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Increasing adherence through mhealth device: a feasibility study design

J.A Jackson
j.a.jackson@students.uu.nl

Master Business Informatics, Utrecht Univeristy
Department of Information and Computing Sciences
Princetonplein 5, 3584 CC Utrecht

Supervisors
Dr. M.R Spruit
Dr. R. Batenburg

Universiteit Utrecht

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1. Introduction

Asthma and chronic obstructive pulmonary disease (COPD) are both chronic airway diseases that have a significant impact on patients health (Chung et al., 2002). Symptoms that are common among COPD and asthma patients are poor airflow and abnormal inflammatory changes in the respiratory tract. Exacerbations which is defined as the sudden worsening of symptoms such as an infection is also common symptom among asthma and COPD patients. Exacerbation is a very important symptom as it significantly influences the patient's life in an adverse way (GOLD Report 2014). Exacerbations are a significant cause of hospital admission and readmission. This places an extensive burden on the healthcare sector (GOLD Report 2014). Inhaled bronchodilators are used to treat exacerbations. Correct utilization and proper adherence of inhalation devices are key factors in the successful treatment of COPD patients. Unfortunately recognizing poor adherence is a difficult task for physicians, furthermore poor adherence can substantially worsen a disease (Osterberg & Blaschke, 2005).

The most recent statistics from 2011 indicate that approximately 477.400 people in the Netherlands have asthma. Figure 1 shows a diagram of patients with asthma ordered by age and gender.

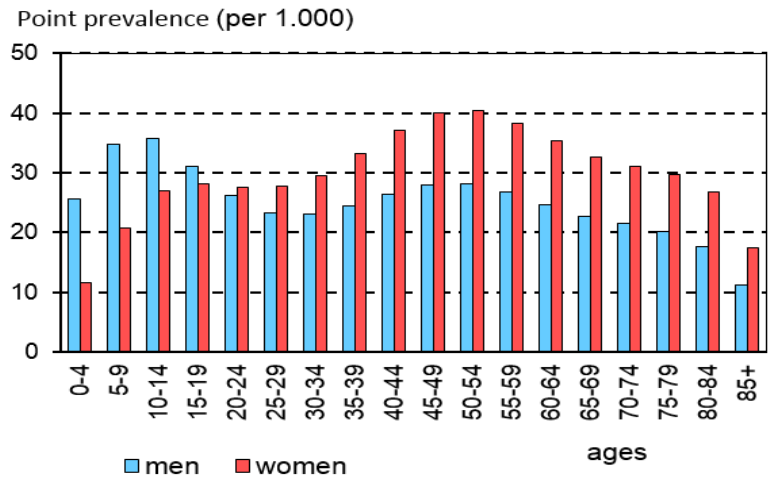


Figure 1 Point Prevalence on 1-1-2011 asthma by age and gender Source LINH; data processed by TIVM

In 2011, approximately 361.800 people in the Netherlands have COPD. COPD occurs mainly in people aged 55 and older, and the prevalence increases with age (see Figure 1).

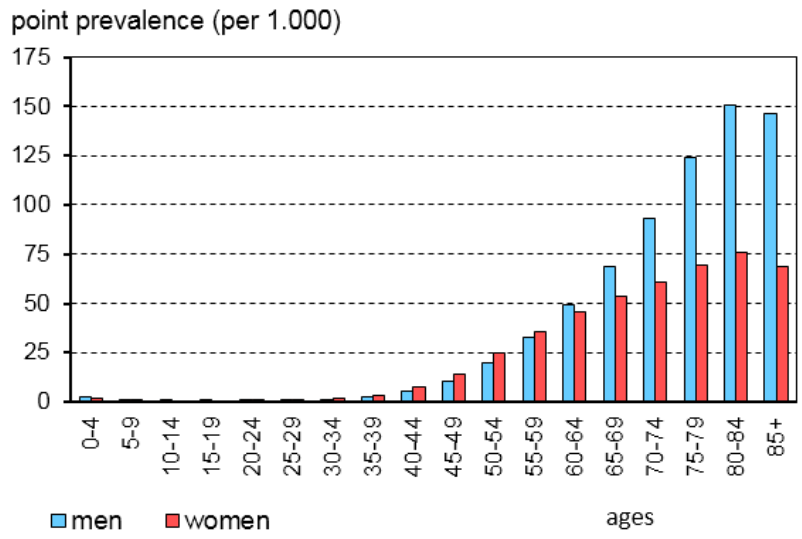


Figure 2 Point Prevalence on 1-1-2011 COPD by age and gender Source LINH; data processed by TIVM

Recently AstraZenaca ® developed a mhealth device named Turbu+ ® for patients with COPD and Asthma.

Turbu+ is a mhealth program made for patient with COPD or Asthma. It helps to gain an understanding of the number of inhalations taken daily and over time. Turbu+ aims to increase adherence of COPD and Asthma patients. It's a device made for patient use. It assists in the remembering of the number of required inhalations per day. It also provides a way to contact you healthcare provider. Additionally it provides patients with tips on how to manage their asthma or COPD. According to the classification by Free et al (2010), the Turbu+ application can be described as medication adherence intervention for patients.

The Turbu+ program consist of four components:

1 Patients Symbicort Turbuhaler

2. An electronic bluetooth device "Turbu+"connected to the Turbuhaler

3. A corresponding app available on Android or Iphone

4. A website www.Turbu+.nl

The following functions are part of the service that Turbu+ ® provides.

It automatically detects whether the patient has correctly performed the initial rotation of the base of the Turbuhaler ®.

It then transmits the data to a central server using the patient's own mobile device that is connected by Bluetooth to the Turbu+® device.

If the patient begins to use Turbuhaler ® more often than was prescribed the system has the ability to prompt additional actions from both the patient and their health care provider.

Reminder functionality to support adherence of the patient's maintenance therapy.

The University Medical Center Utrecht (UMCUU) is one of the largest Dutch hospitals. Within the UMCU the TAilored Self-management & E-health (TASTE) research group focuses on researching self-management and how technology can facilitate self-management within patient groups. Turbu+ aids patient in self-management of their medication use. The TASTE research group are researching the feasibility of Turbu+. A feasibility study will enable the UMCU to assess whether or not Turbu+ is a meaningful and sustainable device ready for routine use Slade Thornicroft & Glover (1999). Adherence to medication is crucial for optimal treatment of COPD. Nonadherence can greatly impair patient's health and has significant economic effects on society. Turbo+ can possibly provide a solution for improving adherence. Currently there are no electronic monitors available for COPD inhalers. Questions remain as to whether mhealth can increase adherence among patients. The following questions are yet to be answered. Can a mhealth device effectively increase adherence? How can we measure the effectiveness? What is the feasibility? This strengthens the necessity for this feasibility study.

Additionally Lareau & Yawn (2010) state that there is a need to investigate the feasibility of electronic monitors for inhalers. However, no clear feasibility method for mhealth applications or devices seems to exist at this moment. The objective of this research is to develop a method to research the feasibility of mhealth applications, and research the usability of the device Turbocheck. The findings of this study will present information that can be used by future researchers.

Primary Objective

The primary objective of the study will be to investigate what how a feasibility study can be designed for different mhealth interventions specifically for mhealth COPD and astma-oriented interventions

Main Research question.

How can a feasibility study be designed for mhealth interventions, specifically for mhealth COPD and asthma oriented interventions aimed at increasing adherence?

Sub Questions

First step is to identify and define what adherence is and how this can be measured.

1. *What is known about Astma and COPD*
2. *What is the definition of mhealth and adherence?*
3. *What is known about mhealth and its effects on adherence*

Next step is to define the different concepts and assessment criteria's of a feasibility study

4. *What types of feasibility studies currently exist?*
5. *What are their main characteristics or properties?*
6. *Which properties and characteristics are relevant for the feasibility design of mhealth applications such as Turbu+?*

Last step is to form a conclusion and recommendation

7. *What can be concluded and what are the next steps?*

2. Research Approach

The following section will present the research method used for this study. It will include the overall design of the study and methods used to answer the research questions.

2.1 Research Method

In order to answer our research questions we will use the design science methodology. Design science aims to apply knowledge of tasks or situations in order to create effective artifacts (March & Smith, 1995)."

There are several steps within design science. The following steps are described by Vaishnavi and Kuchler (2004). The first step is done to provide a basis for a scientific validated instrument. This step is also called the suggestion step. The following step is to design a first version of the instrument based on information gathered in the first step. The third step is to evaluate the instrument. And lastly the conclusion step the whole project will be evaluated within this step

The steps within this research can be viewed in Figure 3

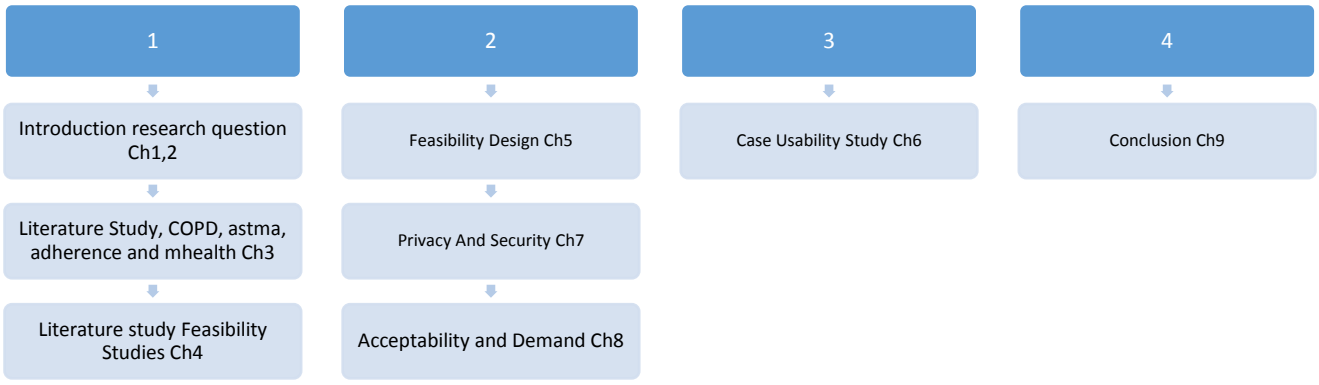


Figure 3 Research steps based on design science

2.2 Structure of this document

This thesis is structured as follows. Chapter 3 and 4 will provide a theoretical framework for determining the main design properties and characteristics for the feasibility of a mhealth device for COPD and asthma patients. The primary goal of this study is to examine literature that is relevant to our set of research questions. We will operationalize this in the chapter 5 which will describe the research design. Furthermore, we will construct a conceptual model based on the concepts derived from the literature study. This model will form the basis of the feasibility study design.

