are-coming>

Curry, A., & Hodgson, A. (2008). Seeing in multiple horizons: connecting futures to strategy. *Journal of Futures Studies*, 13(1), 1-20.

De Haes, H., & Bensing, J. (2009). Endpoints in medical communication research, proposing a framework of functions and outcomes. *Patient education and counseling*, 74(3), 287-294.

De lijnen in de gezondheidszorg. (2017). Retrieved February 5, 2019, from <https://hoezitdegezondheidszorgin elkaar.jouwweb.nl/de-lijnen-in-de-gezondheidszorg>

Dr. Hempel Digital Health Network. (2019, January 22). The critical role of 5G transforming digital healthcare | Why its decisive? Retrieved May 16, 2019, from <https://www.dr-hempel-network.com/digital-health-technology/5g-transforming-digital-healthcare/>

Econsultancy. (2019, February 1). 10 examples of the Internet of Things in healthcare – Econsultancy. Retrieved May 16, 2019, from <https://econsultancy.com/internet-of-things-healthcare/>

Eubank, B. H., Mohtadi, N. G., Lafave, M. R., Wiley, J. P., Bois, A. J., Boorman, R. S., & Sheps, D. M. (2016). Using the modified Delphi method to establish clinical consensus for the diagnosis and treatment of patients with rotator cuff pathology. *BMC medical research methodology*, 16(1), 56.

Gelder, A. (2018, July 8). Professor: Over 15 jaar is kanker chronische ziekte. Retrieved February 3, 2019, from <https://catharinaziekenhuis.nl/pers/nieuws/1096-bepaalde-vormen-van-kanker-zullen-een-chronische-ziekte-worden.html>

Hackernoon. (2018, October 7). Fundamentals of display technologies for Augmented and Virtual Reality. Retrieved April 15, 2019, from <https://hackernoon.com/fundamentals-of-display-technologies-for-augmented-and-virtual-reality-c88e4b9b0895?gi=f741e5544ae>

Heath, N. (2019, April 1). What is AI? Everything you need to know about Artificial Intelligence. Retrieved April 15, 2019, from <https://www.zdnet.com/article/what-is-ai-everything-you-need-to-know-about-artificial-intelligence/>

Holland, P., & Hollister, S. (2018, October 17). The Red Hydrogen One is out this week: Here's everything you need to know. Retrieved April 15, 2019, from <https://www.cnet.com/reviews/red-hydrogen-one-preview/>

Hoogendoorn, A. (2018, 18 augustus). Wat houdt eerstelijnszorg en tweedelijnszorg in? Retrieved Februari 5, 2019, from <https://weblog.independen.nl/huisartsen/wat-houdt-eerstelijnszorg-en-tweedelijnszorg-in/>

<https://www.lhv.nl/actueel/bestuursblog/oak-nuldelijnszorg-kost-geld>

IEEE EMBS. (2019). Wearable & Implantable Technologies. Retrieved April 10, 2019, from <https://www.embs.org/about-biomedical-engineering/our-areas-of-research/wearable-implantable-technologies/>

JRS ECO. (2017, September 8). EU 5G Appèl – Wetenschappers waarschuwen voor mogelijke ernstige gezondheidseffecten van 5G – JRS Electro Health / Eco Wireless. Retrieved May 16, 2019, from <https://www.jrseco.com/nl/eu-5g-appel-wetenschappers-waarschuwen-voor-mogelijke-ernstige-gezondheidseffecten-van-5g/>

Kerr, C., & Phaal, R. (2015). Visualizing roadmaps: A design-driven approach. *Research-Technology Management*, 58(4), 45-54.

Koen-Zorgwijzer. (2017, September 4). Zorg in Europa: Nederland behoort tot duurste én beste - Zorgwijzer. Retrieved March 31, 2019, from <https://www.zorgwijzer.nl/zorgverzekering-2017/zorg-europa-nederland-behoort-tot-duurste-en-beste>

Koen van Zorgwijzer. (2019, February 26). Zorgstelsel Nederland op plek 2 Europa - Zorgwijzer. Retrieved April 7, 2019, from <https://www.zorgwijzer.nl/zorgverzekering-2020/zorgstelsel-nederland-op-plek-2-europa>

Kossarova, L., Blunt, I., & Bardsley, M. (2015, July). Focus on: International comparisons of healthcare quality. Retrieved March 31, 2019, from <https://www.nuffieldtrust.org.uk/research/focus-on-international-comparisons-of-healthcare-quality>

Ku, K. (n.d.). Tiger Penis Project. Retrieved April 23, 2019, from <https://www.kukuangyi.com/tiger-penis-project.html>

Light Field Labs. (2018). Real Holograms, No Headgear. Retrieved April 15, 2019, from <https://www.lightfieldlab.com/>

Loo, R. (2002). The Delphi method: a powerful tool for strategic management. *Policing: An International Journal of Police Strategies & Management*, 25(4), 762-769.

Lustig, A. (2018). Andy Builds [Video]. Geraadpleegd op 23 april 2019, van <https://www.andybuilds.com/projects/Syringe%20Pump/syringe/>

Macfarlan, A. (n.d.). Delphi Study | Better Evaluation. Retrieved June 9, 2019, from <https://www.betterevaluation.org/en/evaluation-options/delphitechnique>

Magsi, H., Sodhro, A. H., Chachar, F. A., Abro, S. A. K., Sodhro, G. H., & Pirbhulal, S. (2018, March). Evolution of 5G in Internet of medical things. In 2018 International Conference on Computing, Mathematics and Engineering Technologies (iCoMET) (pp. 1-7). IEEE.

Marchal, T. (2018, November 8). Will Digital Twins Improve Healthcare for Their Real-World Counterparts? Retrieved April 12, 2019, from <https://www.ansys.com/blog/will-digital-twins-improve-healthcare-real-world-counterparts>

McKendrick, J. (2018, August 20). Artificial Intelligence Will Replace Tasks, Not Jobs. Retrieved April 16, 2019, from <https://www.forbes.com/sites/joemckendrick/2018/08/14/artificial-intelligence-will-replace-tasks-not-jobs/>

Mens, R. (2019, February 19). T-Mobile start sneller dan verwacht met landelijk 5G in Nederland. Retrieved May 16, 2019, from <https://www.onemorething.nl/2019/02/t-mobile-5g-in-nederland/>

References

Morgan, J. (2014). A simple explanation of 'the internet of things'. *Forbes/Leadership*.

Murison, M. (2018a, February 10). Robots to transform Japan's social care by 2020 | Internet of Business. Retrieved April 10, 2019, from <https://internetofbusiness.com/robots-japan-social-care/>

Murphy, M. (2017, September 25). Bloomberg - Are you a robot? Retrieved February 3, 2019, from <https://www.bloomberg.com/tosv2.html?vid=&uuiid=1303e9e0-2802-11e9-a46e-6f6dd253cac2&url=L25ld3MvZmVhdHVyZXMvMjAxNy0wOS0yMCG9naW5uaS1yb2l1dHR5LW9uLWFyZGlmaWNpYWwtaW50ZWxsaWdlbmNI>

Nictiz. (n.d.). Zorgdomeinen - Nictiz. Retrieved February 14, 2019, from <https://www.nictiz.nl/overzicht-standaarden/zorgdomeinen/>

Philips. (2019, January 30). The rise of the digital twin: how healthcare can benefit. Retrieved April 12, 2019, from <https://www.philips.com/a-w/about/news/archive/blogs/innovation-matters/20180830-the-rise-of-the-digital-twin-how-healthcare-can-benefit.html>

Rijksinstituut voor Volksgezondheid en Milieu. (2018). Volksgezondheid Toekomst Verkenning 2018 Een gezond vooruitzicht (Synthese). Retrieved from https://www.vtv2018.nl/sites/default/files/2018-08/112810_010513_VTV_kernboodschappen_TG3_1.pdf

Robot Care Systems. (2019, February 19). Robot Care Systems - LEA. Retrieved April 10, 2019, from <https://www.robotcaresystems.com/>

Royal Haskoning DHV. (2018). De transitie naar het zorglandschap van 2030. Retrieved from <https://www.royalhaskoningdhv.com/nl-nl/nederland/specials/zorglandschap2030>

Samsung. (2019, January 10). [Video] Meet the Samsung Bots: Your Companions of the Future. Retrieved April 10, 2019, from <https://news.samsung.com/global/video-meet-the-samsung-bots-your-companions-of-the-future>

Schooley, S. (2019, June 6). What Is a Vision Statement? Retrieved June 19, 2019, from <https://www.businessnewsdaily.com/3882-vision-statement.html>

Steadman, I. (2017, October 4). IBM's Watson is better at diagnosing cancer than human doctors. Retrieved April 16, 2019, from <https://www.wired.co.uk/article/ibm-watson-medical-doctor>

Techquickie. (2017, April 14). What is 5G? [Video file]. Retrieved March 8, 2019, from <https://www.youtube.com/watch?v=jQLY-Wikb0A>

TSA. (n.d.). What is telecare? Retrieved April 12, 2019, from <https://www.tsa-voice.org.uk/consumer-services/what-is-telecare>

Van Hooijdonk, R. (2018, 4 oktober). 3 incredible medical innovations that shape the future of patient care - Richard van Hooijdonk. Retrieved October 24, 2018, from <https://www.richardvanhooijdonk.com/en/blog/3-incredible-medical-innovations-shape-future-patient-care/>

Van Straten, B., Van der Lende, V., & NPO Focus. (n.d.). Wat maakt CRISPR zo revolutionair? | NPO Focus. Retrieved April 10, 2019, from <https://www.npofocus.nl/artikel/7736/wat-maakt-crispr-zo-revolutionair>

Vastelastenbond. (2015, September 8). Waarom stijgen de zorgkosten? Retrieved April 7, 2019, from <https://www.vastelastenbond.nl/blog/waarom-stijgen-de-zorgkosten/>

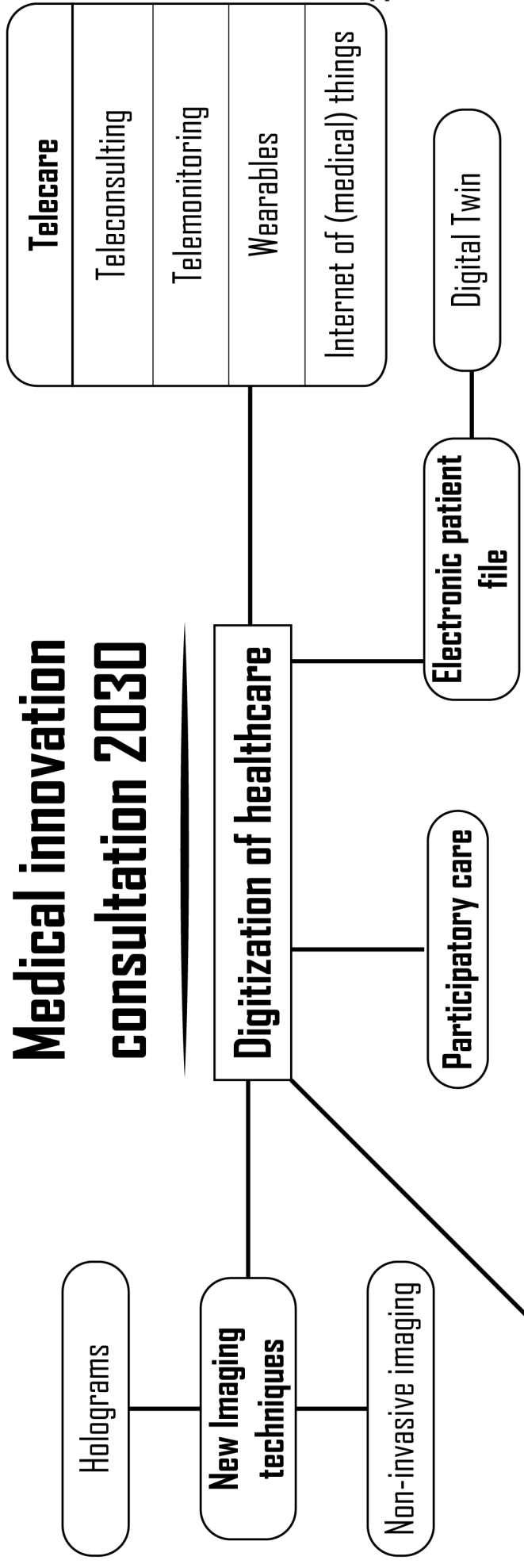
Verge Science. (2018, July 10). Why graphene hasn't taken over the world...yet [Video file]. Retrieved March 8, 2019, from <https://www.youtube.com/watch?v=lesIsKMjB4Y>

Wiggers, K. (2018, October 13). Google AI claims 99% accuracy in metastatic breast cancer detection. Retrieved April 16, 2019, from <https://venturebeat.com/2018/10/12/google-ai-claims-99-accuracy-in-metastatic-breast-cancer-detection/>

WIRED. (2017, April 25). The Robot Will See You Now "AI and Your Health Care | Robots & Us | WIRED [Video file]. Retrieved March 8, 2019, from <https://www.youtube.com/watch?v=xlQu1YKZAOY>

Zinvolle innovaties in de gezondheidszorg | Philips Healthcare.
(z.d.). Geraadpleegd op 30 oktober 2018, van <https://www.philips.nl/healthcare>

Medical innovation consultation 2030



New ways of data analysis through Artificial Intelligence

- Reactive machines
- Limited memory machines
- Theory of mind machines
- Self-aware machines

What has been found

- Healthcare started its' **digitization** relatively late.
- Digital technologies have gotten the time to mature.
- One of the first digital innovations was the **Electronic patient file**.
- **Digital Twin** is a full fledged version of Electronic patient file, as it is no longer just a copy of the paper patient file.
- Because of this care can be provided over longer distances (**Telecare**), while maintaining quality.
- Wearables and IoMT can practically be used to gather medical data everywhere you go.
- **Artificial Intelligence** will be used more and more, to not only assist the caregiver, but also to receiver of care.
- With the introduction of AI and wearables, patients will have to visit the hospital less, as they can find medical information online and get help from the people around them

(Participatory care)

appendix 2 *Example interviewguides*

Expert Semi-Structured Interview Guide - Psycholoog

Vragen voor Expert Interviews

Benodigdheden:

Pen
Papier
Post-its
Camera
Voice Recorder
Generatieve tool

Van te voren de geïnterviewde persoon bedanken voor zijn tijd, en aangeven dat hij/zij mag stoppen wanneer diegene dat wilt.

Vragen of het goed is dat het interview opgenomen wordt.

Hoofdvraag: Welk psychologisch effect zal de digitalisering van de zorg hebben op een consult (in de spreekkamer)?

Naam:

Functie: Hoofd van de afdeling medische psychologie

Jaren in dienst:

Waar ligt uw expertise?

Hoe komt u tijdens uw werk met spreekkamers in aanraking?

Welke aspecten van de spreekkamer zijn voor uw vakgebied relevant?

Voor de volgende vraag maken we gebruik van een 'generatieve tool 2', een methode om uw antwoord te visualiseren, zodat wij hier makkelijker informatie uit kunnen extraheren

Kunt u met behulp van deze plaatjes een netwerk maken van de mensen die u voor uw werk spreekt, welke in direct contact met de spreekkamer staan?

Algemene vragen:

Voor de volgende vraag maken we gebruik van een 'generatieve tool 1', een methode om uw antwoord te visualiseren, zodat wij hier makkelijker informatie uit kunnen extraheren.

Hoe zou u de verschillende aspecten van de spreekkamer benoemen? (Kunt u dat op post-its schrijven?)

Kunt u deze post-its vervolgens op deze bullseye plaatsen waarbij de belangrijkste aspecten meer in het midden geplaatst worden.

Wat zijn voor u de doelen van de spreekkamer in de huidige zorg? En kunt u dit op deze post-its schrijven? (mogen er meerdere zijn)

Kunt u de uw antwoorden op deze bullseye plaatsen in de meest geschikte categorie, waarbij u de doelen meer naar het midden plaatst, hoe belangrijker u ze vindt.

Denkt u dat dit doel in de toekomst nog relevant is in de spreekkamer van 2030?

Hoe moeten deze doelen worden bereikt met medische innovaties?

Welke waarde hecht u aan de huidige spreekkamer?

Vind u dat deze rol en waarde in de toekomst nog relevant zijn in de spreekkamer van 2030? Zou u nog iets veranderen?

Wat is volgens u de ideale spreekkamer?

Welke voorwerpen/instrumenten moeten aanwezig zijn in de spreekkamer?

Welke personen moeten aanwezig zijn in een spreekkamer tijdens een consult?

Vragen op deskundig gebied:

Wat zijn de psychologische aspecten waarop gelet moet worden om een consult voor een patiënt zo goed mogelijk te laten verlopen?

En voor een arts?

Welk gevoel moet een consult opleveren bij een patiënt?

En een arts?

Wat vindt u van de interactie tussen arts en patiënt?

Hoe heeft de computer hieraan bijgedragen??

Wie is er leidend in het gesprek?

Hoe zorgt u dat u tijdens een consult de leiding/regie behoudt?

Wat wordt er verwacht van de patiënt en arts bij een consult?

Is het een doel op zich om tijdens een consult de verwachting tussen arts en patiënt gelijk te trekken?

Hoe verloopt volgens u de informatieoverdracht tussen arts en patiënt?

Is er altijd een fysieke ruimte nodig om een consult plaats te laten vinden?

Wat zijn de dingen die alleen mogelijk zijn in een fysieke ruimte?

Denkt u dat innovaties, fysiek of digitaal het consult kunnen verbeteren?

Waarom wel/niet?

Denkt u dat het implementeren van medische innovaties veel invloed heeft op het consult?

Wat voor invloed heeft dit op de patiënt?

En op de arts?

Wat voor invloed heeft het gemakkelijk beschikbaar maken van data op de patiënt en arts?

Bij wearables?

En innovatie van medisch meetapparatuur in de spreekkamer?

Informatieoverdracht tussen diverse zorginstellingen?

Denkt u dat AI gebruikt kan worden om empathische zorg te leveren?

Wanneer wel/niet

Voor wie wel/niet

Wat voor effect denkt u dat dit zal hebben op de patiënt?

Hoe draagt de AI bij aan de interactie tussen arts en patiënt?

De medische innovaties lijken steeds meer werk voor de arts te bezorgen. Hoe denkt u dat het beroep van arts in de toekomst zal veranderen?

Ziet u de rol van arts meer verschuiven naar het beroep van een psycholoog?

Denkt u dat empathie tijdens een consult centraal kan komen te staan tussen alle innovaties?

Denkt u dat dit nodig is?

Denkt u dat er een andere behoefte is in de spreekkamer bij jongere generaties?

Denkt u dat de digitale generatie minder behoefte aan een fysieke ontmoeting voor een consult?