2.3 Literature Study

A literature study has been executed in order to gain insight about asthma, COPD, feasibility studies and adherence. Goal is to form a feasibility design with which one can determine the feasibility of mhealth applications for increasing adherence among COPD and asthma. A literature review study will allow us to identify, evaluate and interpret all available research relevant to our research questions (Kitchenham & Charters, 2007, p.3). The snowballing method was used within this literature study. The snowballing method consists of three steps (Webster & Watson, 2002). The first step is to gain a set of starting papers. Secondly, the articles included in the reference lists of the relevant articles found in step one are reviewed. Lastly, all articles that cite an article found in step one or two are reviewed.

For creating the starting set of papers, the following keywords were used: 'Mhealth, 'adherence', 'COPD, 'Feasibility, 'Feasibility mobile health', 'adherence COPD' 'adherence asthma', 'mhealth adherence'. Alternative writing forms of these keywords were also used (e.g. 'mobile health')

Databases
This literature is restricted to the search engines Google Scholar and PubMed. Keywords and search strings were constructed based on the main research question and its related sub questions. Search strings focused on mobile health, m-health, feasibility, adherence, compliance, COPD, Chronic Obstructive Pulmonary Disease and asthma.

Paper Selection criteria
Articles found after screening were stored in a folder and was then uploaded to the reference manager Mendeley. Articles that were found not eligible were removed from the folder and from Mendeley. Articles were found not applicable whenever their subject was out of scope of this research.

2.4 Other Research Methods

Usability study
During the literature study usability was identified as a key aspect of a feasibility study. We have been given the opportunity to perform a usability study on the mhealth app Turbu + for COPD and asthma patients. A detailed description of methods used during the usability study can be found in Chapter 6.

3. Literature Study on COPD, asthma, adherence and mhealth

The following section will present the findings of the literature study. The sections within this chapter are dedicated to a following category: asthma and COPD, adherence and feasibility and mhealth.

3.1 Asthma & COPD

3.1.1 Bronchial Asthma

Asthma is a chronic inflammatory disorder of the airways. An important feature of asthma is the inflammatory processes in the airways this is associated with symptoms such as breathlessness, chest tightness and coughing at night or early in the morning. Symptoms are often triggered by an allergic reaction to perennial allergens including pollens, molds, animal allergens or domestic dust mites. The severity of the disease differs per patient and can range from intermittent, persistently mild, moderate or severe. The most recent statistics from 2011 indicate that approximately 477.400 people in the Netherlands have asthma. Figure 1 shows a diagram of patients with asthma ordered by age and gender.

3.1.2 COPD

Chronic Obstructive Pulmonary Disease (COPD) is as a preventable and treatable disease with significant extra pulmonary effects and is characterized by chronically poor airflow. In the most cases COPD occurs after many years of smoking. The more and the longer a person has smoked the greater the chance that he or she gets COPD. The GOLD directive has created criteria with which you can qualify and quantify COPD. Two values are determinative the forced expiratory volume in one second (FEV1) this value says something about the severity, and ratio between FEV1 and the Forced Vital Capacity (FVC) this value determines the level of obstruction. COPD has a large impact on patients' lives. They are required to make large scale differences in their lives ranging from adapting to a healthier life style and adhering to their treatment program. Self-management is a key part of treatment.

3.1.3 Differences Asthma and COPD

Asthma and COPD both feature a central bronchial obstruction. However, the pathophysiology of airway obstruction is different. In asthma the degree of hyper responsiveness and bronchial obstruction changes and hence the severity of the symptoms changes over time. The bronchial obstruction and hyper responsiveness are usually temporary and are depended on the degree of exposure to stimuli. In the case of COPD, the obstruction is almost continuously present in about the same degree. One way to distinguish asthma from COPD is the acute bronchodilator reversibility. Asthma has been characterized as an obstructive disease with bronchodilator reversibility while within COPD there is little bronchodilator reversibility. A bronchodilator is medication that relaxes the muscles in the lungs and widens the airways. There are two types of bronchodilators, short acting bronchodilators (SABA) and long acting bronchodilators (LABA). SABA's are mainly used when unexpected attacks of breathlessness occur. LABA's have long lasting effects and should be used regularly. It can help control breathlessness in asthma and COPD. Both Asthma and COPD are treated with bronchodilators. Research has shown that LABA's are and effective when applied to medium to long term patients with moderate severe COPD.

In 2011, the costs for asthma and COPD amounted to more than 1.5 billion euros. The cost of these diseases was 1.7% of the total cost of health care in the Netherlands, and 48% of the costs for all respiratory disease. The majority of the cost for asthma and COPD were made in the ages 60 to 90.

For COPD the prevalence in this age group is also the highest while for asthma it is roughly equal in all age groups.

3.2 Adherence

Adherence to treatment in COPD and asthma patients is essential for improving their disease management. Adherence has been defined as "the extent to which a person's behaviour (in terms of medications, following diets, or executing lifestyle changes) coincides with medical or health advice."(Haynes & Sackett, 1979). Unfortunately medication adherence is generally poor among COPD patients (Dolce et al., 1991; George, Kong, Thoman, & Stewart, 2005). Adherence is also problematic among asthma patients ranging from 30 to 70% (Bender, Milgrom & Rand 1997). According to the WHO in developed countries patient adherence to long term therapy in chronic diseases is around 50 % (Bourbeau & Bartlett, 2008).

Three types of nonadherence to therapy can be identified; overuse, underuse and improper use (Restrepo et al., 2008). Underuse has been defined as a reduction of daily use as opposed to the standard dose of medication that is indicated for treatment or prevention of a disease. Naturally this means that overuse is an increase of daily use as opposed to the standard dose of medication (Lipton et al 1992). Improver use is observed whenever a drug is used in an ineffective way, or whenever there is avoidable duplication of therapy (Steinman et al., 2006). Underuse is the most common type of nonadherence in patients with COPD followed by overuse and improper use of the medication delivering device(George et al., 2005; Restrepo et al., 2008).

Defining acceptable adherence however is a complicated issue. Currently there is no general agreement about the definitions of adequate or optimal adherence (Lareau & Yawn, 2010). Accurate assessment however is important for effective and efficient treatment. Adherence is commonly measured by accessing pharmacy records filling of dispensed prescription, manual recording of collected prescriptions, physician's estimate and patient self-report (Bourbeau & Bartlett, 2008; George et al., 2005). Studies have however shown that patient self-reports and clinical estimates are often unreliable (Bourbeau & Bartlett, 2008). Electronic monitoring can provide more accurate data medication use as it records the time and date when a medication container was opened. (Milgrom et al., 1996). For this research we will define non adherence for COPD patients whenever a patient overuses or underuses their prescribed medication. For Asthma patient's non-adherence will be defined whenever a patient overuses or underuses their prescribed medication and if a patient exceeds the maximum of extra inhalation allowed.

3.2.1 Factors influencing adherence

There are many factors that contribute to poor adherence in COPD patients. Poor adherence or nonadherence can be either intentional or non-intentional (George, Kong, & Stewart, 2007; Restrepo et al., 2008). According to Sabaté (2003) adherence is determined by five set of factors; patient related factors, health system factors, social economic related factors, therapy related factors and condition related factors. The following will shortly describe the five factors described by Sabaté (2003).

Patient Related factors

Patient related factors are factors that involve patient beliefs, perceptions, expectations, knowledge and resources of a patient. A patient perception of its disease has a major impact on their treatment adherence. Perception is a process by which individuals selects, organizes and interprets information inputs in order to give meaning to their environment (Robbins & Judge, 2003). When patients perceive that their daily health and activities are affected by their disease, their adherence

to treatment regimens are generally higher(Rapoff & Barlet, 2006) . This is also the case when they believe that non-adherence will have serious consequences. Furthermore, if patients perceive that their prescribed dosage is excessive, expensive or inconvenient they tend to have lower adherence rates. Patient knowledge, beliefs, and expectations about their decease also influence adherence behaviour. However, it is not fully understood in what way these factors interact with adherence behaviour.

A selection of patient related factors that are reported to effect adherence are : forgetfulness, psychosocial stress , anxieties about possible adverse effects, low motivation, inadequate knowledge and skill in managing the disease symptoms and treatment, lack of self-perceived need for treatment , lack of perceived effect of treatment , negative beliefs regarding the efficacy of the treatment, misunderstanding and non- acceptance of the disease, disbelief in the diagnosis , lack of perception of the health risk related to the disease, misunderstanding of treatment instructions, lack of acceptance of monitoring, low treatment expectations , low attendance at follow-up, or at counselling , hopelessness and negative feelings , frustration with health care providers , fear of dependence , Anxiety over the complexity of the drug regimen, and feeling stigmatized by the disease.

Social and economic factors

Low socioeconomic status can create a situation where patients have to choose between priorities such as caring for other family members. This is an example of a social en economic factor that can influence adherence. There are some social and economic factors that are more prevalent in developing countries. Nevertheless, there are many social and economic factors that have a significant effect on adherence. The following are factors social and economic factors that are known to have an negative effect on adherence (Sabaté , 2003): low level of education, unstable living conditions, poor socioeconomic status, poverty, illiteracy, low level of education, unemployment, lack of effective social support networks, unstable living conditions, long distance from treatment centre, high cost of transport, high cost of medication, culture and lay beliefs about illness and treatment, family dysfunction.

Health care team and system related factors

Although there is currently little research about the effects of health care team and system related factors on adherence. It is known that good relationship between patient and provider may improve adherence (Rose, Kim, Dennison, Hill, 2000). There are also factors have a negative effect. These include the following: poorly developed health services , non-existent reimbursement by health insurance plans , poor medication distribution systems, lack of knowledge and training for health care providers on managing chronic diseases, overworked health care providers, lack of incentives and feedback on performance, short consultations, weak capacity of the system to educate patients and provide follow-up, inability to establish community support and self-management capacity, lack of knowledge on adherence and of effective interventions.

Condition related factors

Condition related factors are factors that are related to a particular illness that can influence patient's risk perception and the importance of following treatment. A selection of strong

determinants are; level of disability (physical, psychological, social and vocational), rate of progression and severity of the disease, the availability of effective treatments.

Therapy related factors

Therapy related factors are factors are most commonly related to unique characteristics of diseases. Common factors are: complexity of the medical regimen, duration of treatment, previous treatment failures, frequent changes in treatment, the immediacy of beneficial effects, side-effects, the availability of medical support

3.3 Mhealth

Currently the definition of mhealth is still in development (Silberman & Clark, 2011). However, Silberman & Clark state that mhealth has three fundamental characteristics. It should be a device or a software that is health oriented and has mobile use. The wireless communication capability of mhealth applications allows for continuous interactive communication from any location (Free et al., 2010). Norris, Stockdale & Sharma (2009) state that the perceived benefits of mobile health is their portability, immediacy and convenience. They conclude that mhealth will soon become a crucial part of future healthcare. Mhealth has its roots in telemedicine which uses telecommunication to share medical knowledge over a distance. The concept of mobile health was introduced after the introduction of telephones and fax machine (Voskarides, Pattichis, & Istepanian, 2002). Wired communication technologies such as ISDN and POTS were used to implement telemedicine applications (Voskarides et al., 2002). At present 3G, 4G and Wi-Fi networks are used to facilitate the delivery of mobile health services (Escarfullet, Moore, Tucker, & Wei, 2012).

There are numerous of classifications with regard to mhealth applications. An elaborate classification can be found in Free et al. (2010) shown in Figure 7.

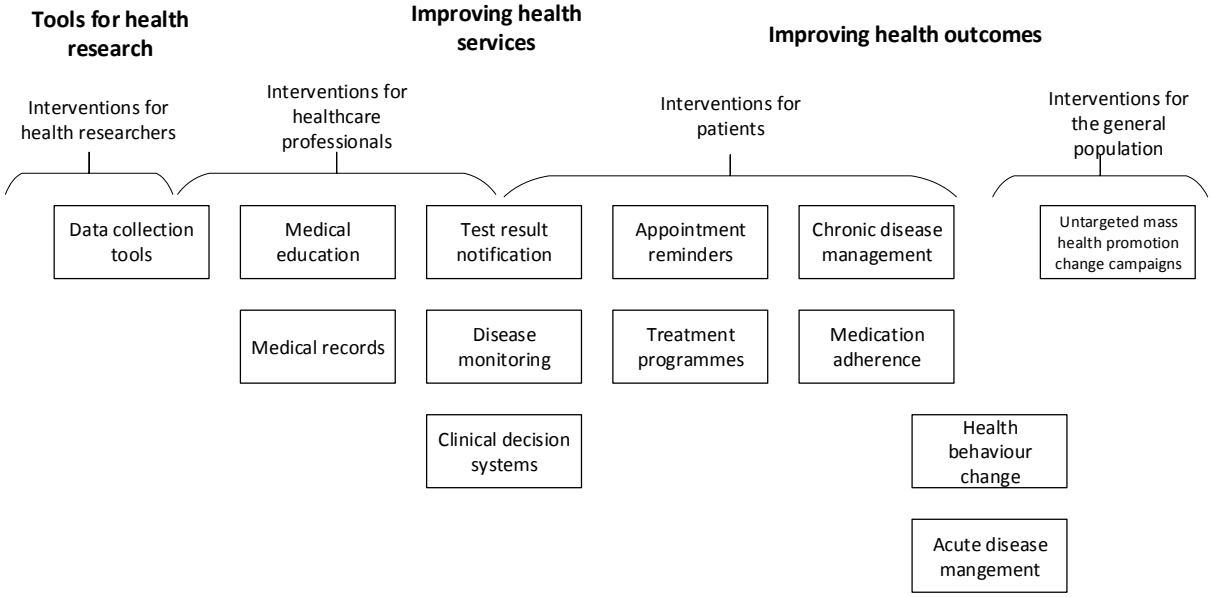


Figure 4 mhealth classification by Free et al (2010)

The classification was constructed after a systematic literature review by the authors. Classifications are based on high level function of the application. Distinctions are made between health researchers, healthcare professionals, patients and the general population. Applications are ordered by health research, health services and health outcomes.

There are various mhealth application available that are focused on increasing adherence. Examples are medication adherence measurement system(mAMS), which is used to measure and improve the adherence by means of closed-loop interaction((Brath et al., 2013). Another example is the AGATE intervention which is mhealth reminder application for alcohol use disorders (Stoner, Hendershot, 2012). These mhealth interventions mainly focused on patient related factors. As mAMS and AGATE used reminders to negate forgetfulness of patients.

Existing frameworks

A set of frameworks are available that help to assess mhealth applications. During this literature study a total of 2 frameworks were identified. Inclusion criteria were

- Frameworks that focused on effectiveness and efficiency and feasibility of mhealth
- Frameworks that focused on multiple themes

Exclusion criteria were the following

- Frameworks before 2006
- Frameworks not thoroughly described
- Papers that were not free
- Frameworks not relevant for this topic

Khoja-Durrani-Scott

The KDS evaluation framework is framework aimed at assessing various mhealth applications. This particular framework focuses on seven themes that can be aligned against the stages of an eHealth lifecycle (Khoja, Durrani, Scott Sajwani, & Piryani, 2013).

The following themes are described

1. **Health service outcomes:** This theme is referring to the principle that a clinical or health intervention should produce a change in the health status of a patient or community. This change should be measured on the basis of:
   - Change in disease or health status
   - Impact on quality of life
   - Change in health indicators
2. **Technology outcomes:** This theme refers to software, hardware and connectivity infrastructure used to sustain and implement an eHealth solution. Measurements can be in terms of relevance, use, safety, appropriateness and effectiveness of technology.
3. **Affordability and cost effectiveness:** This theme related to the extent to which a service is affordable for the user. This can be measured by the amount a user is willing to pay for the service.
4. **Social and behavioural impact:** This theme concentrates on the impact of the intervention. Processes such as analysing, monitoring and managing social consequences
5. **Ethics:** This theme describes various morals and values that are involved. Examples are security, privacy, research, resource allocation, use and access to the solution

6. **Readiness and change:** This theme refers to the readiness of healthcare institutions to implement changes that involve the use of e-health. This can require training and support for new business processes
7. **EHealth policy:** Is defined as a set of statements, directives, regulations and laws that direct and manage the life cycle of e-health

Mhealth Grading tool

The mhealth grading tool presented in the paper by Lee (2013) is a tool that examines the quality of information within mhealth studies. A section of this tool focuses on mhealth applications. This section presents a set of criteria with which you can measure whether all important aspects are covered within a mhealth application. The following will present these criteria

1. **Infrastructure:** These criteria refers to the availability of infrastructure to support technology operations (e.g. access to power, electricity, connectivity)
2. **Technology architecture:** refers to the technology architecture which includes software and hardware
3. **Intervention:** Details of the mhealth intervention and mode if delivery should be clearly described
4. **Usability:** Describes the ability of different user groups to use the technology.
5. **User feedback:** Refers to the feedback given by users about the intervention
6. **Identifies constraints:** describes various constraints in the delivery of the intervention, service, process or product
7. **Cost assessment:** describes the cost assessment of a mhealth intervention from different perspectives
8. **Training inputs:** refers to the training inputs for adopting a mhealth solution
9. **Strengths and limitations:** presents strengths and limitations for mhealth solutions
10. **Language and adaptability:** Adaption to the local language
11. **Replication:** Refers to source code, screenshots or other examples to ensure replication
12. **Data security:** presents data security procedures and confidentiality protocols

3.4 Conclusion

The goal of this chapter was to give an answer to the sub question: What is the definition of mhealth and adherence and what is known about mhealth and its effects on adherence?

The literature study shows that adherence to treatment seems to be a problem among asthma and COPD patients. Failure to adhere to a self-management medical plan results in poor asthma and COPD control. This can lead to exacerbations as well as increased hospitalization which leads to economic consequences. Proper adherence has proven to be a key factor in proper treatment of both diseases. As mentioned there are numerous factors that influence medication adherence behaviours (George, Kong, & Stewart, 2007; Restrepo et al., 2008). These are unique to each individual. Some factors have more impact than others. To promote adherence and negate some of these factors a multifactorial approach is needed (Brown & Bussell 2011). For example high cost of medication has been reported as a cause for nonadherence. Keeping medication affordable can limit the economic factors related to nonadherence.

Patient related factors such as for example forgetfulness, inadequate knowledge and skill, misunderstanding and non-acceptance of the disease have the possibility of being improved by

interventions tailored at educating and motivating patients Sabaté (2003). Mhealth apps are available that are tailored at addressing these issues of adherence. However, there is not much known about mhealth application and COPD and asthma patients.

4. Literature study on feasibility frameworks design

The following section will present the findings of the literature study on feasibility studies. The sections within this chapter are dedicated the identified feasibility studies and how they can be applied to this research

In order to investigate the feasibility of Turbo+ it is essential to determine the definition of feasibility. There a several studies that investigate the feasibility of mhealth adherence systems. Otieno et al. (2014) researched the feasibility of a mobile phone text-messaging system that aims to improve treatment adherence to malaria medications for patients in Kenya. Their outcomes for feasibility where focused on practicality mainly the network access, ownership and use of mobile phones. In addition, on acceptability, the willingness to receive text-message reminders. They concluded that there was a high willingness to receive text-message reminders. The actual measurement of adherence was not included in this article. Strandbygaard, Thomsen, & Backer (2010) studied the impact of a daily text message reminder on one's cell phone on adherence to asthma treatment. This was investigated by performing a randomized control trial study their main outcomes were concentrated on medication count and pharmacy reports. Free et al. (2010) investigated outcome measures for anticipated mobile electronic devices-based interventions, they concluded that primary outcome objectives for medication adherence devices were; Percent of medication doses taken on time and disease management for example asthma management expiration peak flow rate. Rhee, Allen, Mammen, & Swift (2014) developed a mobile phone based self-management aid for adolescent asthma patients. In this research, they also evaluated the feasibility. Main outcomes measures for feasibility and acceptability in this research where patient's user experience, the user friendliness and perceived benefit of the device. They used focus groups to collect data.

Through initial reviews of articles, it has become clear that there is a lack of standardization with regards to the definition of feasibility. The NETSCC http://www.netscc.ac.uk/glossary/ has a definition that seems to be very clear. They state that feasibility studies are pieces of research done before a main study and answer the question can this be done. They are used to estimate important parameters for the design of the main study. The following examples are given

- Standard deviation of the outcome measure, which is needed in some cases to estimate sample size;
- willingness of participants to be randomized;
- willingness of clinicians to recruit participants;
- number of eligible patients, cases or other appropriate participants
- characteristics of the proposed outcome measure and in some cases feasibility studies might involve designing a suitable outcome measure;
- follow-up rates, response rates to questionnaires, adherence/compliance rates, ICCs in cluster trials, etc.
- availability of data needed or the usefulness and limitations of a particular database
- time needed to collect and analyse data

4.1 Feasibility Studies Designs

4.1.1 TELOS

Hall (2007) describes a feasibility framework called TELOS with which can be used for the basis of a feasibility study. TELOS is an acronym for the five key areas Technology, Economic, Legal, Organizational and Scheduling. The following gives a small description of each area

Technology: This area aims to answer the question whether the project technology feasible. Aim is to investigate the technical capabilities of the organization including capable staff and appropriate facilities.

Economic: The area refers to the affordability of the project. Is there enough economic resources available? Is the return of investment (ROI) sufficient?

Legal: This aspect describes whether the project complies with laws and regulations

Operational: This area aims to answer the following questions. Will the project really solve or address the business problem? Factors such as organizational culture and receptiveness to change should be considered.

Scheduling: This area aims to answer the question whether it can be expected that the project will be completed within the recommended time.