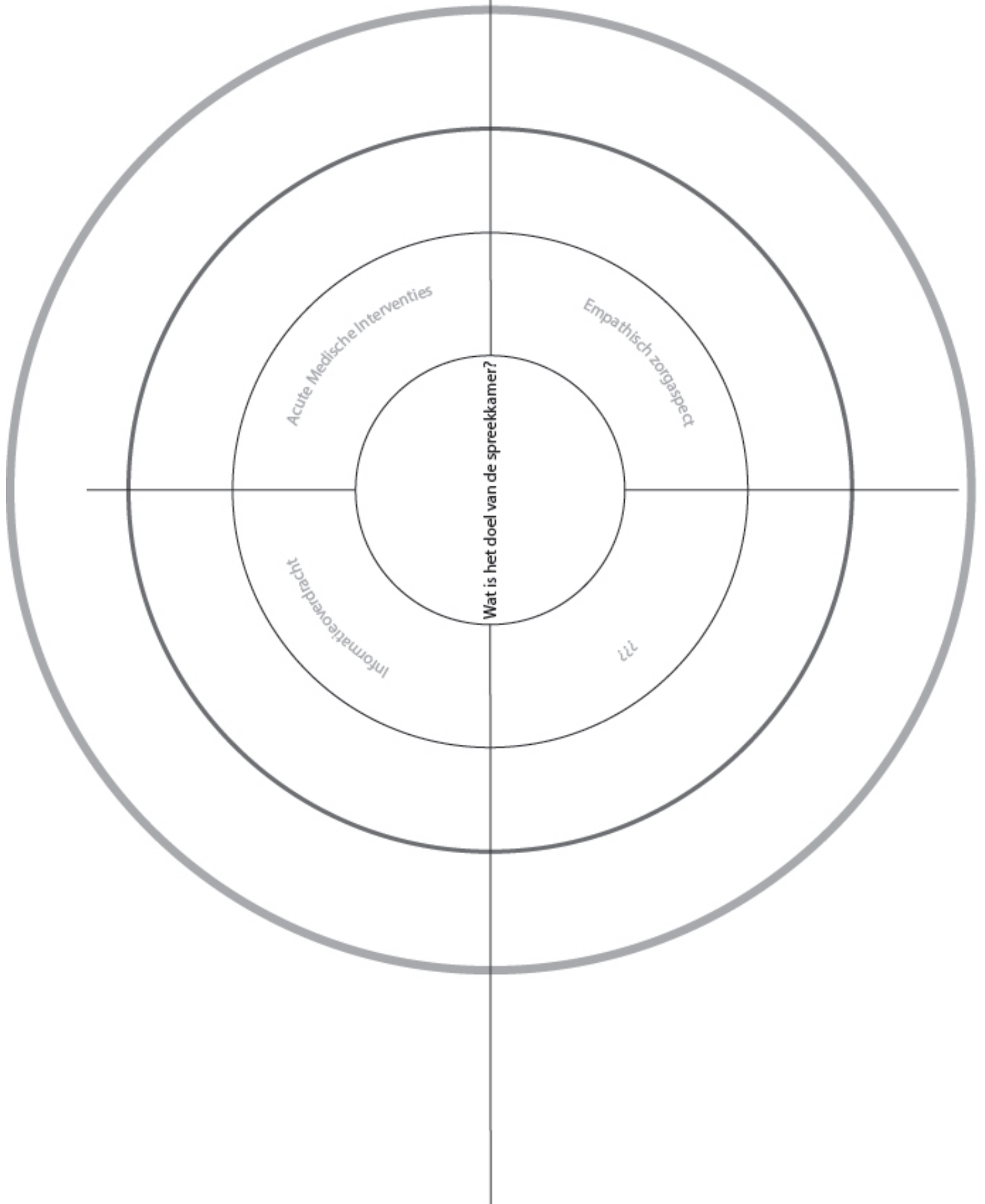
Zou u een netwerk kunnen maken van de mensen die in 2030 bij een consult betrokken zullen zijn? 'Generatieve Tool 2'

Lees nog een keer je notities hardop voor (in het kort) om te kijken of datgene wat jij hebt opgeschreven overeenkomt met wat de geïnterviewde persoon wilde zeggen.

Bedank de geïnterviewde persoon voor de tijd.

Vragen of de geïnterviewde persoon geïnteresseerd is in een eventueel vervolgesprek als er bevindingen zijn gedaan van het kwalitatieve onderzoek en medische innovaties.

appendix 3 *Generative tool for identifying goals of consulting room*



appendix 4 *Keywords interviews*

Samenvatting Expert interviews

Meelopen/Interview Arts (1-18):

1. Andere manier om met een patiënt in gesprek te gaan, los van een fysieke ruimte.
2. EPD = digitale vorm van papieren patiëntendossier. Moet slimmer
3. Commerciële wereld veel verder in doorvoeren technieken
4. Verbetering informatieoverdracht: slechts 20-30% van de informatie in de consult komt over bij de patiënt, patiënt kan liegen, miscommunicatie van arts en patiënt. Patiënt gaat zelf op zoek naar informatie (vaak verkeerd). Patiënt heeft ook informatie na consult nodig maar kan die nu niet krijgen van de arts.
5. Veel administratief werk voor de arts
6. Concept van lean and waste
7. Telemonitoring en elektronische kennisoverdracht zijn de toekomst
8. Patient tailored care: ontzettend veel waarde zullen sterk afwijken per gezond patiënt. Vb Bram Tankink
9. Neuro-economics/nudging
10. Informatieoverdracht tussen artsen is ook nog niet optimaal. Overdracht heel veel ruis en ook last van gebruik EPD.
11. Taalbarrière is ook nog ontzettend lastig op te lossen in de praktijk. Inbellen van een talk is verre van optimaal.
12. Fysieke spreekkamer nog noodzakelijk omdat non-verbale communicatie kan worden opgepikt door de arts. Verschilt sterk per ziekte en de ernst daarvan.
13. In een ziekenhuis moet de patiënt vaak meerdere keren zijn verhaal vertellen als die langs verschillende specialismen moet.
14. Wearables: kan een patiënt nog liegen en mag dat nog? Patiënt moet controle mogen houden over zijn eigen gegevens.
15. Artsen zouden een supersecretarissen moeten hebben die alle ruis kan weghalen.
16. Informatieoverdracht tussen zorginstelling ook alleen met toestemming van de patiënt en op aanvraag. Kost veel tijd.
17. Verminder oogcontact tijdens consult
18. Spreekkamer geen vernieuwing zichtbaar.

Interview Juristen Irene Pijper – Kruit & Anne Marleen den Hertog (19-24)

19. Privacy: informatievoorziening, medische beroepsgeheim, arts en ziekenhuis. Pilot Consult replay. Gesprek wordt steeds vaker opgenomen door de patiënt. Dit zorgt ervoor dat zijn recht op privacy zelf verminderd en transparant maakt naar andere partijen. De spreekkamer wordt dan zowel voor geborgenheid als een fysieke ruimte steeds meer open. Arts wordt hierdoor ook kwetsbaarder en wordt daardoor bedachtzamer.
20. Belangrijke juridische punten: Privacy zowel binnen de behandelkamer wat betreft de fysieke ruimte (niemand mag hier binnenkomen) als geborgenheid. WGBO, behandeling is altijd buiten het zicht van anderen. Contact is het belangrijkste in de spreekkamer. Computer werkt dit dan tegen. Techniek kan bijdragen om het contact tussen arts en patiënt te verbeteren. Privacywetgeving wordt steeds interessanter naarmate er meer medische innovaties worden toegevoegd in de zorg. Er moet van tevoren over nagedacht worden en ingespeeld.
21. Verantwoordelijkheid zal juridisch niet zoveel problemen opleveren, ligt vooral aan het goed vastleggen van de contracten.
22. Steeds vaker wordt een groter team ingezet ter behandeling van een patiënt. Integrale besprekingen zijn dan ook niet ondenkbaar in de zorg. Ook verschuiving van wie het gesprek voert verschuift. Denk bijvoorbeeld aan een verpleegkundig specialist.

23. Belemmering van privacywetgeving: geen informatieoverdracht mogelijk tussen ziekenhuizen. Technische innovatie nog onvoldoende om dit goed op te lossen. Wetgever moet dit tijdig oppakken om de regelgeving duidelijk te krijgen met alle mogelijk innovaties. Denk ook aan regelgeving voor medische apps.
24. Jurdische verantwoordelijkheid ligt bij het ziekenhuis. Evt contractueel bij de maker/leverancier. Oppassen voor afhankelijkheid ziekenhuis bij een bedrijf door monopoly medische innovaties.

Interview Ethiek Inez de Beaufort (25-27)

25. Gemis van de persoonlijkheid van de spreekkamer zeker bij grotere impact van ziekte. Het moet allemaal steriel zijn. Niet bij de SEH, maar zeker bij chronische ziekte. De zorg wordt inwisselbaar. Nieuwe generatie vindt het misschien minder boeiend, dat contact. Moet kosten en effectiviteit boven persoonlijkheid en contact. Rol hulpverlener vervaagt.
26. Teleconsulten ter verbetering van sommige communicatiemogelijkheden. Artsen zijn teveel bezig met de computer. Patient heeft behoefte aan persoonlijke aandacht. Virtuele ruimte is mogelijke voor de spreekkamer, mits de privacy en comfort. Arts bevat een placebo-effect. De persoon van de dokter is belangrijk onderdeel van het zorgaspect van de patiënt. De goede zorg is altijd meer dan alleen technisch goede zorg.
27. Digitalisering in de zorg is onvermijdelijk, maar privacy moet gegarandeerd blijven en dat lijkt best lastig. Kan behoorlijk lastig worden als alle biomedische data van de patient op straat ligt en derde partijen druk kunnen uitvoeren op de keuzes van de patient. Patient moet zelf kunnen beschikken over de data die hij deelt en de arts moet een milieu creëren dat de patiënt geen reden ziet om dit niet te doen.

Interview Onderwijs&Opleiding: Walter vd Broek (28)

28. Voorbereiding op de spreekkamer van de toekomst is essentieel voor de studenten van nu. Het gaat vooral om omgang met opkomende medische innovaties, breder en wetenschappelijker opleiden. Actief samenwerken met de TU Delft en Klinische technologie. Heel verschillend hoe iedere spreekkamer eruitziet en dus ook waar je uiteindelijk in terecht komt. Leren in de opleiding hoe ze deze in het algemeen moeten gebruiken. Patiënten vinden de spreekkamer te technisch. Heel effectief en veel met de computer. Maar terug naar de kern, techniek maken om gesprek weer centraal te maken en beter laten verlopen. Opleiding van de toekomst leert de student flexibiliteit, omgang met complexiteit en het nieuwe werken.

Interview Valued Based Healthcare Jan Hazelzet (29-57)

29. Ziekenhuis loopt behoorlijk achter op het gebied van innovatie. Chief medical innovation officer. Accent op kwaliteit bij acute omgevingen.
30. Patiënten belang is in de afgelopen jaren steeds meer op de voorgrond gekomen
31. Een behandeltraject moet een pakket kunnen worden, dat biedt nog steeds mogelijkheden tot concurrentie. Deze geïntegreerde aanpak is wat je in de toekomst wilt zien.
32. Zorg werkt in Silo's in de zorg. Artsen is gefocussed op biomedische data uitkomsten. Terwijl dit voor de patient niet hoeft te betekenen dat hij zich beter hoeft te voelen.
33. Zorgkosten stijgen, weten vaak niet wat de beste behandelingen zijn. 50% is nog niet bewezen en 50% werkt alleen goed voor het gemiddelde.
34. Toetsbaarheid van kwaliteit: specialist heeft er geen tijd voor. Moet systematisch worden waarbij de patient ook zijn waarde eraan kunnen geven. Nu worden er van te voren vragenlijsten opgegeven.

35. Streven naar beste uitkomsten die voor patiënten relevant zijn vs. kosten van een behandeling
36. Tijdens een consult is er geen tijd voor het verhaal van de patiënt.
37. Het (behandel)proces moet systematischer worden, maar er moet ook meer ruimte komen voor het verhaal van de patiënt.
38. Om dit mogelijk te maken stuurt Erasmus MC 2 weken voor een consult een vragenlijst, welke thuis ingevuld kan worden, en besproken tijdens consult.
39. Zorgt voor een holistische aanpak. De betekenis van een behandeling voor een patiënt wordt steeds meer op de langere termijn gemeten.
40. De vragenlijsten zijn op dit moment nog plat/niet dynamisch en ze moeten reactief worden om de compliance te verhogen. Deze vragen zijn opgedeeld in domeinen bij een bepaalde ziekte wat nu echt relevant is voor de patiënt.
41. De waarde van zorg moet meer gefocussed zijn om wat de kwaliteit en waardeoordeel is van de patiënt. Dit is ook per patiënt verschillend.
42. Er moet meer naar uitkomsten gekeken worden dan naar processen.
43. Er moet gecontroleerd worden of een patiënt het verhaal van de arts begrepen heeft. Grondiger dan de zin; "Heeft u nog vragen?"
44. Soms laten mensen hun arts nu een belangrijke keuze maken omdat ze de arts toch niet begrijpen.
45. Gesprek als voorlichting van onderzoeken die zijn gedaan.
46. Bij elkaar brengen van gegevens< puur medisch, wearables maar ook wat de patiënt vooral vindt en dat mooi geïntegreerd.
47. Replay: arts hoeft niet angstig te zijn. Op basis van de info die we nu hebben wat dit het juiste antwoord. Arts moet gewoon zijn werk goed doen. Kan toch al worden opgenomen. Qua cultuur valt er nog veel te veranderen.
48. Commitment voor vragenlijsten en op waarde gedreven zorg te richten is per individu verschillend. De vragen over de waarde moeten aangepast zijn aan de patiënt (FARELS).
49. De verantwoordelijkheid voor patiënten met meerdere aandoeningen wordt vaak afgeschoven door artsen. Daarom zou het goed zijn wanneer artsen gedeelde verantwoordelijkheid krijgen over de patiënten die zij behandelen. De cultuur moet veranderen en de beloning.
50. Met een horizontale integratie van domeinen voor, tijdens en na ziekenhuisopnames zou dit al een stukken beter moeten gaan. Emc zit nu met meerdere organisaties om de tafel voor:
 51. 1 behandelplan
 52. 1 management team
 53. 1 betaling (met verpleeghuizen bijv. nog niet met huisartsen of fysio's)
54. Een behandeltraject moet een pakket kunnen worden, dat biedt nog steeds mogelijkheden tot concurrentie. en deze geïntegreerde aanpak is wat je in de toekomst wilt zien. Geen ivoren toren blijven zitten maar horizontale integratie.
55. Een gedeelde betaling met meerdere zorginstelling voor 1 behandeltraject. Om kosten te besparen.
56. Uitkomsten moeten boven efficiëntie komen te staan.
57. Er wordt te weinig naar de patiënt journey gekeken.
58. De ziekte behandelen met dit team met dit behandelingstraject levert dit op en kost zoveel.

Interview Ethiek AI (58-59)

59. Arts: informatiemanager, informatica deskundigen, ICT te snel om beroep voor te bereiden, toekomst twijfelachtig. Professionals in spreekkamer menselijk aspect behouden, hoeft geen arts te zijn. Spreekkamer geen ruimte meer maar een metafoor.
60. Cliëntenraad

Zorginkoper (60-65)

61. Shared savings, samenwerking met zorginstellingen en verzekeraars als Erasmus MC op basis van waardegedreven zorg. Nog geen sprake van continue zorg waardoor veel preventie. Spreekkamer is een containerbegrip. Spreekkamer is er helemaal niet meer. Spreekkamerfunctie blijft er altijd.
62. Hartwacht: patiënten zelf dingen opmeten, gegevens bij wijkverpleeging. Patiënt heeft nu meer zelf in de hand. Lijkt op dat stukje van de dutch design week met het onderzoek.
63. Poli complexe behandelbeslissingen: multidisciplinair.
64. Tertiaire ziekenhuis: zeer complex waardoor het onderzoek wel heel specifiek wordt wat geen bijdrage levert aan het overgrote deel van de maatschappij. Je hebt dan sws een hele kleine groep.

Verzekeraar (64-67)

65. Zelfde visie met samenwerking de zorg verbeteren en goedkoper maken. Zorgverzekeraars betaalbaar houden van de zorg en lage kosten voor patiënten.
66. Solidariteitsbeginsel, geen financiële sancties op basis van leefstijl
67. Verzekeraar krijgen geld van premies van cliënten en geld van de overheid naar verwachting hoeveel kosten van hun populatie. Dus maakt niet uit wie je selecteert want dit wordt automatisch gecompenseerd. Je zou wel als verzekeraar je kunnen focussen op een bepaalde groep, bvb ouderen. Om die zorg goedkoper te maken of de behandeltrajecten goedkoper te maken.

Interview interaction designer (67-87)

68. Doelen van de spreekkamer volgens M. Melles:
69. Voor de geïnterviewde dient een spreekkamer ook om informatie uit te delen over de lifestyle van de patiënt en wederzijdse verwachtingen. Deze twee doelen zijn daarom in de doelcategorie "???" geplaatst, niet zozeer omdat ze een nieuwe categorie vormen, maar omdat ze informatieoverdracht en het empathische aspect binnen de spreekkamer verbinden.
70. Innovaties, producten of diensten kunnen gebruikt worden om de benoemde doelen te bereiken. Een voorbeeld hiervan is de gebruikte bullseye generatieve tool, maar dan over bijvoorbeeld het ziektebeeld van de patiënt. Zo zijn er bijvoorbeeld al 'besliswijzers' die hiervoor gebruikt worden.
71. Voorbeeld: Patiënt moet van tevoren nadenken over vragen en deze letterlijk 'op tafel leggen'.
72. Patiënt is vaak niet zo goed voorbereid als gedacht, oorzaak hiervan ligt zowel bij patiënt als medisch personeel.
73. Informatie wordt vaak niet patiëntvriendelijk geleverd.
- 74. "Het doel is dat je het gesprek verbeterd! Niet de besprekkamer."**
75. Rossel van de B. heeft gewerkt met patiëntprofielen, hoe verschillende typen patiënten, verschillende typen van informatie en communicatie nodig hebben.
76. Het gaat niet om de ideale spreekkamer, maar om het ideale gesprek. Hierbij is het belangrijk dat de arts en patiënt elkaar begrijpen. Ook moet alles besproken worden waar de patiënt mee zit en wat de arts moet weten. Dit zorgt er allemaal voor dat alle betrokkenen met goeie verwachtingen, inzet, patiëntenparticipatie en adherence je zorgproces ingaat.
77. Wanneer er een spreekkamer komt moet deze middelen bevatten welke het gesprek ondersteunen. Dit kunnen fysieke maar ook digitale oplossingen zijn

78. Thomas van Rompay, Uni Twente, Invloed van de lay out van spreekkamer op gesprekken.
79. Goede interactie tijdens een consult, wanneer beide partijen hun best doen elkaar te begrijpen, bij inkomende én uitgaande communicatie.
80. Teleconsulten zullen fysieke spreekkamer consulten niet vervangen, maar ze bieden wel een goede toegevoegde waarde.
81. Het is belangrijk naar het totale zorgproces te kijken, waar heeft de patiënt welke informatie nodig? Waar moet het echt fysiek? Waar kan het met een teleconsult? Moet dat teleconsult met een arts? Zolang de patiënt maar de info en geruststelling krijgt die deze nodig heeft.
- 82. Op momenten waarop je een arts niet perse hoeft te zien zou een (Whats)appje al genoeg kunnen zijn om een patiënt gerust te stellen, deze mag gewoon niet het idee krijgen tegen een robot te praten, daar ligt een grote taak/uitdaging voor ontwerpers.**
83. Al die dit faciliteert kan een rol krijgen binnen de gezondheidszorg
84. Privacy, regelgeving, financiën e.d. zijn voor ontwerpers geen problemen, maar uitdagingen waarmee rekening mee gehouden moet worden. Het zijn issues, maar het einddoel voor de designer blijft toch het zoeken van de meest gebruikers gerichte oplossing.
85. Alle betrokkenen/stakeholders, zien risico's/gevaren vanuit hun eigen domein. Voor ontwerpers is het enige gevaar dat iets niet haalbaar is.
86. Gevaar zit m vooral in het feit dat technologie ondoordacht gebruikt wordt, waardoor het niet werkt. Dit kan er uiteindelijk toe leiden dat het qua privacy niet werkt, het niet gebruikt wordt door de patiënt of dat het de werkdruk van de arts alleen maar verhoogt.
- 87. Het gevaar bij dit project is waarschijnlijk dat de startvraag niet goed geformuleerd is. Het gaat niet om de spreekkamer van de toekomst en de technologie die daarbinnen past, maar het consult van de toekomst en hoe dat zo optimaal mogelijk ingericht kan worden.**
88. Mensen hebben hulp nodig maar op verschillende niveaus bij verschillende ziektes. We willen steeds meer en steeds betere zorg. Dit probleem is niet alleen bij de zorg maar is geheel in de maatschappij een probleem. We denken steeds met nieuwe dingen/innovatie problemen op te lossen in plaats van te kijken hoe we de huidige problemen kunnen verminderen en structureren. Deze eindeloze drang naar nieuw, beter en efficiënter en goedkoper zorgt ervoor dat de ontdekking met medische innovaties de leidende factor is wat ons stuurt en beweegt naar nieuwe gezondheidszorg en nieuwe spreekkamer. Zonder sturing om even time-out te nemen en te kijken wat we nou eigenlijk echt willen. En beter ons focussen op te kijken waar we nou echt innovaties nodig hebben.