4.1.2 Bowen

Bowen et al (2010) describes feasibility as a study that enables researchers to measure whether an intervention is relevant and sustainable. In this article, they propose eight general areas of focus. They state that researchers should choose focus areas that best matches the needs of the situation. The focus areas are

- Acceptability
- Demand
- Implementation
- Practicality
- Adaptation
- Integration
- Expansion
- Limited-efficacy testing

There are three main questions that a feasibility study aims to answer; can it work? Does it work and will it work? (Bowen et al., 2010)

Can it work aims to answer the question whether there is evidence that a product or service might work? Does it work aims to answer the question whether there is evidence that a product or service is effective under ideal situations compared to other practices? Will it work aims to answer the question whether a product or service will be effective in real-life context and within cultures that will use a product or service?

The following sections will give a more detailed description of the above-mentioned focus areas.

Acceptability

This area of focus looks at the reaction of the targeted individual recipient's user adoption of the intervention. Common concepts of this focus are; the intent to continue use, user satisfaction and perceived appropriateness. To measure and explain adoption of IT several user acceptance models have been developed. The Technology Acceptance Model (TAM) is a well-known user acceptance

model and was introduced in 1989. TAM is based on the Theory of Reasoned Action(TRA) (Asjen & Fishbein, 1980) which states that people tend to adopt a behaviour or technology based on their beliefs about the consequences of adoption.

TAM expands on this model by suggesting that two main factors influence individual information systems acceptance. These are perceived usefulness and perceived ease of use. Together these factors influence a person's attitude towards using a product. This will affect their intention to use a product. The actual use of the product is the final result. The TAM model was researched within the healthcare sector. Research has shown that perceived usefulness and perceived ease of use are important elements for assessing acceptance of Health IT (López-Nicolás, Molina-Castillo, & Bouwman, 2008; Wu, Wang, & Lin, 2007) (Holden Kars 2009). The TAM model is shown in Figure 6. Wu et al. (2011) however mention that the TAM neglects the subjective norm on behavioural intention to use. This subjective norm is present within the theory of planned behaviour (TPB).

Research has shown that the integration of TAM and TPB can more effectively explain the technology acceptance in healthcare applications (V., Vekantes, V, Morris, M, Davis G.,, Davis, G., 2009). The theory of planned behaviour consists out of the components attitude, perceived behavioural control and subjective norm. While some components overlap such as attitude and perceived behavioural control. The subjective norm describes the social pressure to perform or not to perform the behaviour.

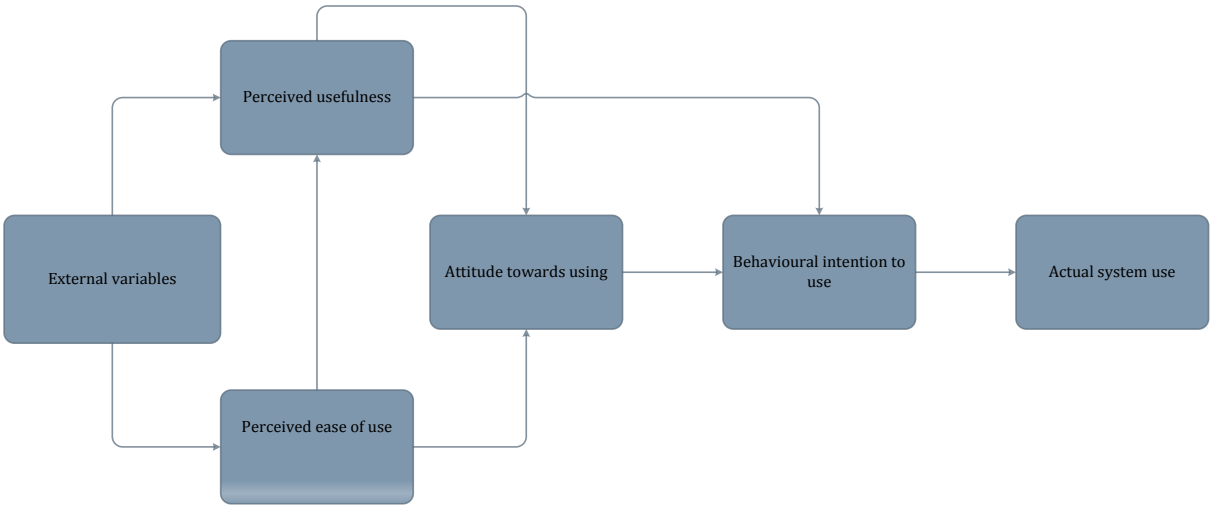


Figure 5 Technology Acceptance Model, Adopted from Davis (1989)

Perceived appropriateness can be determined by concentrating on the service quality. Service quality has been defined as the patient's judgment about the overall excellence or superiority of a product (Zeithaml, V. A. 1987). There are several models that can be used to measure service quality. In mobile health care Varsney uses a four dimensional approach where the focus lies on Information systems (IS), technological, managerial, and medical perspectives. Akter, D'Ambra, & Ray (2010) proposed a conceptual model of service quality in mHealth based on platform quality, interaction quality, and outcome quality. In a more recent study Akter, D'Ambra, & Ray (2013)uses a three dimensional approach where they concentrated on system quality, interaction quality and information quality.

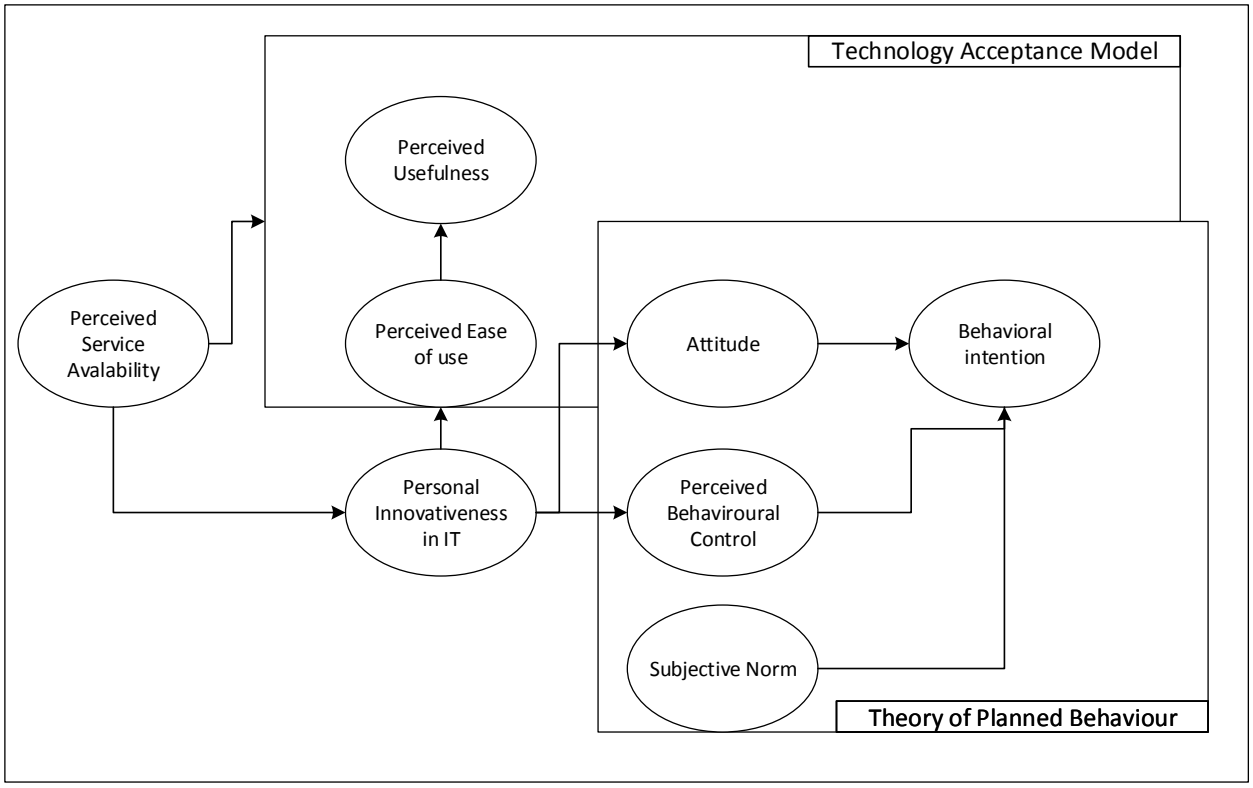


Figure 6 User Acceptance Model by Wu et al (2011)

System quality deals with the systems reliability, efficiency and privacy. Interaction quality reflect the quality of interpersonal relationship between patients and the health care provider over the mobile health application. Lastly the information quality defines whether the patient perceives that information provided serves its actual purpose. Additionally, this dimension reflects whether information is perceived as pleasant or whether this service provokes positive feelings.

Demand

This focus area primarily concentrates on the actual use, perceived demand and intention to use. This focus area is closely related to the focus area acceptability. The models described in the focus area acceptability are also applicable in gathering information about the perceived demand and intention to use. The theory of planned behaviour model can also be used to form a basis to determine whether people in the target population would use the intervention to guide their behavioural choices.

Implementation

This focus area examines the probability and method in which the intervention can be implemented. There are many obstacles that can harm the implementation of a mobile health device. These obstacles will in turn determine the overall feasibility of the intervention. The following obstacles have been addressed within literature

Implementation	Source
Usability	Patrick, Griswold, Raab, & Intille (2008) Siau & Shen (2006)

	Boulos, Wheeler, Tavares, & Jones(2011)
Technology	Yu, Wu, Yu, & Xiao (2006) Boulos et al (2011)
Privacy and Security	Yu et al (2006) Kotz (2011) Norris, Stockdale, & Sharma (2009) (Meingast, Roosta, & Sastry, 2006)

Table 1 Aspects of Implementation

Usability

Usability is a critical part of a mobile health device. It should be useable for all types of individuals(Patrick et al., 2008). Usability also has a direct influence on the perceived ease of use. There are a number of methods that are used to determine the feasibility of a device or application. The most well-known methods are heuristic evaluations, cognitive walkthroughs, think aloud. We have been given the opportunity to perform a full usability study on the Turbu + program, this will be described in chapter 6

Mobile health care devices are heavily depended on network technologies such as Wi-Fi, Bluetooth, 3G and 4G networks, a mobile device is limited in battery life, memory and disk capacity. These challenges will need to be determined as it can limit the use of an mobile health device(Boulos et al., 2011; Siau & Shen, 2006).

Privacy and Security

Most mobile health care applications capture or retrieve patient data. This poses some serious privacy and security concerns(Meingast et al., 2006) . In order gain trust and acceptance of patients, appropriate security measures and processes will need to be in place (Norris et al., 2009). There are several threats that can influence the integrity of a mhealth application. The following threats can be identified Identity, access threats and disclosure threats.

The identity threat explores threats related to a patient's identity. For privacy concerns, it is important that a patient's identity remains anonymous and secure. Access threats are referring to the unauthorized access of a mhealth application. Authentication protocols and mechanisms are used to authenticate the patient and prevents. Encryption protocols ensure that only authorized parties can access confidential information (Kotz 2011; Akinyele et al 2011).

Practicality

This area of focus identifies whether and intervention can be delivered when time, resources or a combination are constrained in some way. This area of focus is also seen as a form of financial feasibility. Examples are: total estimated cost of the project, the projected cash flow and profitability. Project funding potential. Business cases can provide an answer to these questions. A business case helps to project the expected business benefits, the expected costs of the project and the expected risks.

Integration

Integration focuses on the changes needed to integrate a new program or process into an existing infrastructure or program. Example outcomes are; perceived fit with infrastructure and perceived sustainability.

Expansion
Expansion explores the potential success of an already successful intervention with a different population or in a different setting.

Limited-efficacy testing:
This focus area aims to determine whether a new idea, process or program is successful with the intended population, even though it is tested in a highly controlled setting.

4.1.3 COrETeST

Meulendijk et al (2013) proposes a set of recommendations that can be used to design a feasibility study within the field of medical informatics. They were able to identify 5 main concepts which are abbreviated as the COrETeST. These aspects are:

Conceptual feasibility: Within this step a conceptual model is created of the intended product. Important is to investigate this thoroughly. Tools such as UML diagrams can be employed to design the conceptual model

Organizational feasibility: This step explores the current market and its key players. Potential partners and competitors are identified within this step. ArchiMate can be used to map relations between the market and the project.

Economic feasibility: After evaluation and exploring partnerships, strategies can be developed for the intended project Predictions should be made regarding return of investment. Financial and distributive details should be formalized

Technological feasibility: Information exchanges and the usability approach from a technological perspective can be modeled. UML collaboration and activity diagrams are an excellent tool of representing this

Societal feasibility: The final and concluding aspect zooms in on the societal gains that result from the intended venture. Within the medical field societal gains would usually refer to reduced mortality rates, improved health and a decrease in cost.

4.4 Conclusion
This literature study into feasibility study methods provides us with a number of concepts with which we can determine the feasibility of a mhealth device aimed at increasing adherence. With regards to scope we have to make choices that best suit this research and to model this to mhealth for COPD and asthma patients. The following feasibility studies have been identified: TELOS which focuses on 5 main themes: Technology, Economic, Legal, Operational and Scheduling. And Bowen's eight general areas of focus: Acceptability, Implementation, Demand, Practicality, Adaptation, Integration, Expansion, Limited-efficacy testing. During the literature study it becomes clear that some themes and focus areas overlap and have different names within the frameworks.

	TELOS	BOWEN	COrETeST
Technological	x	x	
Legal	x		
Economic/Financial	x	x	x
Usability		x	x
Security		x	
Usability		x	

Scheduling	x	x	
Demand		x	
Previous research		x	
Acceptability		x	

Technology is described within both feasibility study frameworks, others such as the theme operational within TELOS is partially described within Bowen's focus areas. Usability is a part of technological feasibility of the COrETeST. We will adhere to the themes described by Bowen as these themes form a better fit for this particular research. Not all themes by Bowen are relevant or within the scope of this research. The focus areas were filtered based on the following exclusion criteria's

Exclusion criteria 1 focus on financial and legal aspects are excluded since it is out of scope of this research.

The following aspects remain

- Implementation
- Acceptability
- Demand

These aspects are best suited for our feasibility study design. By researching these aspects we will be able to determine if Turbu + in its current form is usable and complies with privacy and security regulations. Furthermore we will be able to determine if demand for Turbu+ is sufficient and if users find it an acceptable device. Chapter 5 will describe these aspects in more detail.

5. The development of a feasibility study on mhealth apps for COPD and asthma patients.

A feasibility study is a study that aims to research whether an intervention is relevant and sustainable. The purpose is to design a framework that can determine the feasibility of a digital patient support service to aid COPD and asthma patients in their self-management.

During the literature study, a comparison was made of feasibility study methods this was followed up by a selection of relevant areas or themes. The following themes were selected in chapter 4

- Implementation
- Acceptability
- Demand

The following will describe the selected areas in more detail.

5.1 Implementation

It will be important to ensure that the technology used is effective, appropriate and relevant.

As stated in chapter 4. Usability, privacy and security are concepts of implantation. The following describes how we can research the concepts.

5.1.1Usability

Task success

Task success is measured by task and expressed in 1 (task success) or 0 (task failure). If a task isn't successful at the first try a 0 is recorded and the subject may again try to accomplish the task. This forms the basis for the learn ability parameter.

Time per task

The time per job is measured in seconds and / or minutes. The time starts after the user has read the scenarios and ends after users have completed a task. For each task, we will look at the amount of attempts that are needed to complete a task.

User errors

Any unintentional actions, error or omission of a user during an attempt by a task is noted. Each instance of an error is described and categorized.

Satisfaction

The assessment of the pleasantness to use the application is measured by use of two questionnaires. The first questionnaire is the based on the Post-Study System Usability Questionnaire with a seven and a questionnaire that aims to gather additional information about the usability of Turboplus.

5.1.2 Privacy and security

An important issue with regards to privacy and security of the product. More specifically is current technology sufficient enough to provide a secure and safe utilization of the intervention. As mentioned. In order gain the trust and acceptance of patient's appropriate security measures and processes are needed. It is important that names, email addresses and other personal information

communication. It enables secure interoperability between systems with a minimum amount of risk for users. The following describes the safety planning steps described

- Review state laws, regulations, and institutional-level guidance
- Determine appropriateness of home-based telemental care
- Determine adequacy of infrastructure and technology
- Site assessments and procedures
- Plan and discuss roles and responsibilities
- Monitor risk during and after treatment

5.2 Acceptability & Demand

Adoption refers to the decision of individual members within an organization to use an application or not (Bouwman et al., 2002). In this case it is not an organization but a group of patients. The concept however remains the same, whether the patients will adopt the application or not. Log data will provide us with information about the actual adoption rates.

As mentioned various models have been created to measure and explain adoption of IT. The Technology Acceptance Model (TAM), Theory of planned behaviour together with service quality can answer whether the intervention is acceptable for users. By use of surveys we will be able to gather this information

A questionnaire will be created which will be based on the model presented by (Wu et al., 2011). This questionnaire will be translated in Dutch and used to assess adoption levels within COPD and asthma patients. A first questionnaire can receive initial expectations and opinions about and digital patient support service. A second questionnaire taken and the end of the case study can give information about the actual adoption rate and can show if expectations were met.

Conclusion

The aforementioned areas of focus that were selected can be used to determine the feasibility of a mhealth application. This chapter outlined these aspects and described how these aspects can be put into practice. The focus areas described can also be modelled in a table. The following table provides an overview of the aspects that are within a feasibility design for mhealth apps aimed at COPD and asthma patients. This table also describes the various parameters that are involved in measuring the aspects of feasibility.

Focus area	Parameters	Description
Technology/Usability	Task success	Task success measures how many tasks were successfully completed. It measures if users can successfully accomplish their goals
	Task time	Task time measures the efficiency part of usability
	User satisfaction	Measures patient perception of overall use
Privacy and security	Security protocols	Specification for encryption and secures communication
	Encryption techniques	Technique used for encryption
	Storage of data	Information about where data is stored
Adoption	Perceived ease of use	the degree to which a person believes that using a particular system would enhance his or her job performance" (Davis, 1989)

	Perceived usefulness	the degree to which a person believes that using a particular system would be free from effort" (Davis, 1989).
Demand	Intent to use	the degree to which a person believes that they will use a product
	Intent to continue use	the degree to which a person believes that they will use a product for a long period of time

Table 4 Feasibility Study Design areas and parameters

6. Applying a key feasibility study element: usability study

A usability study is a key component of a feasibility study aimed at mhealth interventions. This section will describe the main properties of a usability study in depth. Furthermore, the usability study will be applied to the mhealth program Turbu+. The aim of this usability study is to evaluate the usability of the Turbu+. Usability problems and bottlenecks from the Turbu+ will be identified and the results can be used to further develop the interface of Turboplus for a better user experience.

Usability is a term that has been defined in a number of ways. The ISO 9241-11 standard defines usability as "the extent to which a product can be used by specified users to achieve specified goals with effectiveness, efficiency and satisfaction in a specified context of use "(ISO 90241). In this ISO standard the words effectiveness, efficiency and satisfaction are further defined. "Effectiveness" refers to the task completion by user, "efficiency" describes the task in time measure and "satisfaction" refers to the subjective measure of experience of a user. The context denotes to the combination of users, tasks, equipment's & environments. In 2011 the ISO/IEC 25010 which replaced the ISO/IEC 9126 standard defined usability by five components: understandability, learnability, operability, attractiveness and usability compliance. These components can be defined as follows:

Understandability: The extent to which users can identify whether a product or system is suitable for their needs.
Learnability: the capability of the software component to enable the user to learn its application.
Operability: the capability of the software component to enable the user to operate and control it.
Attractiveness: the capability of the software component to be attractive to the user.
Usability Compliance: The capability of the software product to adhere to standards, conventions, style guides or regulations relating to usability.

6.1 Usability Evaluation Methods.

Usability evaluation methods (UEM) are methods that help evaluate and eventually improve the usability of the system. Two types of UEMs can be identified Usability inspection methods (expert based) and usability testing methods (user based). Usability inspection refers to a set of methods in which evaluators inspect the interface. Evaluators in this case are experts. Inspection is aimed at discovering usability problems related towards the design (Mack & Nielsen, 1993). Examples of usability inspection methods are: heuristic evaluation, guideline review, consistency inspection, usability inspection and walkthroughs. (Mack & Nielsen, 1993; Molich et al., 1999). Usability testing methods are methods that are performed by the end user and the practitioner observers the user during this process. Examples of these methods are user performance measurements, log-file and keystroke analyses, think aloud, interviews and satisfaction questionnaires (Ericsson & Simon, 1980; Mack & Nielsen, 1993). For this research we will focus on the most widely adapted UEMs which are heuristic evaluation, cognitive walkthrough and think aloud.

6.1.1 Heuristic Evaluation

Heuristic evaluation is the most commonly used inspection method (Nielsen, 1993; Nielsen 1994). Heuristic evaluation is a method where a small group of experts (not users) inspect a system and evaluates its interface against a set of recognized usability principles called heuristics. The goal of a

heuristic evaluation is to find usability problems. The following describes the most commonly used usability principles which form the basis of heuristic evaluation.

1. Simple and natural dialogue (Language)
2. Visibility of system status (Visibility)
3. Match between system and the real world (Match)
4. Consistency and standards (Consistency)
5. Error prevention (Error)
6. Recognition rather than recall (Memory)
7. Minimize memory load (Minimalist)
8. Help and documentation (Documentation)
9. Speak language of user (Language)
10. Error messages and feedback (Feedback)

During a heuristic evaluation each evaluator will have to go through the interface twice. During the first try the evaluator will attempt to get a general idea about the scope and navigation of the system. After this phase the evaluator should look in to the lay out in more detail. An evaluator will examine the interface, design, navigation structure and interaction structure against the afore mentioned heuristics. The recognized usability flaws will be listed with a reference to the linking heuristic. Each evaluator will independently estimate the severity of the problem. The outcomes of all evaluators will be compared and summarized. This will eventually lead to a report which can aid the designers in revising the design of the system.