Jaap Harlaar

89. Population Health Management, wanneer je de gezondheid van een bepaalde bevolkingsgroep/-laag/-demografie/-gebied o.i.d. in de gaten houdt. Strategien bedenken om de algemene gezondheid zo hoog mogelijk te houden. Niet alleen meer reactief bezig maar ook proactief. Gezondheidszorg wordt dan niet meer losgekoppeld van sociale- of economische domeinen omdat veel gezondheidsproblemen ontstaan door bijvoorbeeld stress door onzekerheidsschuld
90. Pas de manier van communicatie aan op je doelgroep
91. Dezelfde woorden kunnen binnen verschillende vakgebieden compleet verschillende betekenissen hebben, hoe voorkom je dat je langs elkaar heenpraat?
92. Hoe vang je optimaal de fenomenologie en heuristische manier van redeneren binnen de geneeskunde op door een manier van denken die meer geënt is op daadwerkelijk begrijpen wat er aan de hand is?
93. Klinisch technoloog slaat de brug tussen ingenieur en arts.
- 94. Gezondheidszorg is te belangrijk om tegenwoordig alleen nog maar aan de arts over te laten.**
95. Klinische technici worden opgeleid om te leren klinisch redeneren, maar ook om op een deterministische manier te denken
96. De patiënt centraal, maar elk specialisme 'claimt' zijn 'eigen' patiënten,

97. Specialisten moeten zich in dienst stellen van hun patiënten
98. Er moet minstens een iemand zijn die naast de patiënt staat om als het ware de coördinatie tussen de verschillende specialismen te dragen
99. Er moet beleid gemaakt worden en er moet met de patiënt gepraat worden, iemand die dat doet is heel belangrijk en hoeft niet per se een dokter te zijn
100. Met de opkomst van het internet staat informatie altijd ter beschikking, vroeger had de arts al deze kennis en nu zit het gewoon in een app.
101. Erik Jan Vlieger – Het nieuwe brein van de dokter: “Dokters worden steeds meer managers van teams en ze zullen meer de kennis en protocollen in ziekenhuizen en medische apps moeten updaten/bijhouden.
102. Mensen informeren zichzelf tegenwoordig al online, De patiënt zou bijvoorbeeld van tevoren ook al een aantal vragenlijsten in kunnen vullen zodat de arts ook goed geïnformeerd is. Zo kan anamnistische data op een treffende wijze samengevat worden voor de arts. Dit biedt (meer) ruimte voor empathisch aspect van het consult
103. De ‘Digital Twin’ alles wat men van jou weet en meet wordt bijgehouden in een digitale kopie. Hier kan je ook zelf dingen inzetten, fitbit gegevens, emotionele logboeken, rontgenfoto’s ga zo maar door.
104. Het eigenaarschap van medische gegevens is op het moment niet duidelijk? En zeker in de toekomst, Wie is de eigenaar? Ziekenhuis? Patiënt? Techbedrijf
105. Zelfs/juist met de overvloed aan data die er door/voor een patiënt verzameld kan worden, moet het gesprek tijdens een consult er vooral over gaan wat de verkregen data voor de patiënt als persoon betekenen
106. Maak onderscheid tussen een holistische en meer technische aanpak.
107. Bij diagnoses moet er op gelet worden dat ze niet gesteld worden omdat er bijvoorbeeld een vrije OK is.
108. Zorg zit nu in een taakherschikkingsproces, maar het is belangrijk dat het belang van de patiënt leidend is, en blijft.

Interview huisarts Patrick Bindels (110)

109. Het er voor iemand zijn aan de hand van een gesprek is het allerbelangrijkste wat er zich afspeelt in de spreekkamer. Ook al lijkt er veel verandering te ontstaan door de jaren heen wat betreft wat er in de spreekkamer staat, wat er allemaal mogelijk is, wat de arts kan en wil doen, en wat de patiënt wil en kan. Maar uiteindelijk blijft het universeel dat het een gesprek is waar een patiënt zijn verhaal wil kunnen doen, gehoord wil worden en geholpen met zijn probleem. Door de ontzettende toename van informatie en medische mogelijkheden is er ontzettend veel ruis ontstaan rondom dit gesprek en het lichamelijk onderzoek. De dokter is steeds meer tijd bezig met administratief werk en heeft steeds minder tijd voor de patiënt zijn verhaal. De huisarts geeft aan dat er eigenlijk een assistent in de kamer aanwezig moet zijn om te assisteren met noteren van wat de patiënt zegt en zoeken naar benodigd informatie zodat de arts zelf zich kan concentreren op wat de patiënt te vertellen heeft. Het aanvoelen van de menselijk maat en wellicht het onderliggende probleem kan alleen de arts (een andere mens) aanvoelen met het onderbuikgevoel en de lading geven aan het gesprek om de zorgen weg te nemen. Wie stuurt wie aan? De arts past zich aan op de patiënt die steeds mondiger wordt. Maar wordt de patiënt wel steeds mondiger? Het lijkt erop dat de hoeveelheid informatie gegenereerd wordt de patiënt meer onderzoek doet ipv meer duidelijkheid schept voor zichzelf. Als je gaat zoeken op internet vind je vanzelf wel een ziekte waar je aan lijdt. De arts heeft ook hulp nodig om deze stortvloed aan data een beetje te structureren.

Interview specialisten en huisarts (111)

110. Het gesprek begon met de sterke gedachte dat iedere spreekkamer per specialisme heel erg verschilt. En dat de poliklinische spreekkamer door divers gebruik heel kaal en sfeerloos is geworden. Bij het EPD is geen ruimte voor iets persoonlijk (sociale anamnese) terwijl dit wel mogelijk was bij het papieren dossier. Al snel blijkt de kern van ieder consult per ieder specialisme het gesprek tussen arts en patiënt te zijn waarin beiden zich prettig voelen in de omgeving om het gesprek te voeren. De fysieke aanwezigheid van bepaalde dingen zal gedeeltelijk per specialisme anders zijn.

Onderwijs & Opleiding: Hans van Leeuwen (112-120)

111. samenvoeging of samenwerking met studies medical delta. Zien dat de geneeskundestudent de arts van nu voor ogen heeft om te worden en niet de arts van de toekomst die zij moeten gaan worden. Er wordt ook gedacht aan post-academische scholing om de arts van nu om gebied van techniek en innovatie dingen bij te brengen en hier beter mee om te gaan. De wil van de geneeskundestudent lijkt nog niet geopend te zijn waardoor er geen wil is om mee te veranderen. Op dit moment wordt nagedacht om voor vernieuw van de bachelor en hier moet ook plek worden gemaakt voor begrip en academische vorming over innovatie. Dit merkt Andries zelf al: door met dit project heb ik mijzelf een andere manier van denken aangeleerd. Zal deels uit zichzelf komen omdat zijn interesse er vooraf al was. Ook van de geneeskundestudent
112. Project van spreekkamer 2030 opgezet om een focuspunt te creëren op de toekomst van veraf.
113. Medical assitants/medical buddy: goed plan, pas op voor de mogelijk nadelige effecten. Dit is precies hoe een academisch ziekenhuis het zou willen wat betreft zorgleveren.
114. Veranderingen in de zorg: verschuiving van de zorglijnen waarin de huisarts een soort 1,5 lijns zorg wordt en groter. Vraag of er nog artsen zijn in de toekomst denk van niet omdat er nu al dingen kunnen worden overgenomen, Dat empathische zorgaspect wel belangrijk is maar verschilt per persoon en zeker welke generatie.
115. Geneeskundestudent moet beter opgeleid worden om te gaan met techniek en medische innovaties en andere vormen van academisch denken.
116. Samenwerking met TU delft ziet de decaan onlosmakelijk verbonden met de huidige tijd.
117. Vraag of er (super)specialisaties gaan verdwijnen: op den duur wel met mogelijke tussenstappen.
118. Vakgebied gericht op vormgeving van onderwijs, wetenschap en faculteit om verbetering te vormen voor zorg.
119. Terughoudendheid van de zorg is omdat het hier gaat om mensenlevens en dus geen fouten kunnen permitteren en daardoor niet snel nieuwe dingen kunnen introduceren zonder zeker te weten dat ze ook daadwerkelijk werken.

Interview Cliëntenraad (121-124)

120. Comfort is belangrijk in veel aspecten: akoestiek, geur, temperatuur, kleur etc.
121. Vaak komen patiënten emotioneel geraakt binnen. Patiënten vergeten ook alles bij heftig nieuws, dus iemand moet altijd mee om informatie te kunnen ontvangen ten tijde van het consult.
122. De patiënt is meer ingelezen, meer adequaat in wat hij wil en niet wil en wil als gelijke worden betrokken in het zorgproces maar is wel nog steeds de patiënt die een hulpvraag heeft en geholpen wil worden door de arts. De arts naar de patiënt komt. Patiënt
123. Patiënt is flexibel.

Interview Hoofd Philips Healthworks - Alberto Prado (125-131)

124. How was the Start up Breakthrough day? Great, most important technology that was discussed was AI as Adaptive intelligence instead of Artificial. Adaptive of the needs. It's an inevitable trend that people will take care of their health by themselves. And healthcare will be driven by Valued based healthcare. The 4-points of valued based healthcare: Better clinical outcome, better staff experience, patient satisfaction, and less cost. Business progress re-engineering. The reason why it never changed in health and it did in the consumer society: Start-ups: identification and collaboration with start-ups is essential for massive growth in a field market. Philips tries as integrator of these start-ups to use for healthcare systems or hospitals.
125. What type of products and services is Philips Healthcare currently working on? By far the most important is AI and data management, a digital twin, the quality of data and early trias. The use of data... Diagnoses: moleculair, diagnostic, genetic therapy, personalized care. Bio-sensors for elderly care. Medical devices become critical.
126. Privacy? Very seriously issue. International company like Philips should be here the standardized on European level with rules for the AI. Government needs to control it. Unfortunately all over the world the rules of government is not very compatible. Acces to data for Philips to use is needed to get the best AI. Consent comes with therapy. Philips want to deal with healthdata in a proper way. Supertransparent way.
127. AI needs private data, anonomized. Consent has to be signed personalized. Principles and ethics are issuing that Philips should and is taking into account. Sure, that people are worried that data could be used in an evil way.
128. At what stage are you now with in the development of AI? Nowadays we already using AI. We adopted it already. Equally in healthcare. Replacing radiologist? No AI will enhance radiologists. More that radiologist who use AI will replace the once without.
129. What kind of products can you imagine to improve doctor-patiënt interactions? Technology in advance of patient-doctor interaction. Children in MRI with sedation is no good. By other means it. Take care in their own hands.
130. Healthcare in 2030: more preventive, personalized, chronic disease management (post-operative, elderly, cancer no chronic. Private cloud. Blockchain plays a rol.

Medische Psychologie – Adriaan van 't Spijker (>131)

131. Doel van de spreekkamer: dat de arts en patiënt bij elkaar komen. Een ruimte waar privacy belangrijk is. Output verschilt vanuit de arts en vanuit de patiënt.
132. Patiënt: gehoord voelen en serieus met zijn klacht wordt omgegaan. Dat hij weet wat de ziekte is of weet wat het vervolgtraject.
133. Arts: beeld van de klacht en weet welk traject die voor de patiënt moet inzetten.
134. Waarom deze twee perspectieven: vanuit het onderwijs zie je dat studenten graag willen dat de patiënt tevreden de deur uit loopt. Ondanks een ontevreden kan je alsnog goede zorg hebben geleverd. Bijvoorbeeld dat jij vindt dat die niet een bepaalde behandeling moet ondergaan. Heel vaak loopt het perspectief gelijk op. Maar soms net niet. Dat moet je ruimte voor bieden door twee perspectieven
135. Mismatch ontstaat omdat de patiënt niet weet wat er mogelijk is en vaak een verkeerd verwachtingen. We leven ook in een consumptiemaatschappij en dat draagt niet bij aan het beeld wat de patiënt heeft.
136. Empathie is nodig om informatieoverdracht en medische interventies. Mensen hebben vertrouwen nodig om dit te doen. Patiënt in eigen belang dat die zijn medicatie neemt maar als de pa-

tiënt de arts niet aardig vindt neemt hij zijn medicatie niet.

137. Kern van het gesprek: wat is met mij aan de hand. En empathie is een voorwaarde voor deze kern.
138. Hulp op afstand kan prima als het maar gepersonaliseerd is. Er moet een gevoel zijn dat er iets menselijks achter zit.
139. Siri wekt de suggestie dat ie netjes is en daar trappen mensen in om tegen een apparaat terug te praten maar wellicht kan AI nooit dit helemaal overnemen omdat sommige tekst persoon, cultureel, taal, gebonden. Een bakje pleur weet iedereen maar een computer weet dat niet. Een Nederlander in het Italiaans een consult afnemen kan maar de interpretatie van de context zal ontbreken.
140. Innovatie waar wel veel winst te behalen valt/toevoeging is: preventie en technische middelen.
141. Metingen op afstand.
142. Kan de integratie van techniek bij arts of patiënt gemakkelijk plaatsvinden of heeft dit
143. Boek: De patiënt wil see you now. Patiënt heeft zelf kennis en data waardoor die veel meer sturend wordt in het gesprek.
144. Een mens moet de informatie overdragen wat de computer genereert. De klinische blik moet je blijven gebruiken. Het is voor een deel wenen om innovatie in te voeren en de zorg te hervormen.
145. Patiënt wil contact houden met de zorgverlener. De computer kan de informatie geven maar de arts kan de data interpreteren omdat die weet wat dit voor de patiënt inhoudt.
146. Persoonlijke ontwikkeling meer naar de voorgrond. Voor zichzelf en betere inleving
147. Empathisch vermogen van de arts wordt belangrijker. Gesprekstechnieken zijn belangrijk maar niet qua open/gesloten vragen stellen maar dat je weet wat dit voor de patiënt betekend.
148. Data op afstand is fijn maar patiënten kunnen het niet interpreteren. Dus data aanwezig voordat het te interpreteren is wordt mensen onrustig/angstig.

appendix 5 *Insights DDW & Medica*

Inzichten opgedaan tijdens DDW

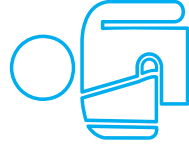
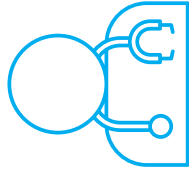
#	Waar	wie	Wat
1	PhilMu	Philips	Sensing: Waarnemen/meten v/ data op afstand
2	PhilMu	Philips	Imaging: Beelden v/h inwendig lichamelijke zonder invasie
3	PhilMu	Philips	Personalization: Personalized treatment based on the DNA of the individual patient
4	PhilMu	Philips	Lumify: Portable Ultrasound - Can be used at home
5	PhilMu	Philips	Azurion: Workflow Innovation
6	IP	Lustig e.a.	Do it together: Open source DIY pump
7	IP	K. Ku	Tiger Penis Project: Cultivate animal parts to preserve the animals and cultural tradition
8	IP	M.MC & Tu/e	Artificial Womb: Replicates the conditions inside an actual womb increasing the chances of survival for premature born babies
9	IP	F Feenstra	CareB&B: B&B in the neighborhood for patients in need of informal care
10	IP	R. Silva	NITI: Support stocking which is easier to put on/take off due to material properties, making it loose at room temp. While tightening due to body heat
11	IP	Enrichers	Smart Furniture Sensor: Gives the body a more active role by enabling it to be used to monitor (some) bodily functions and to control for example your PC
12	IP	Philips	Emerging futures: Overview of 4 possible futures for health care
13	IP	F. Feenstra	Not health institutions, but health care will be changed
14	IP	Teun	Design for Flies: Making rare diseases more interesting for Pharmacy
15	IP	Insight	Caregiver might be a stakeholder as well
16	IP	F. Feenstra	Innovation: thinking (smart) about how you deal with something in the future
17	IP	F. Feenstra	Re-activating hospital: Lying in bed is bad for your health, Get patients out of their room (8h sleep/relax/activate)
18	IP	H&B	Digital Twin can be used to predict course of disease/treatment
19	IP	H&B	Digital Twin Can be used to identify groups at risk
20	IP	H&B	Digital Twin Can help identifying proper treatment plan
21	IP	H&B	Digital Twin Can make the role of doctor more supportive
22	IP	H&B	Digital Twin Allows for specification of more precise persona's/ profiles
23	IP	H&B	Digital Twin Can be used to identify cause of a disease
24	IP	H&B	Digital Twin Can be used to predict diseases
25	Buiten	Gem. Eindh	Social aspect of care is lacking and should definitely be improved in the future
26	Buiten	Gem. Eindh.	Care is too slow, usually takes couple of weeks to get a diagnosis, TweeSteden Hospital in Tilburg does it within a day.
27	Buiten	B. Bierling	VitMon: Patient Monitoring for every setting

H&B :Health & Big Data

Bevindingen Medica

#	Waar	Bedrijf/product	Wat
28	Medica	Lymfa	Pijnbestrijding met laag frequente magnetische straling
29	Medica	HearX	Mobiele klinische gehoorzorg (Smartphone based diagnostics)
30	Medica	Handshoemouse	Ergonomische muis
31	Medica	Cardiosecur	Mobiele ECG monitor
32	Medica	Compugroup Medical	Videoconsulten
33	Medica	Compugroup Medical	Elektronisch patientendossier
34	Medica	Medikationsplan	Gestandaardiseerde digitale behandelplannen
35	Medica	Umana	Compleet vitaliteitsmeet system voor alle gebruikers
36	Medica	Sidly	Telecare service met de mogelijkheid tot telemonitoring
37	Medica	BioTekna	Non-invasieve lichaamscompositiescanner
38	Medica	Komeet	Digitaal registratiesysteem om de zorg voor patiënten eenvoudiger bij te houden
39	Medica	MultiTone	Digital hulpmiddel voor ziekenhuis personeel om beschikbaarheid op te geven en opgeroepen te worden in noodgevallen
40	Medica	iThermometer	Non-invasieve thermometer – kan gebruikt worden om te telemonitoren
41	Medica	Polar	Smartwatches die je lichaamswaarden bijhouden en zich aanpassen aan de manier waarop je sport

Tijlijn van een consult



1. Plaats activiteiten, interacties en handelingen tijdens een consult op de tijdlijn
2. Benoem de positieve en negatieve punten
3. Identificeer de meest interessante activiteiten/interacties
4. Op welke manier kunnen deze punten in de toekomst verbeterd worden?
5. Wat zijn, aan de hand van het opgestelde consult, de doelen van de spreekkamer?