Because it doesn't require end user in the evaluation, it is a method most often used when time and resources are limited. Heuristic evaluation is seen as an tool with a high cost-benefit ratio (Nielsen, 1994). It does however have some limitations, heuristics and guidelines has increased over and could pose a problem for less experienced evaluators. Because of this there can be a high dependence on the experience and skills of the evaluators(Jeffries, Miller, Wharton, & Uyeda, 1991).

6.1.2 Cognitive walkthrough

The cognitive walkthrough is another widely used usability inspection method. The method was first introduced by Lewis, Polson, Wharton, & Rieman (1990) this method concentrates on evaluating the learnability of a system by exploration(Lewis et al., 1990; Polson, Lewis, Rieman, & Wharton, 1992) . This walkthrough is structured around user tasks. An evaluator will examine the user interface based on tasks and use case scenarios. The walkthrough will allow the evaluator to examine the interaction between the systems interface and the user's intention. The cognitive walkthrough is created to evaluate the ease of use of the system for a novice user. A model of four steps is created to simulate the tasks a user performs (Jaspers, 2009). 1 user sets a goal to be accomplished, 2 user inspects available actions, 3 user selects available actions, 4 user performs action and evaluates feedback. The evaluator will answer related questions for each action a user takes. These question are (1) will the user achieve the correct goal? (2) is the correct action obvious to the user? (3) will the user notice the association between the correct action and the desired goal?, (4) will the user notice the progress that is being made towards the goal? Whenever there is a negative answer to any of these question, the action is not free of usability problems. An effective cognitive walkthrough requires a properly defined user background, this is needed in order to prohibit possible mismatches between designers and users. As with the heuristic evaluation

method, cognitive walkthrough also has some drawbacks. Research has shown that cognitive walkthrough only detects one third of usability problems that are detected using heuristic evaluation. However cognitive walkthrough did detect more severe problems then heuristic evaluation (Jeffries et al., 1991). Furthermore differences in user background can affect results in the cognitive walkthrough(Liu, Osvalder, & Dahlman, 2005).

6.1.3 Think Aloud Method

The think aloud method is that originates from the field of cognitive psychology. The method is viewed as a useful way of understanding how people solve problems. In this method users are instructed to think aloud while performing various tasks. This allows for the extraction of verbalized information that they are attending to in short-term memory (Ericsson & Simon, 1980). Usability experts have since adopted this method for the evaluation of computer interfaces. In a usability setting a user is instructed to use an interface while think aloud and stating directly what they think. User comments are recorded and transcribed for further analyses. The assumption is that user's short term memory thoughts about the system will be verbalized. The think aloud method has been criticized for the possible lack of reliability and validity.

Each of these three methods have been proven to be a useful tool for determining the usability of a system. These methods have both advantages and disadvantages and a combination of these methods would be the most successful. Jaspers (2009) compared the afore mentioned usability methods for interactive health technologies. A summary of the advantages and disadvantages of each method is shown in Table 1 adapted from Jaspers (2009).

Method	When	Input	Output	Main advantages	Limits
Heuristic evaluation	Early system design stage	3-5 usability experts	List of heuristics violated	Cheap and fast	Unstructured Dependence on experience and skills of evaluator
Cognitive walkthrough	Early system design stage	Min of two evaluators	List of potential usability problems	Structured	Monotonous Results affected by user background
Think Aloud	System design or implementation phase	5-8 end users	Verbal protocols, usability problems	Insight in to why of the usability problems, rich source of data	Time consuming, Results are affected by evaluators skills, task

	selection Not all thinking is taken into account

Table 6 Comparison of usability study methods

Smartphones

Smartphones are currently well penetrated into western society. Millions of apps are downloaded from app stores each year. In a relatively short time smartphone adoption has captured a wide range of individuals from different age groups and social status. Smartphones are characterized by their natural input which refers to input similar to real life input such as speech, touch and gestures (Câmara, 2011). Within smartphones this is facilitated through the touchscreen allowing the user to interact with the system through direct touch and gestures. This does however pose some challenges with regard to design and usability of an application. Currently there are no existing standards for gestural control and developers seem to ignore universal usability principles of the past(Norman & Nielsen, 2010). Research by Mauney, Howarth, Wirtanen, & Capra (2010) has shown that previous experience with touchscreen devices is a significant factor when handling touchscreen devices. If for instance users had experience with only devices with scroll bars and arrow keys users erroneously swiped down to scroll up.

Patient Perception and adoption

COPD is predominately a disease which occurs among people aged over 40 years. It is therefore important to look at patient perception towards smartphone technology especially with regard to elderly people. According to Venkatesh et al. (2003) elderly accept and adopt technology like anyone else if it meets their needs and expectations. However, there are some barriers that are present within elderly people which are related to visual and hearing impairments and mobility (Gaßner & Conrad, 2010).

6.2 Turboplus

6.2.1 Design of Turboplus

As mentioned Turbu+ is application which aims to help COPD and asthma patients in their treatment. The main aim is to increase their adherence to their prescribed treatment plan. The following is a detailed description of the application with screenshots

The Turboplus program consist of four parts:

1. The bronchodilator Symbicort Turbuhaler

2. A Bluetooth device “Turboplus” which is attached to the Turbohaler

3. A corresponding application on your mobile phone (Android or IPhone 4S and after)
4. And a website www.Turbu+.com

This usability study will be performed within the general practice located at the Gezondheidscentrum Dillenburg in Alphen a/d Rijn between March 2015 and April 2015. COPD patients and asthma patients will be using Turbo+ Bluetooth device, a phone with the Turbo+ app installed and the web portal.

Data

Data for this usability study will be collected through a think aloud session, two surveys and patient interviews. Statistical tests are performed with SPSS version 20

6.3 Chosen Methods

6.3.1 Think Aloud method

During the think aloud session patients will be provided with a smartphone with Turbu+ preinstalled, an inhaler with the Bluetooth device connected and access toward the Turbu+ website.

At the start of the session patients will get an explanation of the Turbu+ program and patients will receive a leaflet explaining the workings of the Turbu+ program. Following this explanation, they will get a maximum of 30 minutes to get familiarity with the system. Afterwards they will be asked to complete a series of tasks that will guide them through the application and website. Patients will be instructed to think aloud during this sessions and mention anything that comes to mind. Each session will be recorded. These recordings will be analyzed to determine the following parameters task completion, time per tasks, user errors, learn ability, satisfaction and problems.

6.3.2 Heuristic evaluation

A heuristic evaluation will be performed, the Turbu + app and the web portal will be evaluated. As mentioned the interface, design, navigation structure and interaction structure will be evaluated and linked against a list of heuristics. An estimation will be made on the severity of each encountered problem.

6.2.3 Interview

After the session has been completed patients will be submitted through a semi structured interview. This interview will aim to gain knowledge on patient's initial thoughts about the user friendliness, usefulness, intent to use and overall satisfaction of the Turbu+ app and website.

6.2.4 Survey

Two surveys have also been developed in order to gather information about user satisfaction with Turbu+. The first questionnaire is based on the Post Study System Usability Questionnaire (PSSUQ). PSSUQ is questionnaire designed to assess user's satisfaction of computer systems (Lewis, 1992b; Lewis, Henry, & Mack, 1990). The questionnaire gathers information about the usefulness, the information quality and the interface quality of system.

6.5 Usability Study

6.5.1 Users

With the think aloud method it has become clear that sufficient amount of qualitative data can be gathered with five users. For this research were able to recruit five patients through general practices. The compensation was fifty euros provided by the UMCU. Basic information, prior smartphone where surveyed before the session. There were no pre requisites other than being able to speak the Dutch language. The pretest survey can be found in de Appendices. Information about the users can be found in table 7.

Code	Gender	Age	Disease	Dosage	Use	Extra Use	As perscribed	Smartphone	Use Smartphone	Installing App	Use special apps
AD01	Female	56	Astma	400/12	3	2	Yes	Yes	daily, several times per day	No	Yes
AD02	Female	59	Astma	200/6	3	2	Yes	Yes	daily, regularly	Yes	Yes
AD03	Male	22	Astma	400/12	3	2	Yes	Yes	daily, several times per day	Yes	Yes
CD01	Female	79	COPD	200/6	3	2	Yes	Yes	daily, regularly	Yes	Yes
CD03	Male	66	COPD	400/12	3	2	Yes	Yes	daily, several times per day	No	No

Table 7 User information

6.5.2 Test Setup

Patients are seated in front of a table where an area is marked off, in this area the smartphone is placed. This is done so that the smartphone will always remain in view of the camera. Patient faces are not recorded during the sessions. Only their hand movements are recorded during the think aloud sessions. The video camera was placed to either the right on the left side of the patient depending on the dominant hand of the patient.

6.5.3 Tasks

12 scenarios were presented to users containing 20 tasks. Each scenario consisted out of a series of tasks. The tasks were created to steer users to access the main functionalities of the application. Tasks were created to be goal oriented. This would allow the researchers to know what the user is looking for and will help in identifying potential usability problems.

6.5.4 Analysis

During the think aloud sessions a considerable amount of qualitative data was gathered. In order to form a conclusion, we will need to analyze the data. The following will describe the parameters task time, task success, satisfaction and problems in more detail.

6.5.5 Task time

The task time parameters will assess the efficiency of a functionality within the application linked to that specific task. This will be done by measuring how long each user needs to complete a particular task. By doing this we will be able to get an understanding about which tasks poses the most difficulty for users.

Data was collected from 20 tasks resulting in a total of 100 task time samples. Task time were measured by using a stopwatch. An average was calculated for each task. All task time where included into the calculations.

6.5.6 Task completion

The task completion parameter will assess the effectiveness of a functionality within the application. The amount of attempts to achieve a successful completion of a task will be measured. During a session whenever a patient attempts an action and does not complete this at the first try this will be marked with a zero. Each attempt that fails to reach the goal will be marked with a zero. Completing the goal will be marked with a one.

6.5.7 Errors

All errors and every unintentional action by a user will be documented.

6.6 Data Analysis

The evaluation results were analyzed in order to identify the usability of the mobile application and the web portal. The results below will give a summary of the usability problems that occurred during the think aloud sessions. Furthermore, usability problems detected during the heuristic evaluation will be shown in the following sections.

6.6.1 Task Completion

The following will present the task completion results. Each participant was measured to determine whether they were able to complete a task. The following will describe how many participants failed or completed each of the 21 tasks.