Activiteiten

appendix 6 *Generative Tool Delphi round 1*
Timeline



Begin consult

Einde consult

t →



appendix 7 *Insights expert interviews*

Insights expert interviews

Here, the results of the expert interviews will be discussed in short for each of the interviewees. At the end of the results section an overview is given of the insights gathered through these interviews.

To make this story comprehensible each interview will be described by a number of insights which might be relevant for either medical or innovative reasons.

1. Doctor/specialist

As a doctor/specialist, J. Alsma was interviewed while he was doing his rounds through the Erasmus MC. Therefore, this interview can better be described as a guided tour through the Erasmus MC.

First, a transfer was visited, where caretakers from the nightshift in the department internal medicine were debriefed and caretakers from the dayshift were being briefed. During this transfer, all new patients are introduced very shortly by name, age, reason for admittance, treatment history, performed actions and follow up steps. After all new patients were introduced, two papers were discussed by two separate doctors which had done research into the separate papers.

What stood out during the transfer, was the way information was relayed. There were presentations prepared, but the slides in these presentations basically contained everything the person presenting was going to say. This led the slides to be literally filled with text, making it practically unreadable.

Once the transfer was finished, several departments were visited, which were also having a transfer. At these transfers Dr. Alsma gave his opinion on the best steps to take when there were patients of whom the caretakers were not able to determine the cause of disease or when they were not sure on how to continue treatment.

The highlights of the interview are listed on the next page:

1. EPF is digital version of the paper patient file. It has to become 'smarter'.
2. Communication and transferring information should be improved. Only 20-30% of information shared during a consultation is retained by patients. And there are often miscommunications between doctor and patient. It is also not always possible





Appendix

Expert interviews overview insights

for patients to get to certain information from their doctors once a consultation is done.

3. Communication between doctors can also be improved. There is a lot of 'noise' present and the EPF is also a nuisance.
4. Physical consulting room is currently still required for doctors to be able to capture non-verbal communication from patients. This does, however, differ per condition and severity.
5. Wearables seem to lower the possibility for patients to lie to their doctors. Will this still be possible in the future? And should it be allowed? However rules and regulations should turn out, the patient should be allowed to maintain ownership over their own data.

Finally, a tour was given through the first aid department where most time was spent interviewing the doctor and where he talked about the hospital and its' workings.

image 37 *A consulting room in the first aid department of the Erasmus MC.*



Appendix

Expert interviews overview insights



2. Member of the client council

To get a client's point of view a member of the client council at Erasmus MC was interviewed. The client council represents patients, and they make sure patients are represented when changes within the hospital are being discussed.



1. Often times patients enter a consultation filled with emotion. They forget a lot when the news is impactful. It is therefore important that there is always a third person on the side of the patient who is able to receive and remember the shared information.
2. Nowadays, patients are more informed, more aware of what they do and do not want and they want to be treated as equals. Even though they are still the patient with a request for help who wants to be helped by the doctor. There is shift taking place in the relationship between doctor and patient, although the patient needs to be guided in this process.

3. Director of Education

This interview was focused on the relevance of this project for the study medicine at the Erasmus MC. The most useful insights gathered were:



1. If a scenario for a new consulting room is created it is relevant to know why it is actually better and how the student should be prepared for his or her future career.
2. It seems that within the vision of a future consulting room, students should be familiarized with technical aspects of their future job.
3. There should be a more clear distinction between clinical technicians and doctors, as it is currently unclear as to what separates them exactly.

4. Dean

The interview with the dean was also aimed at the future of the study of medicine at the Erasmus MC, just as the interview with the director of education above. This section, the following insights can therefore be grouped under the common denominator education, which is done in the final overview found at the end of the user research.



1. It seems that currently, students have the mindset of becoming a doctor similar as the doctors nowadays, instead of a future doctor. There should therefore be a shift for students in the vision of becoming a doctor.
2. There should be in-service training available for doctors nowadays to allow them to be able to keep up and to be able to work with with all innovations and new technologies
3. When renewing the bachelor medicine there should be a place for the understanding and academic study of innovation. A. van Vliet, for example, mentions that working on this project has taught him a new way of thinking. The preparedness to learn this came from his own interests, yet, it should be a topic any medical student should be receptive to.



Appendix

Expert interviews overview insights

4. Currently there is a shift between the different lines of care. General practitioners are providing care somewhere between the first and second line. The question is if there will be anymore gp's in the future, as a lot of parts of their work is already being taken over by AI. The empathic aspect of care is currently still important, although it differs per person and generation what type of connection will be required. Perhaps in a couple of generations patients might prefer digital doctors giving them their diagnosis, in stead of actual human doctors, who knows?
5. The reason healthcare is, and for good reasons should be, cautious, is because they work with actual human lives. Mistakes can not be afforded and new technologies or innovations can only be introduced if it is absolutely certain that they will work.



5. General Practitioner

In the interview with P. Bindels the focus was on the conversation during a consultation from a gp's point of view. While care in the Erasmus MC is often more complex than that compared of gp's, consultations serve a similar purpose. Therefore, the insights of this interview are useful for this project.

1. Being there for someone during a conversation is the most important aspect of the consulting room. Despite all the innovations and new equipment in the consulting room, it remains the universal core of a consultation that it is a conversation in which the patients are heard and helped with their problem.
2. Due to the increase of equipment and available data there has been a significant increase in 'noise' around the consultation. This causes the doctor to lose time performing administrative tasks during consultations, lowering the time available for the actual conversation with the patient. An assistant inside the consulting room would be a very nice addition to take over all these administrative tasks such as: Taking notes and checking information.
3. Sensing the human aspect and maybe even detecting what the underlying problem is can only done by a doctor, or any human for that matter, with a gut feeling. This tells them how to approach the conversation and what they should do or say to take away unnecessary worries.
4. Patients are getting more to say during a consultation as they are able to look up information online on their symptoms. This information often causes more worries than it creates clarity for the patient. Patients bring this information to consultations and doctors have to handle that data within the limited time, as well as all the other data they have to deal with. There should be a (better) way for doctors to deal with this large amount of data.

Appendix

Expert interviews overview insights



6. Clinical Technician

Clinical technicians are a relatively new kind of doctors who try to find a balance between the medical and technical world when practicing medicine. J. Harlaar is the Director of education of the Study Clinical Technology at the Delft University of Technology. He was interviewed to explain more about what a clinical technician is exactly and how this new medical professional might be relevant for the future of healthcare. The most relevant findings with regards to clinical technicians and consultations are listed below.



1. Clinical technicians are focused on explaining the inner workings of the human body in a more technical, mechanical way, as opposed to the more heuristic way of reasoning used in traditional healthcare
2. Healthcare is too important to leave solely to doctors.
3. Similar words can have different meanings between different disciplines. How do you prevent miscommunication?
4. Clinical Technicians gap the bridge between engineers and doctors.
5. There should be at least one person standing next to the patient who is responsible for the coordination of all specialisms the patient has to deal with.
6. Clinical technicians are more specialized in the systematical workings of the human body, yet traditional doctors are more skilled and specialized in the more social and empathic aspects of healthcare.

7. Medical ethicists

For the interview with the medical ethicist the focus was laid on the more ethical aspects of healthcare and innovation. The most interesting findings from these interviews are:



I. de Beaufort:

1. From an ethical point of view there is no limitation concerning the implementation of medical innovations.
2. Medical innovations might have an impact on the privacy of the patient. If no clear laws or regulations are laid out the outcome may differ far from what was intended, in the sense that patients might have to give up too much of their privacy for example. The expectation is that this will not happen, it is, however, a concern.

M. Schermer

1. AI within healthcare is everything which automizes the processes. Think of Big data, Wearables, AI in the consulting room to assist with the EPF, but also as a diagnostics assistant. This will significantly change the healthcare system, and it is therefore necessary to step away from the idea that the consulting room is a physical room, as it should be used as a metaphor within which facilitates a certain purpose.



Appendix

Expert interviews overview insights

2. The doctor can be (partially) replaced in the field of diagnostics and treatment. With physical actions and social aspects this replacement of the doctor becomes way less likely. Patients often prefer social contact with a doctor or nurse during physical actions or social aspects of their treatment. This allows the patients to discuss their treatment with their actual caretaker.
3. The doctors' role will shift more towards management and the empathic care and assistance.
4. The danger with innovation currently is, that it is developing at such a high rate, it is almost impossible to consider possible threats or risks of a certain technology.



8. Medical historian

For the interview about the history of healthcare a visit was paid to 'Trefpunt Medische Geschiedenis Nederland (TMGN, Meeting point Medical History of the Netherlands). This meeting point consists of a number of hangars filled with books from medical libraries which have switched over to a digital system. At this place mostly retired gp's come together to discuss the history of healthcare in the Netherlands. During the visit to TMGN a presentation was attended on the history of babymilk powder in the Netherlands and the how it was promoted to the public. After this presentation interviews were done with T. Bolt, medical Historian from the Erasmus MC and a number of gp's. The most interesting findings from these interviews are shown on the next page..

1. Over the past 30 years there have been innovations introduced in the consulting room, although these did not really influence the practices during a consultation.
2. There has been a decrease in interaction between doctor and patient. This is partly caused by the introduction of the PC inside the consulting room. With this system the doctors are compelled to look at their computer screen in stead of their patient. At the same time, computers can't be removed from the consulting room, as they play a significant role in finding additional information and administrative tasks during the consultation.
3. Patients are able to find information about symptoms online, but they need to be guided to websites which show proper information, to make sure they do not get unnecessary worries.
4. The possibility for patients to find medical information online has made them more assertive. Still, patients will ask for help way sooner than they used to, for things they do know themselves. Patients have stopped thinking for themselves.
5. Interpretation of all values and what they mean is done during a consultation. At the same time the patient uses a consultation to discover what is going on with them.
6. The digital patient file is standardized in such a way, it leaves no room for footnotes. On paper patient files, footnotes were often used to describe personal or physical characteristics of patients which were not necessarily medical, but which provided the reader with more insight on what kind of patient the person described in the file was.
7. The consulting room should be a place which facilitates the building of trust and it is a space where patients can be welcomed in a surrounding where their privacy is

Appendix

Expert interviews overview insights



- guaranteed.
8. There should be made a switch from traditional computers, with mouse and keyboard, towards computers which react to voice commands.
 9. At the start of a consultation it is important doctors talk with a patient before they start typing.
 10. Actions are too often done because they are part of 'protocol'. If a patient can sit straight up and talk, it is way more useful to have an actual conversation, than it is to measure blood pressure, body temperature or saturation for example.

9. Medical psychologist

To get a better understanding of the psychology at work during a consultation, A. van 't Spijker was interviewed. He is a medical psychologist at the Erasmus MC. Below are the most interesting findings from this interview:



1. Purpose of the consulting room is to bring doctor and patient together. It is a space where privacy is important. There is a difference in required outcome for both doctors and patients. Patients want to feel heard and taken seriously. They want to get to know what kind of disease they have and what their future will look like. Doctors want to understand the complaints to determine the right treatment for the patient.
2. There can be a mismatch in the expectations of a consultation between doctors and patients. This is caused because patients often do not know the possibilities which leads to wrong expectations.
3. Empathy is essential to facilitate proper transfer of information and medical interventions.
4. Telecare is fine, as long as it is personalized. It must evoke the feeling there is a human touch to it.
5. Even though AI will be able to analyze data and come to possible diagnoses, a doctor needs to be the one to communicate the information, as doctors know the implications of a possible diagnosis for their patients and they know how to convey news in an empathic manner.

10. Judge

For this interview, two judges were invited. These are the most interesting insights gathered.

1. They think there are possibilities for innovations within the healthcare sector, although privacy law can make it a difficult area.
2. They see that the people who are involved with the treatment of patients, are the ones who actually help the patient. Due to the increase of multi-disciplinary teams it can become difficult to see who is (allowed to be) in contact with the patient. Often times part of the workload is taken over by specialist nurses. These nurses are also the ones to whom the conversations with patients are visibly shifting nowadays.





Appendix

Expert interviews overview insights

3. According to the judges the consulting room is perfect as it is, although it could use the possibility to work remotely.
4. There is an increase in patients who record their consultation. This is, of course, useful to them, as they can listen back to the consultation whenever they need to recall something. It does, however, put the doctors' privacy at risk. It is therefore important that the doctors' privacy is well protected.

II. Care purchaser



S. Hofstede decides on what type of care the hospital should focus on. He is concerned with the strategical future of the Erasmus MC, which made him a stakeholder to talk to. The findings from this interview are not particularly relevant to the consulting room of 2030, as they relate more to the future of healthcare in general. As this will still have an impact on the way consultations will be used, the most interesting findings are listed below:

1. Consulting room is a catch-all term. It does not exist anymore. The function of the consulting room, however, will always remain.
2. Costs of healthcare should be kept low with the help of shared savings. Making agreements with medical instances and insurance companies to finance research, equipment and treatment to lower costs for all participants in this agreement. Money saved this way can be reinvested where necessary.
3. Patients are already able to measure their own heartrate, glucose and more, which gives them more control.
4. Academic hospitals can not become too specialized in highly complex research and treatment as it does not benefit the larger part of the population while having high expenses.

12. Specialist in value-based healthcare



The interview with professor Hazelzet was focused on value based healthcare. A healthcare system based upon a model introduced by Porter (2006). The most interesting insights from this interview are:

1. Healthcare is behind in the field of innovation compared to other industries.
2. Patients interest has moved to the foreground in the past years
3. There are Silo's within healthcare. Different departments within healthcare focus completely on their own expertise, while giving little to no attention to patients that do not entirely fit their expertise.
4. Value is determined differently for both doctor and patient. A doctor can look at quantitative values of a patient and see a minor improvement, whilst the patient does not experience any change.
5. The conversation in the consulting room has to be supported with data which is relevant for both the doctor and patient. Although the use of this data can also take

Appendix

Expert interviews overview insights



place outside of the consulting room.

6. The outcome of treatments should become more important than efficiency. This can be achieved by paying more attention to the complete patient journey.

13. Interaction designer

M. Melles is a (research) designer within the field of healthcare, with a focus on collaboration between healthcare professionals, and also between healthcare professionals and patients. She was interviewed because of her designerly expertise of healthcare and to gain a better understanding of how to design for the consulting room.



1. The goal is to improve the conversation (consultation), not the consulting room.
2. At times where seeing a doctor is not absolutely necessary, sending a (WhatsApp) message might suffice to comfort a patient. Patients just can not get the feeling they are talking to a robot. That is where the big challenge or task lies for designers.
3. Patients are often not as prepared as they might think. The cause of this lies with medical personnel as well as patients.
4. Good interaction during a consultation can be achieved when both parties try to understand each other, this is the case with both incoming- and outgoing information.
5. Make sure to create a treatment plan tailored to the patient it is created for.

14. Insurance company

To get an understanding of how insurance companies look at the future of healthcare and the consulting room, M. Spengler from Menzis, a insurance company in the Netherlands was interviewed.



1. The goal of Menzis for the future of healthcare is the same as that of the Erasmus MC. They want to improve healthcare while lowering costs through cooperation with healthcare instances and hospitals.
2. The solidarity principle: Patients will not have to deal with any financial sanctions based off of their lifestyle.
3. Insurance companies get money from their client's monthly premium and from the government based on expected costs of their population of insured clients. This way it does not matter which patients an insurance company selects as they are automatically compensated. It is however possible to focus on a specific target group, like elderly people, to lower their costs and to come up with more specialized, yet cheaper, treatment plans.



Appendix

Expert interviews overview insights



15. MedTech company

Philips Healthworks is a division of Philips which has set up a platform for medical start ups to support them in bringing their new and innovative products to the market and making sure the start ups meet the right standards to be able to compete with the fierce competition in the medical sector. A. Prado is the CEO of Philips Healthworks and he explains how Philips, as a medtech company, sees the future of healthcare. The most interesting findings can be found below.

1. AI needs private, anonymized data, for which consent has to be signed by the owner of that data. To make sure this is done properly, Philips is taking ethics and principles very seriously, to minimize the risk the data being misused.
2. Privacy is a very serious issue. International MedTech companies like Philips would like to see standardized law on a European, and preferably global level, for AI. Access to data on such a scale is preferred, as bigger data leads to a better AI.
3. Healthcare in 2030 will be more aimed at prevention, more personalized and aimed at chronic disease management. To enable this it is highly likely that private cloud, where patients store their personal medical data, and blockchain will play a role.

Conclusion

Through these expert interviews a lot of valuable information is gathered which will be used during the ideation to come up with new ways a consultation can be set up.

For now, the most interesting insights per group are gathered in an overview shown on the next page (image XX). This overview not only shows the insights, but it also shows four categories in which the different interviewed experts can be grouped. The groups identified are:

1. Social/empathic

The first and most present group of subjects discussed. These are the people who focus on social and empathic aspects such as caring for patients, making sure the interaction during a consultation goes as fluently as possible.

The most interesting insight shared by all interviewees from this group is that:

"The conversation during a consultation is that what should be focused on. Doctor and patient have different expectations for a consultation and it is important they try to understand each other."

2. Technical

The technical group is more focused on technical innovations and new ways of practicing medicine, while still holding the patient in high value.

The most interesting finding from doing these interviews was:

Appendix

Expert interviews overview insights

There are different groups working on innovations to improve healthcare. Clinical technicians are learning to practice medicine in a more technical manner, MedTech companies provide medical and consumer products which can be used to support patients or gather data outside a consultation. Interaction designers look at the best way to improve communication during a consultation as that seems to be the most important aspect of a consultation.

3. Financial

The financial subjects discussed during the expert interviews can be found in this group. These are the people you need to talk to when you are thinking about the future expenses of the healthcare sector to find the best way to lower the costs for everyone.

The most important finding from this group was:

To keep medical expenses as low as possible it is necessary to cooperate with other healthcare instances to be able to share costs and invest in innovations together with these other health institutions.

4. Regulation

With the final group, regulation, the topics discussed were more about the regulations needed for a consultation to be safe for both doctor and patient. It is thought to be necessary that new laws will be created which regulate innovations within the healthcare sector. Like the way medical data is shared, but also if, and how it may be used as big data, so it can be used by A.I. as learning material.

The most important finding done in this group was that:

If AI will be useful in healthcare for data analyzation all depends on laws on privacy and data sharing. It is therefore necessary a conversation is started discussing the possibilities and limitations of AI, to be able to draw up proper laws, which allow for the use of AI whilst not hindering the data's owner or medical personnel in their work.

appendix 8

Report Delphi study, A. van Vliet

Time to catch up; implementing medical innovation in the consulting room of tomorrow.

Andries van Vliet¹

¹ Department of Internal Medicine, Erasmus Medical Center, Rotterdam

E-mail: a.d.vanvliet@erasmusmc.nl

Abstract

In the past decades, the consulting room has stopped developing and adapting to today's continuously evolving society. It is essential with the unstoppable stream of innovation to change the consulting room into a relevant central meeting point between physician and patient in future's healthcare. The aim of this study was to create a vision of the consulting room in 2030, taking into account the objectives of the consulting room and the possibilities of medical innovation. To reach this objective we developed a Delphi method to establish a consensus of a possible vision of the consulting room in 2030. The study used a four-round Delphi method to create a vision of the medical consultation in 2030. The result of this Delphi study indicates that a new timeline of consultation must be created with the implementation of 4 medical innovations. The vision of the medical consultation in 2030 offers a solution and shows an overview what will be possible in the future of healthcare.

Keywords: Delphi, Consultation, Medical, Innovation.

1. Introduction

In the past decades, the consulting room has stopped developing and adapting to today's continuously evolving society. The average consulting room is equipped exactly the same since World War II, except for the introduction of the computer (1). Although this traditional consulting room had been used as primary and central point of care for many years (2), the past few years a lot of progress is made in the field of medical innovation (3). These developments offer new possibilities to support all the components in healthcare. Unfortunately, hardly any of these developments found their way to the consulting room yet. The problem is, while medical innovation is increasingly implemented in western society, the average consulting room stopped developing. Therefore, the consulting room is losing its value as central meeting point between physician and patient, and thereby losing its essential aspect in healthcare.

The traditional layout of the consulting room was designed to create the best working environment for the physician, without facilitating effective communication between patient and physician. Due to this, the medical

consultation room forces the patient to play a passive role and its physician an authoritarian role during the medical consultation (2). The consulting room contains a desk designed for the physician with a mobile chair, while the patient has with limited access to the computer screen because of his/her fixed chair. This causes a detached position between physician and patient. Although the traditional consulting room has been used for many years, the design needs to be reconsidered due to a changing healthcare system and its effect on the physician-patient interaction (4,5). The most important changes are the focus on patient-centered care, the transition from acute to chronic and preventive care and innovation of healthcare by improving digital information transfer, the internet as source of medical information and electronic patient files (2).

The introduction of the electronic patient file, which was implemented in the consulting room due to the implementation of the computer, could be regarded as the only significant 'innovation' to enhance the medical consultation between physician and patient. It was supposed to enhance automated information processing within the healthcare system. Unfortunately, this innovation so far only

remains a digital copy of its paper predecessor offering almost none of the benefits of making use of the computer (6). Moreover, the physician seems to have changed his centre of attention from the patient to the computer screen (7). Hence, one could argue whether this ‘innovation’ in the consulting room has led to improvement of healthcare.

Contrary to the consulting room, in the past few years a lot of progress was made in the field of technological innovation (3). Many new technologies are available or are currently under development that could improve the consulting room (8-11). These developments offer new possibilities to improve the consulting room. Few of these innovations have so far found their way into the consulting room (3), especially because there are so many possibilities of implementing medical innovation in the consulting room.

Furthermore, the introduction of telemonitoring and teleconsulting give physicians the additional possibility to deliver ambulatory care to the patient. Therefore, the use of a physical consulting room seems less necessary in the future (12). Second, the consumer industry is producing advanced technology for the use of the average consumer to manage their own health conditions. Using digital applications for smartphone, patients are now able to track and interpret individual medical data (13).

What also made its appearance in recent years is the so called ‘wearable’. These small portable devices continuously record biomedical data from their wearer (14). Even the measurement of caloric intake already is possible with a smartwatch (15). It is a matter of time before patients start asking their physician questions about the relevance of this biomedical data (13). Unfortunately, the current consulting room is completely unprepared for these developments (16).

In short, it is essential with the unstoppable stream of innovation to change the consulting room into a relevant central meeting point between physician and patient in future’s healthcare. The aim of this study was to create a vision of the consulting room in 2030, taking into account the objectives of the consulting room and the possibilities of medical innovation. To create a vision of the consulting room 2030, consensus among experts of the consulting room on two subjects is required: the challenges the current consulting room is facing and the possibilities of medical innovations that must serve as solution to these challenges. This vision can be used for the implementation of medical innovation in care, education and research. Currently, there is no consensus on the recommendations that apply to medical innovations in the consulting room. This lack of consensus disturbs the development of the consulting room and the healthcare as such. This is why consensus about the vision of the consulting room within the healthcare system 2030 is

essential. To reach this objective we developed a Delphi method to establish a consensus of a possible vision of the consulting room in 2030.

2. Method

The Delphi method is a systematic and iterative process that uses multiple rounds for determining consensus among a panel of experts. In each round a questionnaire is filled in by a panel, based on their expert opinion. After each round a researcher sends back the results of the consensus in an anonymous summary (17). This method is based on structured communication with a panel of experts to reach consensus on a specific topic, in this study the consulting room in 2030. The Delphi method is commonly used in healthcare. It is known as reliable method to reach consensus with a clinical problem, when there is little research that has led to any solutions. Second, the Delphi method is convenient to reach participants in a short period of time to ask for their opinion. Third, through anonymity every participant has an equal voice regardless of status, social status and personality (17).

2.1 Delphi study design

Our Delphi study consisted of a four-round process in which several groups of experts participated. Three specific groups were composed to contribute separately to a specific Delphi round: a research group, an expert panel and an user group and to come to a consensus vision of the consulting room 2030, see figure 1.

2.1.1 Research group The research group consisted the head of the internal medicine department, 2 physicians of the internal medicine department, 1 intensivist, 2 engineers of the industrial design faculty and 2 researchers. The research group interpreted the results, monitored and planned the Delphi process and recruited the expert panel and user group. The research group executed round 1 of this Delphi study (see Appendix 1 for full details of the research group).

2.1.2 Expert panel The expert panel consisted a group of experts who, together, contained all the areas of expertise to create an overview on the consulting room and healthcare in 2018 and contain all areas necessary to create an overview of the consulting room of 2030. The expert panel executed round 4 of this Delphi study (see Appendix 2 for full details of the expert panel).

2.1.3 User group The user group consisted of physicians, nurses, physicians in 2030 (medical students) and patients (off the future), see figure 1. In other words: likely (current or future) users of consultation rooms. The user group filled out the anonymous online questionnaires of round 2 and 3.

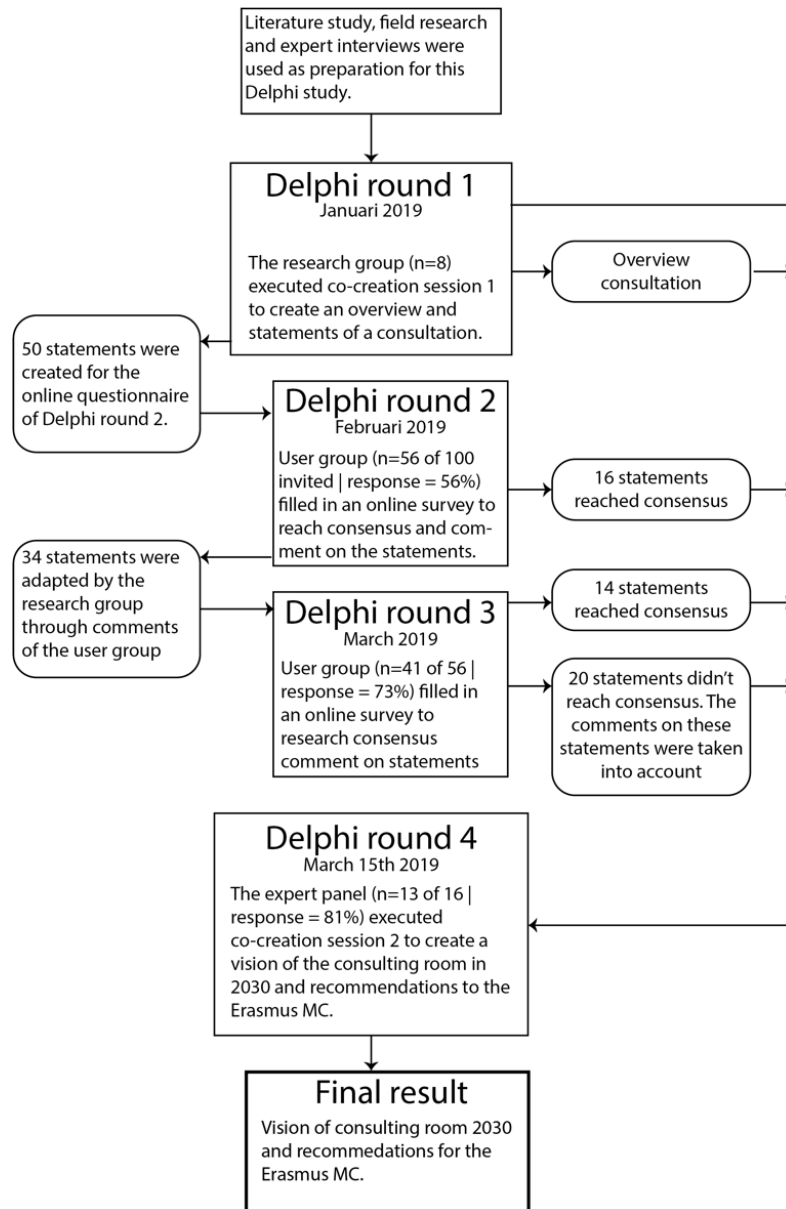


Figure 1. Overview of the Delphi-method. This figure shows all the steps in this Delphi study in the parts with square corners. In- and output were described in the parts with round corners.

2.2 Preparation of the Delphi study

Ahead of the start of the Delphi study a preliminary set of information concerning the consulting room and medical innovation was gathered by members of the research group. This set of information included a literature search, field research and expert interviews to create an overview of the consulting room in 2018, medical innovations and the healthcare in 2030.

2.2.1 Literature search Literature has been searched for multiple subjects: the current state of the consulting room, and medical innovations of the consulting room in 2030.

PubMed was used with the following search terms for the current state of the consulting room: consulting room, design, patient-physician interaction, communication, information transfer, objectives of the consulting room, vision on healthcare, general practitioner, patient-centered care, patient satisfaction, ambulatory care, healthcare policy of the consulting room, development of the consulting room. The search terms for the medical innovation of the consulting room in 2030 were: healthcare innovation, innovation of the consulting room, medical technology, healthcare of the future, consulting room of the future, digitization, artificial intelligence, telemedicine, teleconsulting, wearables, big

data, electronic health records. Due to absence of high-quality literature on the topic of the consulting room on PubMed, literature was also searched with an equivalent Google search.

2.2.2 Field research More information was gathered about medical innovation which were already in practice and/or still under development that could apply to the consulting room of the future. The field research was executed by searching for events, based on agendas of healthcare & innovation events found on the internet, during the 20 weeks of research such as a congress, tour or presentation. Events needed to contain information about medical innovations or experience in practice of the consulting room (see Appendix 3 for full details of the field research).

2.2.3. Expert interviews Interviews were held with each member of the expert panel. Each interviewee was considered an expert of the consulting room in case their working field was correlated with healthcare by working at a healthcare institution or contributing to healthcare by innovation, design, education or management. The interviews were conducted to provide a better view of the current state of the consulting room and its objectives.

2.3 Delphi round 1

January 2019, the research group executed co-creation session 1 to define an overview of the medical consultation in 2018 (Appendix 4). The medical consultation was chosen instead of consulting 'room' to ensure writing the scenario of the consulting 'room' 2030, was not bound to a physical space only. Therefore, at this point the definition 'medical consultation' is used. Co-creation session 1 is a design process where the eventual users of a product or service are given the opportunity to design with supervision of the designer, so new insights can be processed and be added to the eventual design. In this session all the steps, interactions, pros and cons of the medical consultation in 2018 were composed.

As result, a timeline of the medical consultation in 2018 and statements concerning the medical consultation for the online questionnaire of round 2 and 3 were composed. These outcomes were used as starting point for the vision of the medical consultation in 2030.

2.4 Delphi round 2

February 2019, an online questionnaire was designed with the statements concerning the medical consultation composed in round 1. This anonymous, online questionnaire was conducted by the user group. The objective was to reach consensus with each statement. A 5-point Likert scale was used varying from strongly disagree (score 1) to strongly agree (score 5). Additionally, an 'neutral' option (score 3) was provided to capture uncertainty. Besides that, it was possible to add comments with an open text space next to each statement (18).

2.4.1. Data analysis and definition consensus To determine if consensus was reached on each statement, three statistical measurements were used to determine the level of agreement (18). The level of agreement was determined by calculating the median, the percentage agreeing (score 4) or strongly agreeing (score 5) on the 5-point Likert scale and the interquartile range (IQR). When statements reached very high or high agreement, as shown in table 1, consensus was reached. Also, in parallel, very high disagreement and high disagreement was considered as consensus.

As result, statements were removed from the following online questionnaire in round 3, when consensus was reached. These statements were included for use in round 4, though, as recommendation to the vision of the medical consultation in 2030.

When moderate, low or no agreement was reached, statements were adapted with added comments of the user group. In round 2 and round 3 the level of agreement was determined with this statistical method. Statements, that did not reach consensus, were adapted using the comments that were given in the open text spaces.

<i>Level of agreement</i>	<i>Score</i>			<i>Level of consensus</i>
	<i>% Median ≥ 4 (%)</i>	<i>Median</i>	<i>IQR</i>	
<i>Very high agreement</i>	≥ 80	5	0	Consensus
<i>High agreement</i>	≥ 80	4 or 5	≤ 1	Consensus
<i>Moderate agreement</i>	60-79	≤ 4	≥ 2	No consensus
<i>Low agreement</i>	< 60	< 4	> 2	No consensus
<i>No agreement</i>	< 60	3	> 2	No consensus
<i>High disagreement</i>	≤ 20	1 or 2	≤ 1	Consensus
<i>Very High disagreement</i>	≤ 20	1	0	Consensus

Table 1: Levels of agreement, how they are scored and corresponding level of consensus. IQR = Inter Quartile Range.

2.5. Delphi round 3

Another online questionnaire was composed, which contained the adapted statements that did not reach consensus in round 2. The same method was used to determine statements reached consensus as in round 2.

2.6. Delphi round 4

Statements were also included to use in round 4 as recommendation to the vision of the medical consultation in 2030, if consensus or strong consensus was reached in round 3. Other statements, that did not reach consensus, were taken into account to design a vision of the medical consultation in 2030 due to the comments that were given in the open text spaces.

In the final round (March 2019), co-creation session 2 took place during a face-to-face meeting with the expert panel to define the vision of the medical consultation in 2030 (Appendix 5). All results of the previous Delphi rounds were composed and designed as a timeline of the medical consultation in 2030. In co-creation session 2 the expert panel evaluated the timeline of the medical consultation in 2030.

2.7. Final result

The results of the co-creation session 2 was used as the endpoint of this study whereby a vision of the medical consultation in 2030 was designed and recommendations to the Erasmus MC were composed.

3. Results

3.1 Round 1: Research meeting

This preliminary research, with 14 interviews, 5 event of the field research and found literature (see Appendix 3, 6&7 for full details of the preliminary research) was presented to the research group during a face-to-face meeting. Thereafter the research group executed co-creation session 1 to create an overview of medical consultation in 2019, see figure 2. The research group constructed a timeline of the medical consultation with 22 steps and commented on each step. With this timeline and the constructed comments, 50 statements were composed to create the online questionnaire of round 2 and 3, composed as shown in table 3. These statements consisted of 9 major subjects of the medical consultation: preparation, trust, requirements, time management, completion, physical space, equipment, information provision and healthcare of the future.



Figure 2. Caption text.

3.2 Round 2 & 3: Online questionnaire

In round 2 the online questionnaire was filled in by 56 participants of the user group (see table 2 for a characterization of the user group).

One statement reached very high agreement, 13 statements high agreement, 0 statements very high disagreement and 2 high disagreement. This resulted in 16 statements reaching consensus and therefore were excluded from the online questionnaire in round 3.

The 34 remaining statements were adapted through comments of the user group. In round 3 the online questionnaire was filled in by 41 participants of the user group. As result statements reached one very high agreement and 13 statements high agreement. Resulting in 14 statements reaching consensus in round 3 and 30 statements

reaching consensus in total (60%). However, 20 statements did not reach consensus (40%).

The feedback of the statements was discussed in the research group and were taken into account creating the medical consultation in 2030. In most of the major topics 60% or more of the statements reached consensus. Remarkably, the statements of the subjects 'equipment of the consulting room' and 'healthcare of the future' only 33% and 14% reached consensus respectively. The results of each statement are presented in table 2 and were used to construct the vision of the medical consultation in 2030 in figure 7.

User Group	No. of users (women)	Age (SD)	Use of the consulting room (daily/weekly/monthly/annually)
Patient	17 (9)	45 (\pm 17)	1 / 2 / 2 / 17
Physician	3 (1)	35 (\pm 16)	3 / 0 / 0 / 0
Patient of the future	3 (2)	33 (\pm 14)	0 / 0 / 0 / 3
Physician of the future	33 (23)	22 (\pm 2)	4 / 9 / 4 / 11
<i>Total</i>	<i>56 (33)</i>	<i>30 (\pm15)</i>	<i>8 / 11 / 6 / 31</i>

Table 2. Characterization of the user group. The 4 types of the user group were characterized with data of the online questionnaire. Characteristics were shown per type of the user group.

Consensus statements survey, Delphi round 2 and 3 N= amount of statements	Score			Level of agreement (consensus)
	≥ 4 (%)	Median	IQR	
Preparation consult Consensus 3 of 4 statements (75%)				
Care institutions should facilitate information sources about care problems such as thuisarts.nl in order to get the correct medical information to patients and to prevent unnecessary worries.	90	5	1	High (Consensus)
The electronic patient file enables the physician to get a good overview of the patient.	89	4	1	High (Consensus)
The medical consultation starts at a different time for the patient than the physician.	82	4	0,5	High (Consensus)
Prior to the medical consultation, the patient must be informed how the medical consultation has been set up based on the reason for arrival, so that the conversation between doctor and patient can proceed smoothly.	70	4	1	Moderate (No consensus)
Trust during medical consultation Consensus 5 of 7 statements (71%)				
It is important for the patient that the physician acts professionally.	98	5	0	Very high (Consensus)
Physicians and patients have an equal influence on the relationship of trust.	98	5	1	High (Consensus)
A physician is professional when information is searched on the internet during the medical consultation when there is transparency.	93	4	1	High (Consensus)
Social talk can be useful during a medical consultation to improve trust, even if this depends on the type of patient and the physician's assessment.	85	4	1	High (Consensus)

The physician's retrieval of the patient from the waiting room contributes to the medical consultation.	84	4,5	1	High (Consensus)
During a first medical consultation, at first, a relationship of trust between physician and patient must be built a bound of trust before the actual medical consultation can take place.	68	4	1	Moderate (No consensus)
Prior to the medical consultation, a patient must be given guidelines which information is relevant to appoint during a medical consultation.	54	4	1	Low (No consensus)
The requirements during medical consultation Consensus 5 of 6 statements (83%)				
At the end of a medical consultation, the follow-up steps given by the physician must be clear to the patient.	100	5	0	Very high (Consensus)
The physician must guide the patient through the conversation.	93	4	1	High (Consensus)
Identifying the reason for the patient's arrival is the most important during a medical consultation.	82	4	1	High (Consensus)
The treatment plan is determined by physician and patient together.	80	4	1	High (Consensus)
A medical consultation in a physical space is essential to observe the patient's non-verbal communication and to be able to take it into account during the medical consultation.	80	4	1	High (Consensus)
Physical examination is not only done to find the diagnosis, but more and more to reassure the patient.	44	3	1	No agreement (No consensus)
Time management during medical consultation Consensus 3 of 4 statements (75%).				
It is more important that a physician completes a medical consultation well than that it starts a new medical consultation on time.	93	5	1	High (Consensus)
The physician must have enough time to determine the next steps for the patient after the medical consultation.	90	4	1	High (Consensus)
After the medical consultation, a patient should receive an overview of what was discussed during the medical consultation with the possibility of additional information.	88	5	1	High (Consensus)
Healthcare is not efficient enough to create enough time that the physician can take care of each specific need of each patient.	63	4	2	Moderate (No consensus)
Completion of medical consultation Consensus 3 of 5 statements (60%)				
A medical consultation is successful when a patient feels helped and heard.	95	5	1	High (Consensus)
The patient and physician come together in the medical consultation room to determine the treatment process that the patient will enter based on a possible diagnosis and subsequent treatments.	87	4	1	High (Consensus)
Physician and patient are both responsible for the patient's diagnostics treatments.	82	4	1	High (Consensus)
In the future, the computer must be replaced with artificial intelligence that helps the doctor with his administrative tasks so that his focus can be entirely on the patient.	76	4	1	Moderate (No consensus)
Resources must be added to the medical consultation to increase understanding between doctor and patient.	56	4	1	Low (No consensus)
Medical consultation in a physical space Consensus 3 of 5 statements (60%)				
The computer must be replaced by artificial intelligence, so administrative tasks of the physician can be taken over, placing the conversation between doctor and patient central.	85	4	1	High (Consensus)