Task number and description	**Number of times failed**
15 You wonder why some posts disappear, look for the answer.	3
6 How many inhalations do you have to take this morning	1
7 How many inhalations have you taken this morning	1
8 What is the maximum period for which you can view your compliance in the app?	1
10(Has something changed on the page ' compliance '?	1
11 Activate the Turbuhaler 4 times and wait 1 minute	1
12 Change the time of the reminder to an hour later and save it	1
14 What is the number	1
20 You need information about your illness via the web portal. Where can you find information about your illness ?	1
1 Attach Turbu+ on your new Turbohaler.	0
2 Turbu+ open the app on your phone. With the PIN 4 times 0	0
3 (Open the menu. What options do you see?	0
4 See if you have messages.	0
5 You want to see if you are taking the medication as the caregiver prescribes. Where you view this?	0
9 Active the Turbuhaler	0
13 Your Turbu+ is not working who do you contact	0
16 View Terms and Conditions	0
17 Your Turbuhaler is empty describe what you must do	0

18 See how your medication compliance requirement has been.	0
19 What is the maximum period for which you can view your compliance in the portal	0

Table 8 Tasks failed

The results show that Tasks 6,7,8,10,11,12,14,15 and 20 were not completed by one participant. Task 15 was not completed by 3 participants. This task involved users answering the question "Why do some messages disappear from the message inbox?" The answer for this question could be found in the questions section. All users understood that the answer was located in this section. Three out of the five users were however unable to find this answer. This was mainly due to the fact that the arrows which allows users to go to the next page went unnoticed by most patients Task 6, 20 and 7 were not completed due to a misunderstanding of text and language. Task 10 and task 11 were failed because of a technological problem with the system. The system was unable to register the activation of the Turbuhaler. Task 8 and 14 were not completed due to the fact that users were unable to locate a specific function.

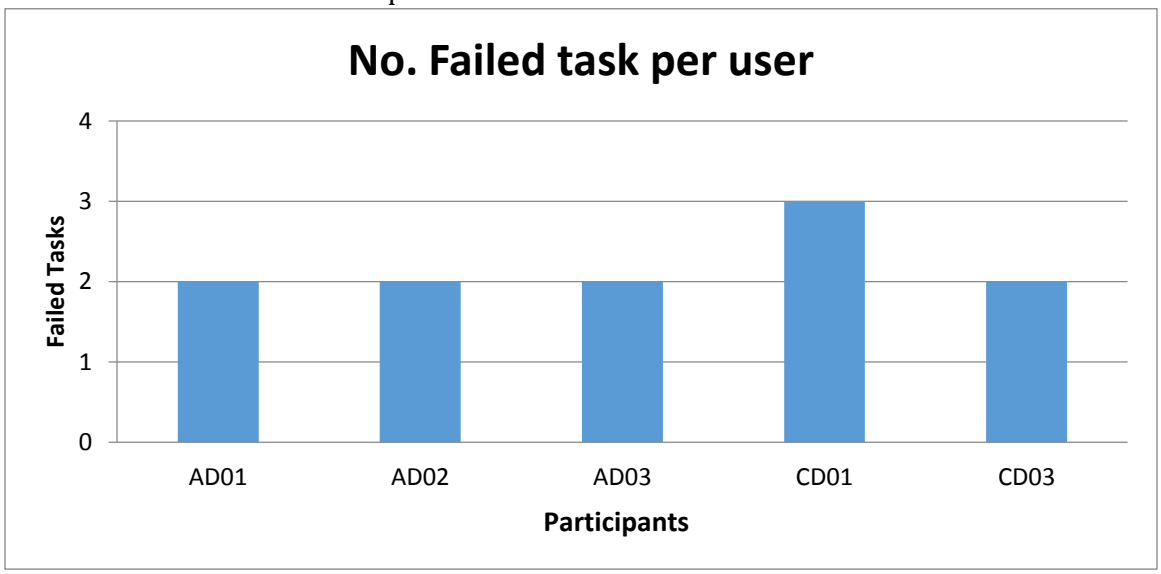


Figure 7 No. Failed task per user

The user CD01 failed one more task than the other users., it was however not significant enough to take make any conclusions. 6.6.2 Task Time The following will show the average time each participant spend on a task as well as the average time per participant on the total number of tasks. The task time was measured by starting a timer whenever a participant started a task, the timer was stopped when the participant either completed the task or gave up. Results of uncompleted

task are not included in the results.

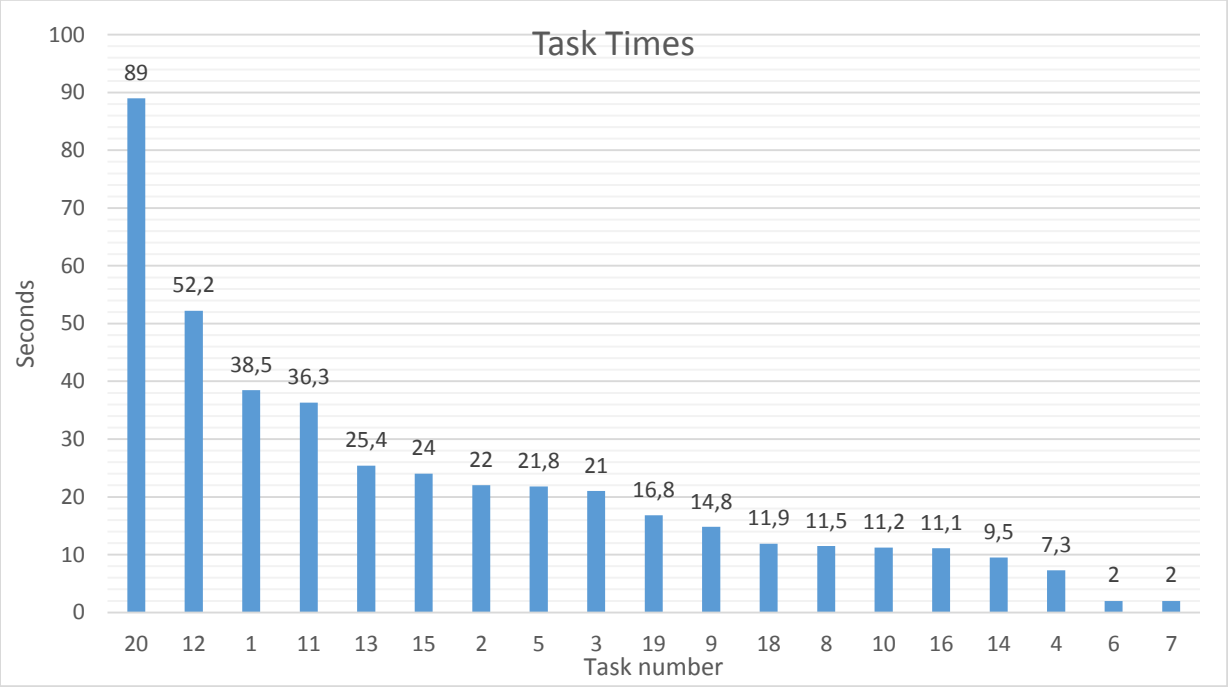


Figure 8 Task times

The task time results show that the task 12 and 20 took a considerable amount of time to complete. Task 12 was indeed a time consuming task as it involved changing the reminder timer. However, the task time is still a bit high. Design changes are recommended for this task. Task 20 is generally speaking a simple task and the task time is far too high for this task. This task involved looking for information about patient's illness. An explanation for the high task time could be that the name for this section was not what users expected. The name for this section was advice many users looked elsewhere first before checking this section of the web portal. All other task times had a decent average.

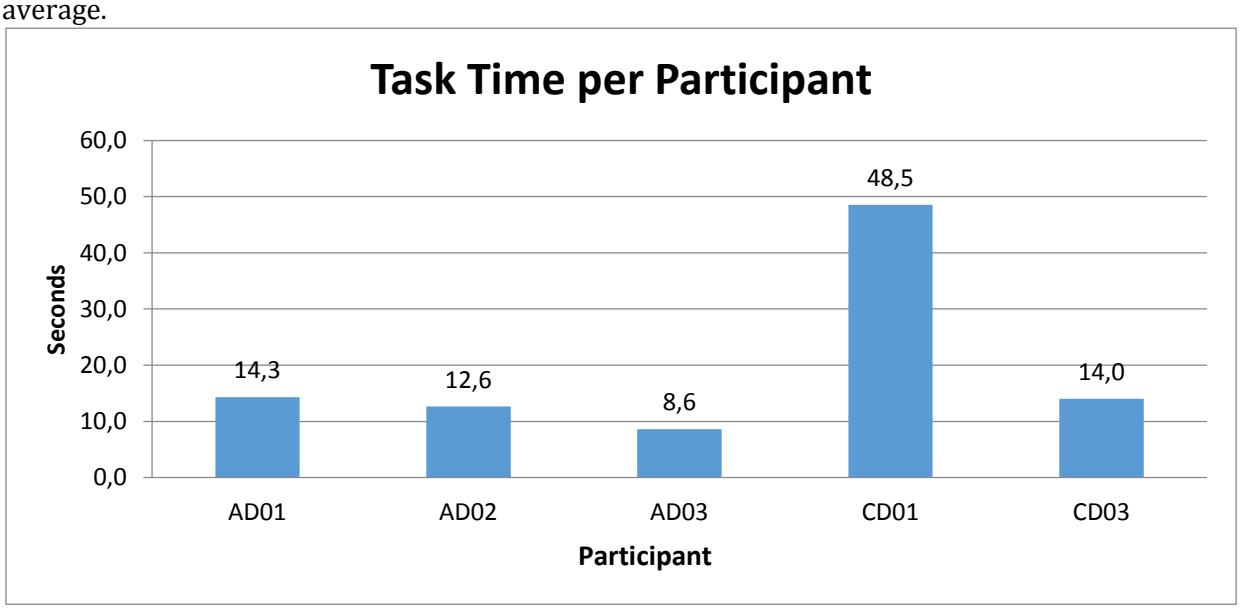


Figure 9 Task Time per participant

User CD01 took quite a longer time to complete the tasks than any of the other users, CD01 needed more time finding the right functions. This could be due to the fact that this user was the oldest participant. This user was however familiar with smartphones. AD03 had the lowest average time and was the youngest user. An assumption could be that older users have more difficulty using the application than younger users. However, we can't make any definitive statements.

6.7 Heuristic Evaluation

As mentioned a heuristic evaluation is an inspection method that helps to identify usability problems in the user interface of a program. During this heuristic evaluation we adhered to the principles described by Nielsen mention in paragraph 4.1.1. The following problems were detected during the think aloud sessions and during a heuristic evaluation.

6.7.1 Usability Problems

Visibility

The main usability problems described in the following three tables are about a lack of visibility and lack of minimalist design of certain functionalities or menu items. Some pages within the app went unnoticed because indicators were not noticed. Other functions within the app were not noticed or were too complex to understand by users. The lack of visibility can cause confusion about certain functions within the application, which could lead to usability problems. It is important that these issues are resolved to facilitate a smooth adoption of the application.