The medical consultation room is designed to facilitate the physician in his work.	80	4	1	High (Consensus)
Some of the medical consultations could also take place digitally, in particular follow- up medical consultation.	70	4	2	Moderate (No consensus)
Innovation must be implemented which make it possible to observe non-verbal communication and intuition of the physician in a medical consultation in the digital space.	49	3	2	No agreement (No consensus)
Everything a physical medical consultation room can offer for a medical consultation can also be digitally facilitated.	11	2	1	High (Consensus)
Equipment in the consulting room Consensus 1 of 3 statements (33%)				
Implementation of innovations within a medical consultation must lead to a lower workload for the doctor in order to be able to focus on the conversation with the patient.	93	5	1	High (Consensus)
More equipment must be put into the medical consultation room to be able to carry out small medical interventions on the spot.	70	4	2	Moderate (No consensus)
More diagnostic equipment needs to be put in the medical consultation room to achieve faster diagnostics.	63	4	1	Moderate (No consensus)
Information provision of the medical consultation Consensus 5 of 8 statements (62,5%).				
When patients want to search information about health, there must be a possibility to be assisted with approved guidelines for medical information.	95	5	1	High (Consensus)
Patients must also be able to receive medical information outside the medical consultation without the doctor being unnecessarily burdened.	95	4	1	High (Consensus)
Patients should have the opportunity to see their estimated waiting time before the medical consultation.	88	5	1	High (Consensus)
A summary must be provided by a device in the medical consultation room, so that the patient and doctor have an overview of what has been discussed afterwards.	87	5	1	High (Consensus)
Patients must have continuous access to their medical data.	80	4	1	High (Consensus)
It must be possible that prior to the medical consultation, certain tests have already been taken on the patient based on his complaints and therefore suspected diagnosis.	78	5	1	Moderate * (No consensus)
The continuous collection of medical data by the doctor with the consent of the patient leads to improved care.	73	4	2	Moderate (No consensus)
The patient must have access to view their own medical data, while the physician remains the manager and determines to what extent the patient has access to specific medical data.	59	4	3	Low (No consensus)
Healthcare of the future Consensus 1 of 7 statements (14%)				
I would be willing to wear a wearable (bracelet / necklace / watch / item of clothing / etc.) In order to collect my medical data.	76	4	1	Moderate (No consensus)
Artificial intelligence supports the doctor in making diagnosis.	68	4	2	Moderate (No consensus)
Healthcare institutions must receive preventive warnings of artificial intelligence to properly monitor the patient's disease with the patient's approval.	68	4	2	Moderate (No consensus)
Patients should be able to get a medical electronic assistant to help them make the best choices when it comes to their	59	4	2	Low (No consensus)

health.

The doctor increasingly plays an advisory role in which the patient is given more control over his own treatment.	54	4	1	Low (No consensus)
I would like to have a chip implanted to collect my medical data, should it be necessary to improve my health.	39	3	2	No agreement (No consensus)
In the future, the doctor will be replaced by a form of artificial intelligence.	7	2	1	High disagreement (Consensus)

Table 3: Overview results online questionnaire. Each major topic divided the statements in different group. In this table the statics were presented of % of agreement, median and IQR. In the last column level of agreement and if consensus was reached or not was shown.

* Median and IQR suggest consensus was reached, however with a level of agreement $\leq 80\%$, the statement was determined as no consensus.

3.3. Interpretation of the statements' results

Due to the results of the statements, the opinion of the user can be collected from the statements that reached consensus and that reached no consensus. These results were taken in consideration during the design of the consultation in 2030.

3.3.1 Preparation of the consultation The user group states that patients and physician should get improved information facilities prior to the consultation. Patient should be able to get evidence based medical information to prevent unnecessary worrying. Informed about the planning of the consultation at beforehand was found unnecessary. The physician must have a good overview of the medical information with the electronic patient file. The patient and physician will be able to prepare better for the consultation. The exact moment when the patient and physician start to prepare for the consultation differs. Therefore, the source of information should be able to facilitate information apart from each other.

3.3.2 Trust during consultation Trust between physician and patient are a very important element to ensure a good consultation. The physician has to be professional and transparent of his/her actions during the consultation. Trust must be built up during the consultation and is not necessary at forehand. Picking up the patient from the waiting room and social talk can be useful to improve trust. Contributing to trust practically is a task of the physician. Patients do not have guidelines contributing to the relationship between physician and patient.

3.3.3 The requirements during consultation An important requirement during consultation is communication to be able to transfer information. The information transfer between patient and physician are facilitated by verbal, non-verbal and textual given information. During the consultation, the reason for the patient's arrival needs to be identified and follow-up steps need to be clear at the end of the consultation. The physician needs to guide the patient through the conversation, but both will eventually determine

the treatment plan. The patient needs to receive an overview of what was discussed during the consultation to be able to retrieve all the given information.

3.3.4 Time management Time management is essential to maintain efficient healthcare, but the well-being of patients is more important. The physician needs to have time to complete the consultation in a proper way for the satisfaction of the patient and determine the next steps.

3.3.5 Completion of consultation At the end of the consultation, the patient needs to be helped and heard. The treatment plan needs to be discussed with the patient and physician together. The responsibility lies with both of them. Technical aids are not that favorable as contribution.

3.3.6 Consultation in a physical space The consultation room is designed to facilitate the physician in his/her work. Administrative task of the physician should be taken over by artificial intelligence so the conversation with the patient is placed central. Nowadays, not everything can be facilitated digitally what can be offered in a physical room. Therefore, consultation must be as if it is in a physical room.

3.3.7 Equipment in the consulting room Implemented innovation within the consultation must lead to a lower workload of the physician in order to focus on the conversation with the patient. There should not be placed any more equipment in the consulting room.

3.3.8 Information provision Medical information should be accessible for the patient outside the consulting room. The patients must be assisted with medical information, approved by his/her physician. Also, information about the consultation should be accessible and additional information must be provided when desired.

3.3.9 Healthcare of the future The user group has a low agreement on how future's healthcare will be. None of the medical innovations were approved. Only the use of artificial intelligence for administrative tasks should be implemented to assist the physician. Tasks of the physician will remain the

same in the future, no medical innovations will be implemented.

3.4. Round 4 Expert panel: Vision of the medical consultation in 2030.

On March 15 Delphi round 4 took place in a face-to-face meeting with 13 of the 16 invited experts (81%). The timeline of the medical consultation in 2019, suited medical innovations for the medical consultation in 2030, overview of the expert interviews was sent as literature in advance by email. During the face-to-face meeting, the collected data of this Delphi study was presented at the expert panel within a vision of the medical consultation in 2030 (fig. 3). Thereafter, the expert executed co-creation session 2 (see Appendix 5 for full details of the research group). The expert

panel discussed and commented each step on the basis of the generative tool.

The vision of the medical consultation in 2030, shown in figure 3, reached consensus with the expert panel in round 4. The four most important medical innovations are the ambulatory care, participatory care, data analysis by artificial intelligence and image forming techniques. In figure 3 the medical consultation in 2030 is bigger than the (physical) medical consultation room and can be compared to the entire treatment process of the patient in 2019. The four medical innovations are implemented in this medical consultation in 2030 by designed devices by the research group.

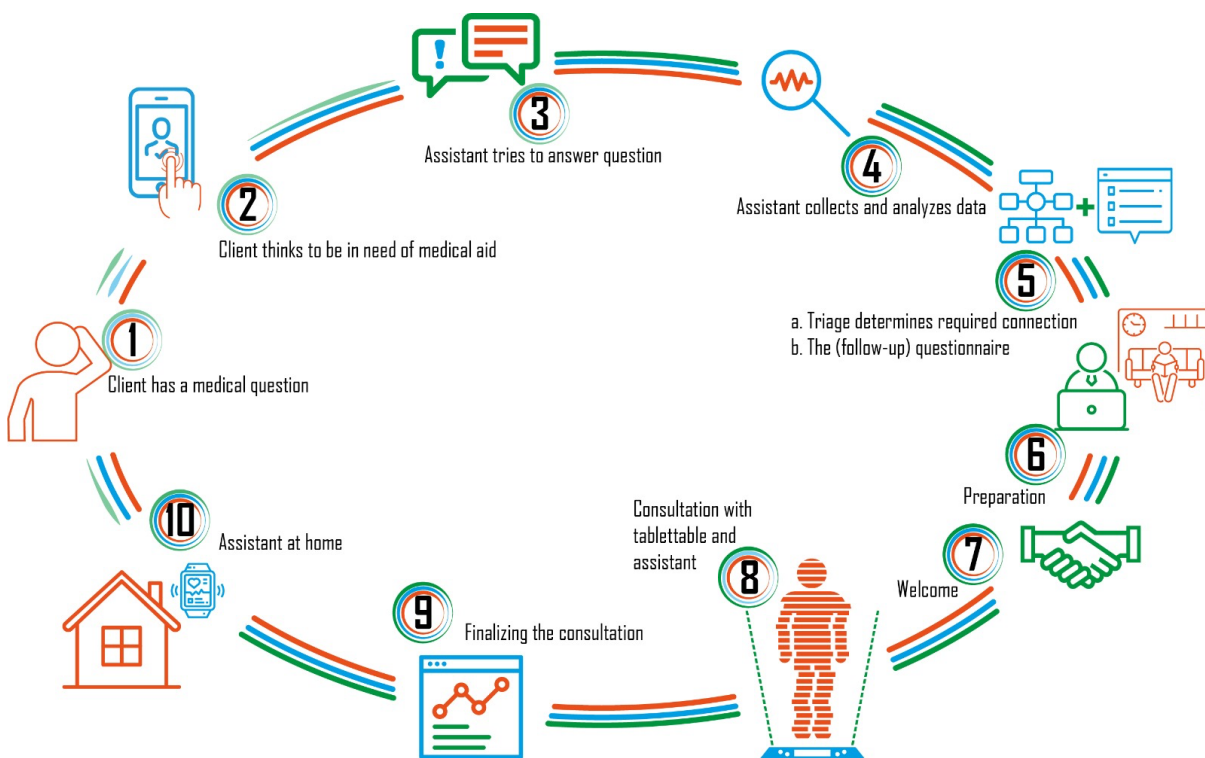


Figure 3: Vision of the medical consultation room 2030. Every number (circular, n) represent a chronological step in a consultation process in 2030 that takes place between patient, physician & medical innovations (medical coach).

3.4.1 Data analysis by artificial intelligence

At step 2, 3 and 4 of the medical consultation of 2030 the patient contacts a medical coach for medical assistance. The medical coach is a virtual, online coach based on artificial intelligence to support a patient with medical information and estimate whether there is a medical problem that needs further assistance. The medical coach was designed as improved information facilitator prior to the consultation which reached consensus with the user group as improvement of topic ‘the preparation of the consultation’. To facilitate the physician with information about the patient.

The medical coach uses the electronic patient file and background information of previous conversations with the patient and medical coach. The medical coach has a human form, based on patients’ preferences, and can interact with the patient with a conversation. Stated by the user group in topic ‘Trust during the consultation’, trust between physician and patient are a very important element to ensure a good consultation. Social talk can be useful to improve trust. Therefore, a human form of the medical coach was designed.

When there is a medical problem, the medical coach advises the patient what kind of healthcare connection is

suiting for his medical problem and personal preferences. These healthcare connections are types of medical consultations that the patient can use for medical consultation in 2030. There are 4 kinds of healthcare connections: 1) only medical information is required that the medical coach is capable of giving to the patient and no empathic care of another human being is needed because of the mildness of the medical problem or the patient is experienced enough due to a chronic disease; 2) medical information is required and empathic care is needed but the patient is not experiencing it as an urgent problem and just wants to be ensured by his/her physician. A video message is sent of the patients' medical problem and questions to his/her physician so that the physician can reassure the patient at a convenient moment; 3) telemedical consultation is required; medical information is required, empathic care is needed, the patient is experiencing an urgent medical problem and wants medical support as soon as possible and the patient or physician has no problem with a digital interaction; 4) a physical medical consultation is required when patient or physician consider a physical medical consultation is necessary with the possibility of physical examination and potential medical interventions. These 4 types of consultation will create efficient healthcare, whereby well-being of the patient is most important, as stated in the user group with topic 'Time management'. The satisfaction of the patient will be reached by facilitating the best medical consultation with taking into account the patient's preferences. The medical coach will determine and facilitate the next steps. Second administrative tasks of physician are taken over by the medical coach, so that the physician can spend all his/her time on the conversation with the patient. The user group stated that the consultation must be as if it is in a physical room. Therefore, these healthcare connections are divided which objectives of today's consulting room are needed to help the patient in the best possible way.

The medical coach suggested the healthcare connection which is suited for the patient's healthcare problem, based on given information by the patient. The medical coach will connect the healthcare connection with the patient. Eventual questionnaires and additional research, such as taking a blood sample, are proposed to the patient. Prior to the healthcare connection, physician and patient need to be prepared for the actual consult which will take place shortly. The medical coach can prepare the patient by giving information about the design of this specific medical consultation and what the patient can do to contribute to good care. Meanwhile, the medical coach would give the physician an overview of the patient with the conversation between medical coach and patient, patient history, information of other healthcare institutions about the patient, additional research data and suggestions of clinical reasoning by the medical coach. The physician will be well prepared

and can focus on the conversation with his/her patient. Also, these functions of the medical coach improve the information facilities prior to the consultation which reached consensus with the user group as improvement of topic 'the preparation of the consultation'.

3.4.2 Imaging-forming techniques Then, in step 7 the physician will pick up the patient from the waiting room whether this is digital or physical and the medical consultation will take place in step 8. During this actual medical consultation, the conversation will play an essential role to support the patient with empathy and trust between patient and physician. As earlier stated, trust is a very important element during consultation. The implemented innovation helps to resolve peripheral matters such as administrative work as stated by the user group with the topic 'Consultation in the physical space'. Thereby, the physician will be able to completely focus on the conversation with her/his patient. At the end of the consultation, the patient needs to be helped and heard. The treatment plan needs to be discussed with the patient and physician together. The responsibility lies with both of them. Technical aids are not that favourable as contribution to the conversation, as stated by the user group with topic: 'Completion of consultation'

The medical coach will be in as a tool to support the medical process between physician and patient during the medical consultation. The tabloid table or hologram table, supported by the medical coach, will help to transfer and translate information between physician and patient by its functions: 1) This table will record the conversation as a film and compose the status for the electronic patient file and visualise the essentials during the conversation which patient and physician can add information. This introduces textless imaging makes it possible to transfer information with images; 2) The table prepares images to support the physician to explain the medical problem; 3) Also a checklist will be composed to be sure all the subjects will be discussed during the medical consultation. 4) The table can generate evidence based medical information during the medical consultation. The computer will be unnecessary in the medical consultation in 2030 which will lead to a better interaction between patient and physician (X). The table can also be incredibly useful for use with low-literate patients. The tabloid table, as implemented innovation, leads to a lower workload of the physician in order to focus on the conversation with the patient. No more equipment is added to the consulting room, but better equipment leads to a better consultation, as stated with the user group with topic 'Equipment in the consulting room'. Second, the information transfer by communication is improved by the tabloid table as stated by the user group with topic 'the requirements during the consultation'. The information transfer was improved by recording the conversation, textless imaging,

checklist to discuss and supply of medical information during the conversation.

At step 9, all the information gathered and discussed can be very overwhelming by the patient. Almost 80% of what is discussed during medical consultation is forgotten (19). Therefore, the medical coach needs to be able to give a summary of the medical consultation and the patient is able to repeat the information discussed during the medical consultation. The user group stated with the topic 'the requirements during consultation' that the patient needs to receive an overview of what was discussed during the consultation to be able to retrieve all the given information.

3.4.3 Participatory care As at the beginning of the treatment process, the patient will be home after medical consultation. During this period the patient is responsible for its own health. This is not different from healthcare in 2019, but the patient has a lot more tools to participate in improving its health. As discussed, the medical coach can facilitate the patient with evidence-based information where prevention will be the most important focus point. Also, information about a chronic disease, treatment and symptoms can be given by the medical coach. Another important objective is that patient can measure their own biomedical data and interpret the outcome. This objective can be executed by wearables which are connected to the medical coach. The wearable can measure continuous and non-invasive biomedical data from the patient and let the medical coach interpret it. Also, the physician can use this information of the wearable to monitor patients at a distance and intervene when its desirable by patients and physician.

As stated by the user group with the topic 'Information provision': medical information should be accessible for the patient outside the consulting room. The patients must be assisted with medical information, approved by his/her physician. Also, information about the consultation should be accessible and additional information must be provided when desired. By letting the patient participate in its own treatment process, these medical innovation lead to a lower workload of the physician and let the physician focus of the conversation. Instead of placing more equipment in the consulting room, more facilities of healthcare are implemented and placed outside the consulting room, whereby less equipment is needed to have a medical consultation, stated by the user group with the topic 'equipment in the consulting room'.

3.4.4 Ambulatory care With these wearables, telemonitoring, imaging form techniques and the teleconsulting, which were described earlier, ambulatory care can be implemented in the healthcare sector, which should lead to less workload of the physician and personalized care for the patient. Both topics, stated by the

user group, cited in participatory care are also important with ambulatory care. All medical innovations which are used ambulatory should lower the workload of the physician, improve information facilities and let to equipment of the consulting room placed outside.

4. Discussion

A vision of the medical consultation in 2030 was created with 4 Delphi rounds. Round 1 composed the overview of medical consultation in 2018 and subjects that needed to be researched to create a future medical consultation with the possibilities of medical innovations. The online questionnaire of round 2 and 3 gave an insight of the opinion of the user group of the consulting room. Certainly not all statements reached consensus, especially the statements of subject 'future of healthcare' did not reach any agreement. Remarkably, because most of the medical innovations found as improvements of today's consulting room did not get the agreement of the user group. Thereafter, the expert panel reached consensus of these medical innovations unanimously. Explanation can be given by interviews of the expert panel and founded literature. In these interviews was stated how conservative physicians and patients are about healthcare. Innovating the medical consultation or healthcare in its whole, is a too great risk which caretaker and caregiver are not willing to take. Therefore, both users of the consulting room prefer the medical consultation that has not been changed since World War II with all its rituals and culturally determined design. Yet, with the statements that did reach consensus the user group clearly stated that the medical consultation of today is far from perfect and should be improved. Meanwhile, medical innovations are rejected by the user group, the solutions from the user group for improving the medical consultation room remain unknown. Second in other research, found in the literature search, patient federation and other key players, suggested as in the expert panel, encourage the idea of implementing medical innovation in future healthcare (21,22).

4.1 Recommendations

During Delphi round 4, questions had been asked by the expert panel about the vision of the medical consultation in 2030 and the suggested medical innovations. These following recommendations were discussed and highlighted for future research: role of physician and patient, reliability of the healthcare system, risk of overmedicalization, involvement of caretaker, disagreement between physician, medical coach and patient, solution to health refusers, understanding data and notification of physician or patient.

4.1.1 Role of physician and patient The expert panel pointed out that the titles of physician and patient should not be used in 2030, but respectively client and caretaker. With changing

the titles, the authoritarian role of the physician and passive role of the patient is removed during the medical consultation (2). Also, the name of medical ‘coach’, did not seem suitable by the expert panel and therefore suggested medical assistant, emphasizing its supporting role.

4.1.2 Reliability of the healthcare system In this vision, it will be possible to monitor patients and prevent disease becoming symptomatic, putting a greater responsibility to the patient and the medical coach. The expert panel pointed out that there must be invested in research towards artificial intelligence (AI) in healthcare to ensure a reliable healthcare system in 2030. Besides, the system needs to function properly, because patients will share a lot of their personal data with an online digital system. Privacy is an important aspect in healthcare that relies on trust between physician and patient. The data must be protected and only shared with consent of the patient.

4.1.3 Risk of overmedicalization With the medical coach and healthcare shifting towards prevention, more people will engage healthcare before falling ill. At first the patient will contact him/her medical coach if the patient assumes that medical care is needed. The medical coach will need ascertain if the step within the healthcare system is needed. When does someone become a patient within this healthcare system? The system of the medical coach must prevent overmedicalization and make a distinction if medical care is needed.

4.1.4 Involvement caretaker After the previous step, deciding if medical care is needed, a healthcare connection needs to be made. The exact moment to notify the physician, when a patient wants to make a healthcare connection, is questionable. When notifications are sent to early, it will lead to abundance of information and the physician will not be able facilitate care to the patient who really needs it. The medical coach must be able to connect the ‘real’ patients with the right (health)care provider.

4.1.5 Disagreement between physician, medical coach and patient

After the medical coach advices, a certain healthcare connection, the client will decide if he/she concurs with the given advice. What if the advice does not comply with the wishes of the patient? When the advice of the medical coach is refused, ethical dilemmas will raise about paternalism, beneficence and non-maleficence. How far can a healthcare system of caretaker go to assist the patient with the best care and advice? What will happen when a patient refuses medical aid when this endangers their wellbeing or medical aid was not advised by the medical coach, although the patient is convinced that the healthcare problem cannot be solved without a certain healthcare connection?

4.1.6 Understanding data Patients need to understand data that will be provided with telemonitoring and the use of wearables. Without medical knowledge patients will not be able to interpret all the medical data that is generated. To make this data more understandable, ‘Fuzzy Logic’ can be used. Fuzzy Logic is based on removing precise numbers of this data and the use of color coding. Through the use of colors it will be much easier

to interpret if a value is deviated, which endangers health and contact with a care provider.

Unnecessary worrying is prevented because of understandably data.

4.1.7 Notification of physician or patient With implementation of medical innovations, such as wearables, telemonitoring and the medical coach, a lot of data can be generated. What will happen if a biomedical value is exceeded. Who gets a notification? The patient who cannot interpret the data and act accordingly, besides activating the medical coach and start worrying? Or the physician who will get numerous notifications per day so daily work will get unbearable. The medical coach needs to be able to properly determine who should receive a notification and at what moment.

4.2 Strengths

A lot of strengths can be pointed out in this study. At first, the partnership between two researchers that studied medicine industrial design made a quite unique study within healthcare research. Best of both worlds was used to design this Delphi study and vision of the medical consultation. It also symbolizes that collaboration of medicine and technique are a necessary and very efficient method in today’s development and innovation of healthcare. Second, the use of three specific groups in a Delphi study to create the vision of the medical consultation in 2030 and therefore taking into account all the different point of views of this specific subject. Third, the use of a Delphi method in this study to create a vision within healthcare. The Delphi method made it possible to reach a lot of people in a short period of time, by anonymity every group was estimated at the same level and the Delphi method gives the possibility to research qualitative and quantitative data.

4.3 Limitations

The study has also got the following limitations. This study was designed during an iterative process of designing the vision of the medical consultation in 2030, which made it hard to describe the methodology of the study, ensuring full reproducibility. This study is, for we know, one of the first, ways of creating a view in the future of healthcare. Second, this study was limited due to a time limit of 20 weeks of research that might affected the quality of the research and

therefor research was only done within the Netherlands whereby generalizability may be doubted. Third, the size of the user group was limited and deviation of the different kind of users was limited. Fourth, if consensus was reached with the statements of the online questionnaire, the levels of agreements determined by the statistical values, can be doubted. It appeared that the levels of agreement had some overlap, partially because of the limited size of the user group, partially because Delphi's definition of consensus

4.4. Future steps

Within research of medical innovation in the medical consultation several future steps are recommended. The study should be repeated in a larger user group in international setting to make a more generalizable research and answers can be found how the user group sees the improvement of the medical consultation in the future. Second, more research of medical innovation should be performed with the vision of the medical consultation in 2030 as starting point. Third, medical innovations suggested in this study should be researched with more detail to see the effects on physician, patients and their interaction. Fourth, the feasibility of implementation medical innovation should be researched how this vision can be put into practice. Last, the recommendation of the expert panel of the study should be researched. All these future steps should lead to a structural adapting healthcare system to today's innovating society.

5. Conclusion

The medical consultation is losing its value as central meeting point between physician and patient, an essential aspect in healthcare. With numerous medical innovations there are many possibilities. Unfortunately, the medical consultation has not been improved yet. Designed with the Delphi method, the vision of the medical consultation in 2030 offers a solution to this problem and shows an overview what will be possible in the future of healthcare. Although, the users of the consulting room are sceptic on implementing medical innovation within the medical consultation, experts need to keep working on the future of healthcare with more research on medical innovation in the medical consultation. It is time to catch up with the innovating society to create the medical consultation of the tomorrow with the medical innovations of today.

5. References

- [1] Ajiboye F, Dong F, Moore J, Kallail KJ, Baughman A. Effects of revised consultation room design on patient-physician communication. *Herd*. 2015;8(2):8-17.
- [2] Almquist JR. Consultation room design and the clinical encounter: the space and interaction randomized trial. *HERD*. 2009 Fall;3(1):41-78.

- [3] Einspruch G. Innovation in Healthcare Delivery Systems: A Conceptual Framework. *The innovation Journal*. 2010.
- [4] Pearce C, Walker H, O'Shea C. A visual study of computers on doctors' desks. *Inform Prim Care*. 2008;16(2):111-7.
- [5] Okken V, van Rompay T, Pruyn A. Exploring space in the consultation room: environmental influences during patient-physician interaction. *J Health Commun*. 2012;17(4):397-412.
- [6] Noordman J, Verhaak P, van Beljouw I, van Dulmen S. Consulting room computers and their effect on general practitioner-patient communication. *Fam Pract*. 2010;27(6):644-51.
- [7] Frankel RM. Computers in the Examination Room. *JAMA Intern Med*. 2016;176(1):128-9.
- [8] Hijink M. De strijd tussen Google en Amazon over het 'slimme huis'. *NRC Handelsblad*. 2018.
- [9] Armstrong S. The computer will assess you now. *Bmj*. 2016;355:i5680.
- [10] Obermeyer Z, Emanuel EJ. Predicting the Future - Big Data, Machine Learning, and Clinical Medicine. *N Engl J Med*. 2016;375(13):1216-9.
- [11] Beam AL, Kohane IS. Translating Artificial Intelligence Into Clinical Care. *Jama*. 2016;316(22):2368-9.
- [12] McLean S, Sheikh A, Cresswell K, Nurmatov U, Mukherjee M, Hemmi A, et al. The impact of telehealthcare on the quality and safety of care: a systematic overview. *PLoS One*. 2013;8(8):e71238.
- [13] Mosa AS, Yoo I, Sheets L. A systematic review of healthcare applications for smartphones. *BMC Med Inform Decis Mak*. 2012;12:67.
- [14] Slade Shantz JA, Veillette CJ. The application of wearable technology in surgery: ensuring the positive impact of the wearable revolution on surgical patients. *Front Surg*. 2014;1:39.
- [15] inKin. Healbe GoBe: Can a Fitness Tracker Count Your Calorie Intake? 2018.
- [16] Roper L. Please leave your phone outside: policymakers and medical app providers are encouraging patient participation, but doctors in the consult room are not. *BMJ*. 2017.
- [17] Eubank BH. Using the modified Delphi method to establish clinical consensus for the diagnosis and treatment of patients with rotator cuff pathology. *BMC Med. Res. Meth*. 2016 May 20; 16: 56
- [18] Van der Steen JT. White paper defining optimal palliative care in older people with dementia: a Delphi study and recommendations from the European Association for Palliative Care. *Palliat Med*. 2014 Mar;28(3):197-209.
- [19] Kessels RP. Patients' memory for medical information. *JR Soc Med*. 2003;96(5):219-22
- [20] Diamond IR. Defining consensus: a systematic review recommends methodologic criteria for reporting of Delphi studies. *J Clin Epidemiol*. 2014 Apr;67(4):401-9
- [21] Patiëntenfederatie Nederland Meer mens, minder patiënt! Onze visie in 5 toekomstbeelden. 2018.
- [22] Royal Has Koning d.v. Delpihi rapport: 'De transitie naar het zorglandschap van 2030. 2018

6. Appendix

Appendix 1: research group

This group played an active rol with the design and implementation of this Delphi study. They also executed round 1 op this Delphi study.

- medical student/researcher, Erasmus MC
- student/researcher Strategic Product Design, TU Delft
- AIOS internal medicine
- director acute medicine Fellowship
- internist acute medicine & intensivist
- head of the department internal medicine
- User participation designer
- head of the department Industrial Design

Appendix 2: Expert panel

This panel presented all the areas of expertise to create an overview on the consulting room and healthcare in 2018 and were necessary to create and test the consulting room of 2030. They also executed round 4 of this Delphi study.

- The dean of a medical faculty
- Director of education of Medicine
- Manager Sales & External Relations
- Head of the department of the general practitioner
- Head of the deparment medical psychology and psychotherapy.
- Head of the client council
- Stafmember of the client council
- Head of the department internal medicine
- Vice Dean Faculty of Head of Industrial Design
- Director of Education Technical Medicine

- User participation designer
- Prof. in Healthcare Quality & Outcome
- Head of the department Ethics

Appendix 3: locations field research

- Dutch Design week 25 October 2018, Eindhoven
- Medica (congres) 15 November 2018, Düsseldorf
- Philips Healthworks 9 January 2019, Eindhoven
- Physican tour 13 november 2018 Erasmus MC, internal medicine/emergency centre.
- De geneeskundestudent, 19 januari 2019, Jaarbeurs Utrecht

Appendix 4: Co-creation session 1

The co-creation session 1 is a design process where the eventual users of a product or service are given the opportunity to design with supervision of the designer, so new insights can be processed and be added to the eventual design. In this case all the steps, interactions, pros and cons of the medical medical consultation in 2018 were composed. This was used as starting point for the design of the consulting room in 2030 and statements that were used in the online questionnaire of round 2 and 3.

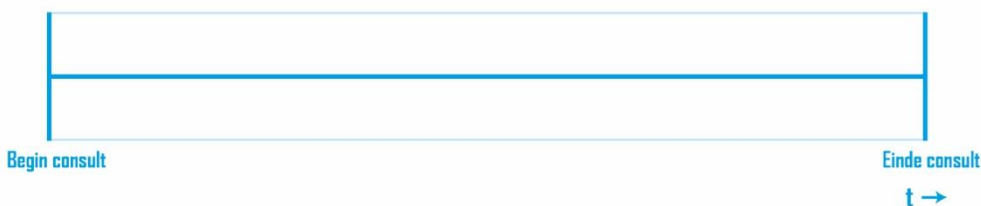
In co-creation session 1 the medical consultation timeline of 20318 was evaluated with this tool below. Each step, interaction, pros and cons, and objectives were composed by the research group on the basis of the questions of the tool. They needed to compose the steps that were taken by each point of view (patient and physician).

Tijdlijn van een consult



1. Plaats activiteiten, interacties en handelingen tijdens een consult op de tijdlijn
2. Benoem de positieve en negatieve punten
3. Identificeer de meest interessante activiteiten/interacties
4. Op welke manier kunnen deze punten in de toekomst verbeterd worden?
5. Wat zijn, aan de hand van het opgestelde consult, de doelen van de spreekkamer?

Activiteiten



Appendix 5: Co-creation session 2

The co-creation session 2 is a design process where the eventual users of a product or service are given the opportunity to design with supervision of the designer, so new insights can be processed and be added to the eventual design. In this case all the steps, interactions, pros and cons of the medical medical consultation in 2030 were evaluated. This was used as the endpoint of this research whereby a vision of the medical consultation in 2030 was formed and recommendations to the Erasmus MC. Findings regarding

medical innovations that could apply to the consulting room 2030 were shared in co-creation session 2.

Each step was tested separately by the expert from every point of view in the consulting room (medical coach, patient and physician).

In co-creation session 2 the medical consultation timeline of 2030 was evaluated with this tool below. Each step was tested separately by the expert panel on the basis of the questions of the tool. They needed to see that were taken by every point of view (medical coach, patient and physician).

Stap # : Titel : Omschrijving: Omschrijving van de stap en wat er hier grofweg plaatsvindt.				
Regels: <ul style="list-style-type: none"> Schrijf de reden voor het ondernemen van een stap per persoon of coach op (Reden?), Motivatie (Waarom?) en resultaten voor de betrokken personages op de corresponderende kleur post its, en plak deze in de juiste kolom. Benoem, indien mogelijk, 3 positieve en 3 negatieve punten aan de hand van het tot nu toe opgestelde blad Verzin 1 tot 3 aanpassingen om aangekaarte voordelen te benutten en/of verzin 1-3 aanpassingen om aangekaarte nadelen te verhelpen 				
Wat te doen?	Waarom?	Resultaat:	Commentaar:	Aanpassingen?
Patient Arts Gezondheidscoach <small>Geef een korte omschrijving van de handelingen die de verschillende actoren uitvoeren.</small>	Patient Arts Gezondheidscoach	Patient Arts Gezondheidscoach	Patient Arts Gezondheidscoach	Patient Arts Gezondheidscoach

Appendix 6: overview insights expert interviews

This appendix shows an overview of the insights that were collected with the interviews that were held with members of

the expert panel as preparation for the Delphi study. Each blue cube represents an expert interview within its most important insight. The legend shows which expertise are connected.

- Sociaal/Empathisch
- Technisch
- Financieel
- Regelgeving

Inzichten

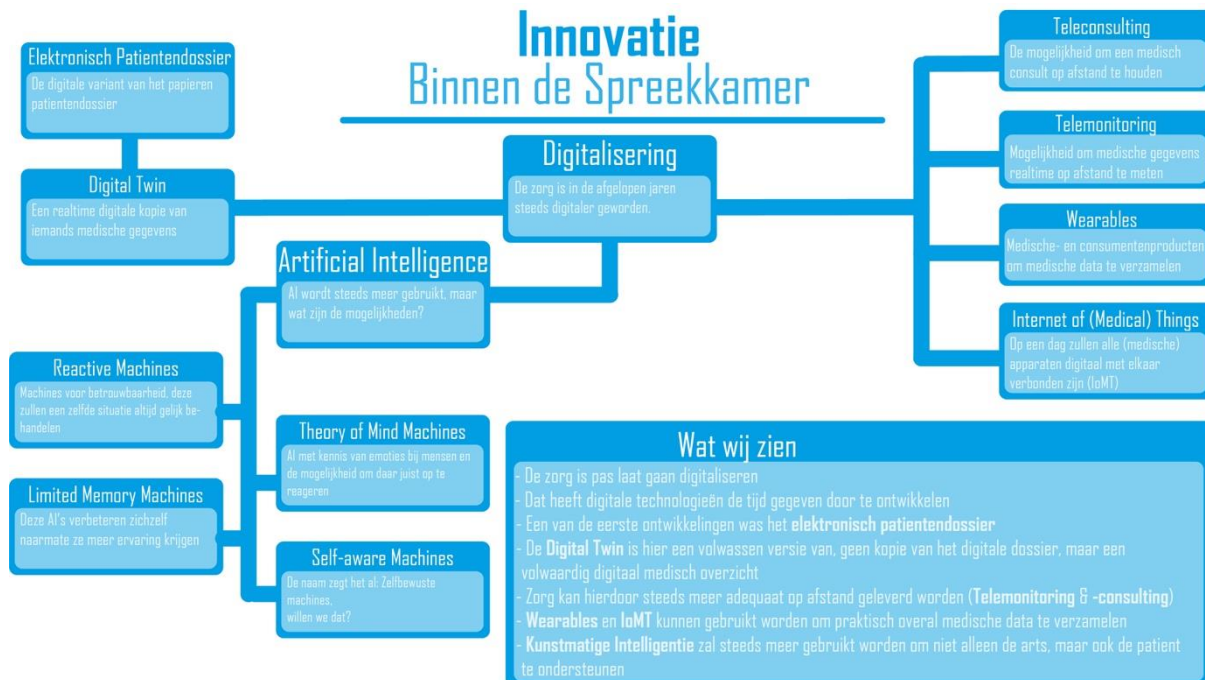
Verzameld uit expertinterviews



Appendix 7: Overview medical innovations

This appendix shows an overview of the medical innovations that were collected during this study. Digitization was the most important aspect which contained

all the medical innovations for the medical consultation in 2030. The lines show the connection between the medical innovations.



Ideation Clustering

appendix 9 *Clusters created when looking for search areas.*

Probleem en oplossing

Bevindingen

1. Verbinding met de TU Delft om in de geneeskundeopleiding de omgang met medische innovatie een criterium is, waarbij er een onderscheid gemaakt wordt tussen het meer holistisch en technisch redeneren
2. Zorg bevindt zich in een taakoverschikkingsproces met een toename van techniek en innovatie als aanvullende elementen, waarbij zorg zo groot wordt dat techniek en innovatie nodig zijn om overzicht te kunnen behouden.

Bewijs

- 22, 28, 63, 93-96, 107, 109, 110, 112, 115-118, 135
93. Hoe vang je optimaal de fenomenologie en heuristische manier van redeneren binnen de geneeskunde op door een manier van denken die meer geënt is op daadwerkelijk begrijpen wat er aan de hand is?
96. Klinische technici worden opgeleid om te leren klinisch redeneren, maar ook om op een deterministische manier te denken
107. Maak onderscheid tussen een holistische en meer technische aanpak.

Search Area

Techniek die geïntroduceerd wordt moet de grootte van een medisch team constant of gelijk houden.

Probleem, geen oplossing

Bevindingen

1. Het consult is de plek waar alles samenkomt op het gebied van zorg
2. Hierdoor is het nodig om alles, of in ieder geval heel veel, van de zorg te weten om een goed consult op te zetten
3. Wanneer je het consult veranderd, moet het totale zorgsysteem daarop aangepast worden voor het beste resultaat

Bewijs

- 77, 78, 82, 86, 88, 110, 111, 113, 131
88. Het gevaar bij dit project is waarschijnlijk dat de startvraag niet goed geformuleerd is. Het gaat niet om de spreekkamer van de toekomst en de technologie die daarbinnen past, maar het consult van de toekomst en hoe dat zo optimaal mogelijk ingericht kan worden.
113. Project van spreekkamer 2030 opgezet om een focuspunt te creëren op de toekomst van veraf.
131. Healthcare in 2030: more preventive, personalized, chronic disease management (post-operative, elderly, cancer no chronic. Private cloud. Blockchain plays a rol.

Search Area

Waar willen we met de zorg naartoe?

Regels

Bevindingen

1. Alle (grote) organen die te maken hebben met zorgkosten moeten gaan samenwerken én investeren om zorg te verbeteren en zorgkosten te verlagen
2. Zorghervorming moet MedTech bedrijven meenemen

Bewijs

- 29, 31-33, 35, 54, 55, 58, 61, 64-66, 69, 92, 101, 103, 125, 144
32. Zorg werkt in Silo's in de zorg. Artsen is gefocussed op biomedische data uitkomsten. Terwijl dit voor de patiënt niet hoeft te betekenen dat hij zich beter hoeft te voelen.
35. Streven naar beste uitkomsten die voor patiënten relevant zijn vs. kosten van een behandeling
61. Shared savings, samenwerking met zorginstellingen en verzekeraars als Erasmus MC op basis van waardegedreven zorg. Nog geen sprake van continue zorg waardoor veel preventie. Spreekkamer is er helemaal niet meer. Spreekkamerfunctie blijft er altijd.

Search Area

Fair Medicine
Organen die zorgkosten maken moeten samen een platform ontwikkelen om nieuwere, goedkopere en innovatieve technieken ontwikkelen en testen

Regels

Bevindingen

1. Privacy is momenteel nog een probleem omdat veel mensen bang zijn dat er misbruik gemaakt zal worden van hun data

Bewijs

- 19-21, 23, 24, 27, 47, 71, 90, 105, 124, 127, 128
21. Verantwoordelijkheid zal juridisch niet zoveel problemen opleveren, ligt vooral aan het goed vastleggen van de contracten.
27. Digitalisering in de zorg is onvermijdelijk, maar privacy moet gegarandeerd blijven en dat lijkt best lastig. Kan behoorlijk lastig worden als alle biomedische data van de patiënt op straat ligt en derde partijen druk kunnen uitvoeren op de keuzes van de patiënt. Patiënt moet zelf kunnen beschikken over de data die hij deelt en de arts moet een milieu creëren dat de patiënt geen reden ziet om dit niet te doen.
124. Patiënt is flexibel.

Search Area

Draai het daarom om, kijk niet naar hoe ziek of gezond iemand is, maar kijk naar de stappen die iemand zet om gezonder te blijven of worden
(Kijk hiervoor naar de hardlooppapp STRAVA)

Ideation Clustering

Probleem

Bevindingen

1. Techniek die kan zorgen voor zorg op afstand is een gegeven feit in de toekomst. Hierbij moet gelat worden op behoud van de kwaliteit van de fysieke ruimte.
2. Waar medische gegevens verzameld worden veranderd, maar de kennis om die gegevens te interpreteren ligt nog steeds bij de arts.

Bewijs

12-14, 26, 46, 61, 62, 83, 139, 142, 143, 149

12. Fysieke spreekkamer nog noodzakelijk omdat non-verbale communicatie kan worden opgepikt door de arts. Verschilt sterk per ziekte en de ernst daarvan.
46. Bij elkaar brengen van gegevens< puur medisch, wearables maar ook wat de patiënt vooral vindt en dat mooi geïntegreerd.
62. Hartwacht: patiënten zelf dingen opmeten, gegevens bij wijkverpleeging. Patiënt heeft nu meer zelf in de hand. Lijkt op dat stukje van de dutch design week met het onderzoek.

Search Area

?

Regels

Bevindingen

1. Deze cluster is een collectie met eigenschappen waar het consult in de toekomst aan moet voldoen

Bewijs

1, 36, 38, 39, 41-43, 45, 50, 57, 72, 73, 79, 80, 100, 106, 121-123, 133, 134, 137, 138, 145-148

1. Andere manier om met een patiënt in gesprek te gaan, los van een fysieke ruimte.
36. Tijdens een consult is er geen tijd voor het verhaal van de patiënt.
57. Er wordt te weinig naar de patiënt journey gekeken.
73. Patiënt is vaak niet zo goed voorbereid als gedacht, oorzaak hiervan ligt zowel bij patiënt als medisch personeel.

Search Area

Richtlijnen en eisen voor het consult in 2030

Regels

Bevindingen

1. Ethische Artificial Intelligence richtlijnen

Bewijs

84, 87, 104, 114, 120, 126, 129, 130, 140, 141

84. Al die dit faciliteert kan een rol krijgen binnen de gezondheidszorg
87. Gevaar zit in vooral in het feit dat technologie ondoordacht gebruikt wordt, waardoor het niet werkt. Dit kan er uiteindelijk toe leiden dat het qua privacy niet werkt, het niet gebruikt wordt door de patiënt of dat het de werkdruk van de arts alleen maar verhoogt.
114. Medical assistants/medical buddy: goed plan, pas op voor de mogelijk nadelige effecten. Dit is precies hoe een academisch ziekenhuis het zou willen wat betreft zorgleveren.

Search Area

Richtlijnen om overige problemen met behulp van Artificial Intelligence op te lossen

Oplossingen

Bevindingen

1. Ontbrekende factoren voor continue zorg en empathie
2. Het consult is het startpunt van de zorg

Bewijs

25, 30, 40, 49, 51-53, 59, 60, 89, 97-99, 102, 108

51. I behandelpjan
52. I management team
53. I betaling (met verpleeghuizen bijv. nog niet met huisartsen of fysio's
30. Patiënten belang is in de afgelopen jaren steeds meer op de voorgrond gekomen
99. Er moet minstens een iemand zijn die naast de patiënt staat om als het ware de coördinatie tussen de verschillende specialismen te dragen

Search Area

Medical Health Assistant/coach
1. Digitale coach
2. Medische 'cabine'
3. Robot met menselijke/empathische eigenschappen

Het gesprek - intern

Bevindingen

1. Informatieverwerking en -overdracht werkt momenteel nog niet goed. Dit is heel belemmerend
2. Tast en geur zijn geen onderdeel van intuïtie

Bewijs

2-11, 34, 47

12. Fysieke spreekkamer nog noodzakelijk omdat non-verbale communicatie kan worden opgepikt door de arts. Verschilt sterk per ziekte en de ernst daarvan.
46. Bij elkaar brengen van gegevens< puur medisch, wearables maar ook wat de patiënt vooral vindt en dat mooi geïntegreerd.
62. Hartwacht: patiënten zelf dingen opmeten, gegevens bij wijkverpleeging. Patiënt heeft nu meer zelf in de hand. Lijkt op dat stukje van de dutch design week met het onderzoek.

Search Area(s)

Verbeter EPD
Zoek naar voorbeelden in de commerciële wereld:
FB, UI van computerspellen
Tekstloze dataopslag
Visuele dataoverdracht
Auditieve dataoverdracht

Het gesprek - extern

Bevindingen

1. Er is geen gezamenlijke taal voor arts en patiënt om mee te communiceren.
2. Dit zorgt voor veel onbegrip tussen arts en patiënt
3. Het is moeilijk voor de patiënt om beslissingen te nemen als deze de gevolgen niet kan overzien. Dit maakt het ook lastig voor de patiënt om vragen te stellen

Bewijs





44, 48, 70, 74-76, 91, 136

44. Soms laten mensen hun arts nu een belangrijke keuze maken omdat ze de arts toch niet begrijpen.
75. "Het doel is dat je het gesprek verbeterd! Niet de spreekkamer."
91. Pas de manier van communicatie aan op je doelgroep
136. Mismatch ontstaat omdat de patiënt niet weet wat er mogelijk is en vaak een verkeerd verwachtingen. We leven ook in een consumptiemaatschappij en dat draagt niet bij aan het beeld wat de patiënt heeft.

Search Area














Een nieuwe taal of manier om te communiceren voor arts en patiënt

appendix 10 *Overview insights expert interviews*

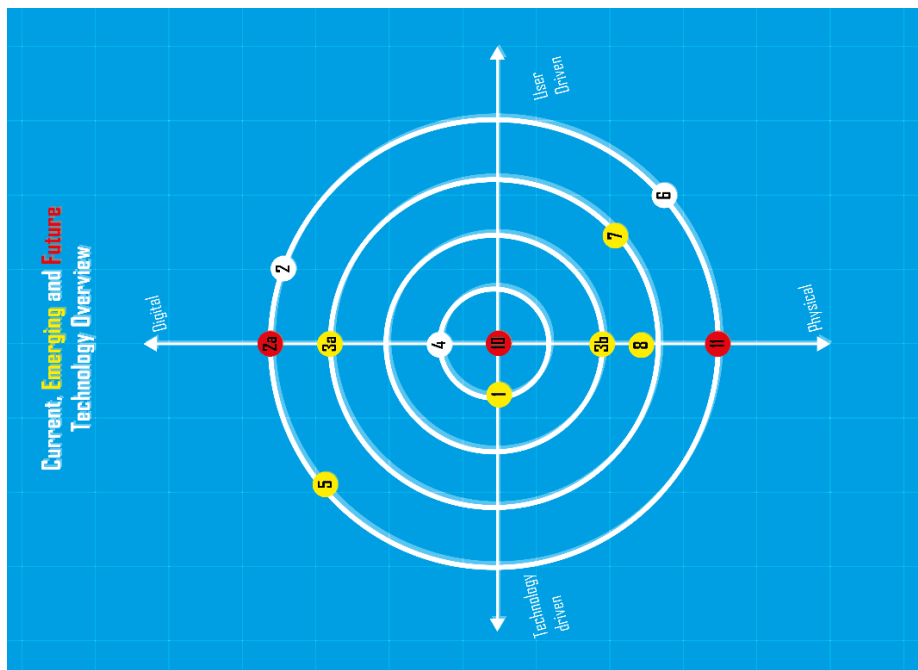
-  Sociaal/Empathisch
-  Technisch
-  Financieel
-  Regelgeving

Inzichten

Verzameld uit expertinterviews

 <p>Interaction Designer Innovatie binnen de spreekkamer moet interactie bevorderen</p>	 <p>MedTech Bedrijven Deze zijn vooral bezig met het ontwikkelen van dingen als teleconsulting, -monitoring en wearables als het om de spreekkamer gaat</p>	 <p>Klinisch Technoloog Klinische technologie is een onvervrijd vakgebied over kennis en kunde van techniek binnen de medische zorg van de toekomst</p>
 <p>Medisch Psycholoog Om informatieverdracht en medische interventies goed te laten verlopen is er empathie nodig. Dit kan gefaciliteerd worden door een vertrouwensband op te bouwen tussen arts en patient.</p>	 <p>Zorginkoper Samenwerking is essentieel om de zorg te verbeteren. Op basis van waardegereven zorg, shared savings en samenwerking met diverse zorginstellingen kan de beste zorg worden bereikt en de beste medische innovaties haalbaar en betaalbaar worden</p>	 <p>Politiek In een volgend project moeten er ook beleidsmedewerkers van het ministerie van volksgezondheid geïnterviewd worden over hun visie op de toekomst van de zorg</p>
 <p>Medisch Ethicus Er moet voor gewaakt worden dat het persoonlijke aspect in de spreekkamer niet verloren gaat door innovatie.</p>	 <p>Patiënten Patient is meer betrokken en geïnformeerd bij zijn zorgtraject, maar wil zich nog steeds geleid voelen worden binnen dit traject door een arts</p>	 <p>Verzekeraar De zorg van de toekomst kan betaalbaar worden gehouden door alle betrokkenen samen te laten investeren in een betere toekomst voor de patient. Er mogen nooit sancties voor patienten worden opgelegd.</p>
 <p>Arts/Specialist Interactie moet worden verbeterd door vermindering van informatieverwerking, en hulpmiddelen moeten dienen om dit op te vangen</p>	 <p>Value based Healthcare In de toekomst zal waardegereven zorg worden bedreven. De waarde wordt bepaald in de spreekkamer met de arts door te kijken naar de individuele patient en de complexiteit van de ziekte</p>	 <p>Jurist Privacy in de spreekkamer moet gegarandeerd worden, ondanks het feit dat de wereld steeds transparanter wordt</p>
 <p>Onderwijs De opleiding moet studenten aanleren flexibel om te gaan met medische innovaties en complexe situaties binnen het continue veranderende vakgebied</p>		

Bijlage 2: Overzicht technologische innovaties:



#	Name	Explanation
Administratief		
1	Personalisation	Personalised treatment based on DNA
2	Electronical Patient Files	Digital version of paper patient files
A	Digital Twin	Realtime digital copy of your medical data
Beeldvormingstechnieken		
3 A	Seeing	Augmented-/virtual Reality, Non-invasive imaging
B	Displaying	New Display Types, Holographs
Telecare		
4	Mobile care	Telemonitoring, Wearables, Implantables, Consumables and more
Analyzing		
5	Data Analysis	Bio-Composition scanner, Artificial Intelligence
Other		
6	Rituals	Tiger Penis Project
7	Participatory care	CareB&B, Design for Flies
8	Activating furniture	Smart Furniture sensor
9	Not-relevant for consult	Bio-manufacturing, Crispr-Cas
Mobile networks		
10	5G	20Gb/s internet speed, Internet of Things, Improved privacy
Robotica		
11	Robotics	Care robots, Operating robots,

Current technologies, Emerging technologies < 2 years, Future technologies > 2 years

Overzicht Tijdlijn Consult 2019

Vervolgafspraken van patiënt en/of arts **22.**

Informatie aan patiënt meegeven **21.**

Informatie invoeren, status uitschrijven + administratieve afhandeling **20.**

Behandeling (medische interventie) uitleggen en/of uitvoeren **19.**

Samenvatten + vervolgtraject bespreken inclusief verwachtingsmanagement van de patiënt **18.**

Informatie samenbrengen, opstellen DD (differentiaaldiagnose) en werkdiagnose **17.**

Moment tot nadenken voor de zorgverlener om klinisch te redeneren en vervolgstappen te bedenken **16.**

Aanvullend onderzoek **15.**

Lichamelijk onderzoek **14.**

Evt. opzoeken aanvullende informatie door de arts **13.**

Verdiepende vragen worden gesteld **12. 13. 14. 15. 16. 17. 18. 19. 20. 21. 22.**



1. 2. 3. 4. 5. 6. 7. 8. 9. 10. 11. Hulpvraag moet zo volledig mogelijk in beeld worden gebracht

10. De arts start anamnese

9. De patiënt vertelt zijn eigen informatie

8. Voorstellen en social talk

7. De arts haalt de patiënt op

6. De arts kijkt op de computer welke informatie beschikbaar is over de patiënt

5. De patiënt meldt zich aan en gaat zitten in de wachtkamer tot de arts beschikbaar is voor het consult

4. De patiënt heeft vooraf informatie ingewonnen en bedacht welke informatie hij gaat geven aan de arts

3. Er wordt een afspraak gemaakt

2. Er vindt een triage plaats om te bepalen wat de ernst is van de hulpvraag

1. De patiënt legt contact met de zorg door de behoefte aan medische hulp

Probleemstelling van de zorg

Bevindingen

In de komende 10 jaar zal er veel veranderen. Niet alleen binnen de zorg, maar binnen de maatschappij in het algemeen. Dit roept vragen op die wij niet kunnen beantwoorden, omdat wij hier (nog) niet de expertise voor hebben.

Bij het vormgeven van het consult van 2030 moet er rekening gehouden worden met een continue veranderend zorglandschap en het snelle opkomen van medische innovaties

Spreekkamer 2019

Zorg 2030 + Medische innovaties
Consult 2030

Consult 2019 ≠ Consult 2030
Fysiek + Fysiek + Digitaal

Wat is het doel van de spreekkamer?

Hoofddoel:

Zorgconnectie bieden voor de volgende 3 subdoelen.

3 Doelen van het consult in 2019

1. Empathisch zorgaspect
2. Informatieoverdracht
3. Medische interventies

Doel van het consult in 2030

Doelen consult 2019

+

Arts en patient bij elkaar brengen met hetzelfde doel

Zorgconnectie

=
Bij elkaar brengen

=
Contact met zorg

Visie

77, 110, 111

Het gaat niet om de ideale (spreek)kamer, maar om het ideale gesprek. Dit kan gefaciliteerd worden door arts en patient de mogelijkheid te geven zich puur op het gesprek te richten en (administratieve) ruis te verminderen. Menselijk contact binnen de zorg blijft essentieel. Het is essentieel om een empathische band op te kunnen bouwen tussen arts en patient, maar ook een vereiste om de intuïtie van de arts tot zijn recht te laten komen.

Design Brief

Overbrug de informatiebarriere rondom het consult om arts en patient dichter bij elkaar te brengen

Design Brief

Overbrug de informatiebarriere rondom het consult om arts en patient dichter bij elkaar te brengen

Onderscheidende eigenschap: Het **dichter bij elkaar brengen** van arts en patient.

Categorie-omschrijving: Het gaat hier om **het totale consult**. Vanaf het moment dat de patient informatie gaat verzamelen tot na het moment dat de arts klaar is met zijn of haar administratieve werkzaamheden betreffende het consult.

Doelgroep: De doelgroep bestaat uit zowel de **Arts en Patient**. Het gaat om de communicatie tussen deze twee belanghebbenden, maar ook over de **communicatie tussen artsen**.

Overbruggen: Door de informatiebarriere tussen arts en patient te **overbruggen** kan de tijd voor het gesprek tijdens een consult veel beter benut worden. De arts beleeft meer werkplezier, patient voelt zich gehoord, en de vertrouwensband, en daarmee empathie, kan ook sneller opgebouwd worden.

Regels & Richtlijnen

- **Regels en Richtlijnen voor het zorgsysteem van 2030**
- **Regels en Richtlijnen voor het consult van 2030**

Belangrijkste bevindingen

- Investering in zorg en de verbetering van zorg en medische innovatie kan alleen slagen met samenwerking (shared savings)
- Patienten kunnen veel data verzamelen, maar overheid moet bepalen hoe hiermee om te gaan, en hoe bedrijven om moeten gaan met biomedische data
- De politiek moet een sturende rol innemen en vooroplopen met regelgeving op het gebied van zorg en integratie van medische innovaties en medtech bedrijven. Innovatie gaat namelijk steeds sneller en er moet van tevoren over de consequenties nagedacht worden

Search areas

Oplossingen

1	<p>Fair Medicine Organen die zorgkosten maken moeten samen een platform ontwikkelen om nieuwere, goedkopere en innovatieve technieken te ontwikkelen en testen</p> <p>Zorgplatform Een platform waarop alle partijen binnen de medische sector, dus ook medtech-bedrijven bij elkaar kan komen om te zoeken naar de beste, goedkoopste, innovatieve oplossingen</p> <p>Resultaat - Ontwikkel een zorgplatform om samenwerking tussen zorginstellingen te versimpelen</p>
2	<p>Pre- en Post-consult Zorg in de thuisituatie</p> <p>Betere zorgconnecties Met behulp van toepassingen en producten zoals de thuisarts, careBnB, Alexa en zorgrobots zal de connectie tussen patient en zorg beter onderhouden kunnen worden</p> <p>Resultaat - A.I. als nieuwe zorgconnectie - Patient wordt eigen heelmeeester</p>
3	<p>Tijdens het consult Toepassingen die tijdens het consult gebruikt kunnen worden</p> <p>Verbeterde communicatie Dataopslag en -overdracht voor tijdens en na het consult is vaak inefficiënt. Verbeter de communicatie m.b.v: A.I. visuele/tekstloze dataopslag en gepersonaliseerde communicatie</p> <p>Resultaat - EPD/Digital Twin in Hologramvorm - Visualiseren via hologrammen - Behandelplan visueel opstellen en uitleggen</p>
4	<p>Search Area Techniek die geïntroduceerd wordt, mag geen extra werkdruk op medische teams leggen</p> <p>Doelgerichte innovatie Innovatie is alleen nuttig als het de gebruiker ondersteunt. Probeer innovaties te vinden die een doel dienen</p> <p>Resultaat - A.I. als assistent van de arts - A.I. als triagesysteem - A.I. als hub voor de patient</p>
5	<p>Privacy Kijk naar de stappen die iemand zet om gezond(er) te blijven en/of worden</p> <p>Draai het om Momenteel is privacy nog een gevoelig onderwerp, zeker wanneer het gaat om persoonsgegevens binnen de gezondheidszorg. Wat gebeurt er wanneer je anders naar gezondheid kijkt?</p> <p>Resultaat - Een persoonlijk platform waarop je je 'fritheid' bij kunt houden</p>

appendix 14 Design Brief and Search areas for creating a new patient journey