Problem	Description	Heuristics violated	Source	Severity
Show current menu item	The app does not always show on what page the user is on	Visibility, Memory	App	Quick Fix
Message about overdose of medication is late	Message warning about overdosing arrived after approx. 20 minutes	Visibility, Feedback	App	Technical issue

Description of taken and to be taken inhalations	One user was unable to identify the number of inhalations that where taken and the inhalations that are to be taken	Visibility	App	Needs new design
Login screen	The field for inserting our pin code was not noticed by 3 users.	Visibility,	App	Quick Dix

Problem	Description	Context	Source	Severity
Multiple chapters in advice(advies) are not noticed	Chapter within advice go unnoticed by some users. Indicators are at the bottom of the page, depending on the size of the screen users may not notice that there are more chapters.	Visibility, Minimalist	Webportal	Quick Fix
Page with clocks describing the number of inhalations is too complex.	The page in compliance with clocks describing the number of inhalations is too complex. Some users where unable to understand this page	Minimalist	App	New Design

Clock next to time is unclickable in reminder (herinnering) menu	The clock next the time indicator is unclickable.	Minimalist	App	Quick Fix
Some question lists are not noticed	The multiple chapters of answers in the question list are not noticed by some users.	Minimalist	App	New Design
Maximum period of compliance viewed in the app	One user was unable to locate the number	Visibility	App	Quick Fix
Chapters for advice in webportal need shortcuts	The multiple chapters for advice can be reached with the arrows. However it is tedious work to get to a specific chapter	Memory	Web Portal	Quick Fix
The indicators to swipe from left are not noticed	On several occasions users did not notice that they could swipe form left to right and back	Visibility	App	Quick Fix

Table 9 Heuristic evaluation Visibility

Language

The main usability problems described in the table below involve issues with a lack of clear information and language. There were some issues with the texts used for functions within the app and within the web portal. Users were at occasion unsure what was meant with a certain text. Users expected other information at certain functions. This led to some confusion about the various functions within the app and web portal. This caused some users to miss information within the app and web portal.

Problem	Description	Context	Source	Severity
The compliance (Naleving) menu item might not be user-oriented.	It might be unclear as to what can be found under the header compliance	Match, Language	App	Quick Fix
The advice (advies) menu might not be user oriented.	It is not clear what information can be found under the header advies Some users expected prescription details from doctors	Match, Language	App/Webportal	Quick Fix
Unclear that contact information can be found in careplan (zorgplan	It is unclear that contact information can be found in zorgplan.	Match	App	Quick Fix

Table 10 Heuristic evaluation Language

Consistency

The main usability problems described in the following table are about a lack of consistency of certain functionalities or menu items. There are some consistency problems within the app and webportal. It is unclear where information can be found within the app. Furthermore, there are some consistency issues with menu items in the application. Users may be unable to find information because of these consistency errors. It is also important that the text and functions are consistent with the webportal.

Problem	Description	Context	Source	Severity
There is no clear difference between messages(berichten) & advise(advies).	It is not clear what information can be found under the header messages and advise	Consistency,	App	Quick Fix

Some menu items have additional items and some don't	Some list has sub list underneath them and some don't. This can be confusing for the user. The user most now remember which menu item has sub items underneath them. No indicator is shown	Consistency,	App	Quick Fix
Advies(advice in app shows something different then advies(advice) in webportal	Advies in the app shows messages of warnings or recommendations, while Advies in the webportal shows information about the patient's disease. These are two totally different things but with the same name.	Consistency,	App/Webportal	Quick Fix

Table 11 Heuristic evaluation Consistency

The list of problems detected suggests that there are some problems with the visibility of certain features. This was a recurring problem, as described in section heuristic evaluation users experienced difficulties noticing the arrows to scroll from pages left to right. This resulted in the fact that some patients were unable to view key pages in the application. Furthermore, names of certain pages did not meet the expectations of patients, which resulted in incomplete tasks.

A possible explanation might be that user's knowledge of these functions was not known. It might be wise to give an instruction on the various methods of going through the pages.

This usability study investigated the usability of Turbu+, which is tailored to increasing adherence among COPD and asthma patients. The purpose of this usability study was to detect usability problems and determine whether Turbu+ is user friendly. Subjective experiences and opinions where gather from participants to measure of what tasks caused to most difficulties and whether they were satisfied with the application. A set of 20 tasks were presented to users. The test produced results from multiple date sources. Analysis of the results from the task completion, task time, questionnaires and interviews showed which usability problems users were experiencing.

6.8 Interview Analysis

The following will describe what information as obtained during the patient interviews. The patient interviews can be categorized by the following sections.

1. Most useful aspect of the Turbu + app
2. Patient opinion on future implementation of Turbu + program
3. Patient opinion about warnings and reminders
4. Patient opinion about compliance page
5. Patient opinion about privacy issues
6. Patient opinion about the visibility of information
7. Patient actions when app malfunctions

Most useful aspect of the Turbu + app

During the interviews two patients mentioned that the reminder functionality was the most useful aspect of the Turbu+ app. Patients had the following statements

"Sometimes you are on holiday or you are away, or it is busy in the house and then I forget it sometimes. I think whoops. And I'd quite like to have an app that you just get a message that you take your puff. Yes, I would take it." - AD02

"It happens sometimes that I think oh you haven't taken your puff yet. And for that, I find it very useful". - AD03

Two other patients mentioned that the compliance page was the most useful aspect of the Turbu+ app. The following was stated by a patient

"It *has become an automatic action, it often happens that I take my inhaler and I lie down and that I sometimes get confused if I have taken it or not. It's probable that at times I inhale and extra time when I already had inhaled enough times. Now I would be able to monitor that".* - AD03

"I would use it; it is always useful to monitor it a bit". – AD01

One Patient mentioned that he thinks the app is more useful for others, he did not see anything particularly useful for him. The patient mentioned the following about the compliance page "You use the inhaler or you don't. You know that so I don't have to see that again". The patient mentioned the following about the reminder functionality.

"You don't expect to need the reminder functionality" - Interviewer

" For me personally no, but I can understand that there are people who would like to be reminded." CD03-

Patient opinion on future implementation of Turbu + program

About the possibility of a future implementation of all participants were positive. The following was mentioned.

"I would definitely love it", "*Just so convenient also to keep track of how often you take it", "I think it's a very good idea". - AD02*

Patient opinion about warnings and reminders

Patients were asked if they would act upon the warnings provided by the Turbo + app. All participants responded that they would act upon the recommendations given by the Turbo+ app.

Patient opinion about compliance page

Patients were asked if they would use the compliance page to monitor their inhalation pattern over a seven or 30-day period. Two Patients mentioned that they would probably not use it, three patients mentioned that they would actively use it. The following was mentioned by the patients who mentioned that they would not use the compliance page.

"That's interesting, but I think it has more value for the caregiver to look back at the past 30 days". – AD03

"Well no because I you either using that thing, or you're not using it. So you know that, so I do not have to see that again."- CD03

Patient opinion about privacy issues

All patients mentioned that they would not mind if their general practitioner was able to see their inhalation patterns. Patients were also asked if they think that it is necessary that the general practitioner should ask for permission to view patient inhalation data. One patient mentioned explicitly that the general practitioners should ask for permission first. Other patients mentioned that they understand that other patients would be wary to share their information but they would not mind allowing caregivers to view their inhalation data.

Patient opinion about the visibility of information in the web portal

Patients mentioned that it took some time to find the information in the web portal but that it would improve with time. They mentioned that the information in the web portal was very valuable. The following was stated

"*Yes well it took a while, you get used to the app and then you switch to the web portal . It looks a lot alike but it is still a different overview*".- AD03

Patient actions when app malfunctions

Patients were asked who they would contact if the Turbu+ app or device malfunctions. All patients mentioned that they would contact the manufacturer and not their general practitioner.

6.9 Survey

As mentioned users were presented with a survey. This survey gathered information about the usefulness, information quality and user interface. For the PSSUQ survey an overall satisfaction score is measured by obtaining the average of the four sub-scales of the PSSUQ. The average of questions 1 to 19 represents the overall usability. The average of questions 1-8 represent System usefulness, the average of items 9-15 represents Information Quality, and the average of items 16-18 Interface Quality.

The following results were gathered

	N	Min	Max	Mean	Std. Deviation	Variance
Overall	89	0	6	5.3146	.89944	0.809
System Quality	30	0	6	5.1714	1.04278	1.087
Information Quality	29	0	6	5.3793	0.86246	.744

Interface Quality	15	0	6	5.7000	0.48305	.233

Table 12 Questionnaire results

6.10 Conclusion

The purpose of this usability study was to determine usability problems within the Turbu+ program and determine the overall usability of Turbu+. During the think aloud sessions the results from the questionnaire showed that users experienced the application as user friendly. All users were satisfied with the system, information and interface quality. Some user however stated that they were not sure if the application was needed as they said that they generally do not forget to take their inhaler and they did not think that they would check to see their adherence through time.

Based on the goals set for this usability study we can come to the conclusion that overall the usability of Turbu+ is good. There are however a couple of usability problems that can be corrected. A list of these problems are shown in the heuristic evaluation section. Most usability problems were about consistency and visibility. These problems can be especially confusing for older patients. It is recommended that there is a consistency in language and among all platforms. This will elude confusion. Also some features were not clearly visible, this was especially clear with the swiping mechanisms. Some users were not aware that this was possible in some pages. This is likewise a key issue that can lead to confusion. Clear indicators can alleviate some of these issues. In the end during interview analysis and survey analysis all users did note that they had a pleasant experience with the system.

7 Security and Privacy

Security is also a key aspect when determining the feasibility of a mhealth device. Privacy and security are key principles of the patient physician relationship. Unfortunately, mobile-based services create a whole array of security risks compounding the privacy problem. Recent research papers address the privacy and security concerns related to internet and mobile healthcare applications (Dong and Dulay, 2006; Peyton et al., 2007; Zheng et al., 2007). Privacy threats and information security threats can be categorized into two areas (NRC, 1997; Rindfleisch, 1997).

1. Organization threats that arise from inappropriate access to patient data (i.e an outside hacker that obtains patient data)
2. Systemic threats refers to an agent within the information flow who exploits data beyond its intended use

It is important to investigate whether anonymization, pseudinymization, encryption of data and databases are required. Approaches such as the OCTAVE (Operationally Critical Threat, Asset and Vulnerability Evaluation) are used to identify security flaws within organizations.

7.1 OCTAVE

The OCTAVE approach was developed at the Software Engineering Institute (SEI) at Carnegie Mellon University. It is constructed on three core groups of principles – information security risk evaluation principles, risk management principles and organisational and cultural principles. OCTAVE is self-directed which means that people within the organisation are responsible for setting the organisation security strategy. Typically a small team from operational or business units and the IT department cooperate address the security needs of the organisation. The OCTAVE approach has been shown to be successful in in managing information security in compliance with HIPAA(Woody, 2006).

Security within and an organization has to deal various threats. These threats can come from people within the organization or from people outside the organization. Threats can also form from system problems or insecure organizational and technical practices. OCTAVE can identify the current state of security practice within the organization.

The OCTAVE method consists out of a three-phased approach with eight processes. These processes are visualized in figure 10

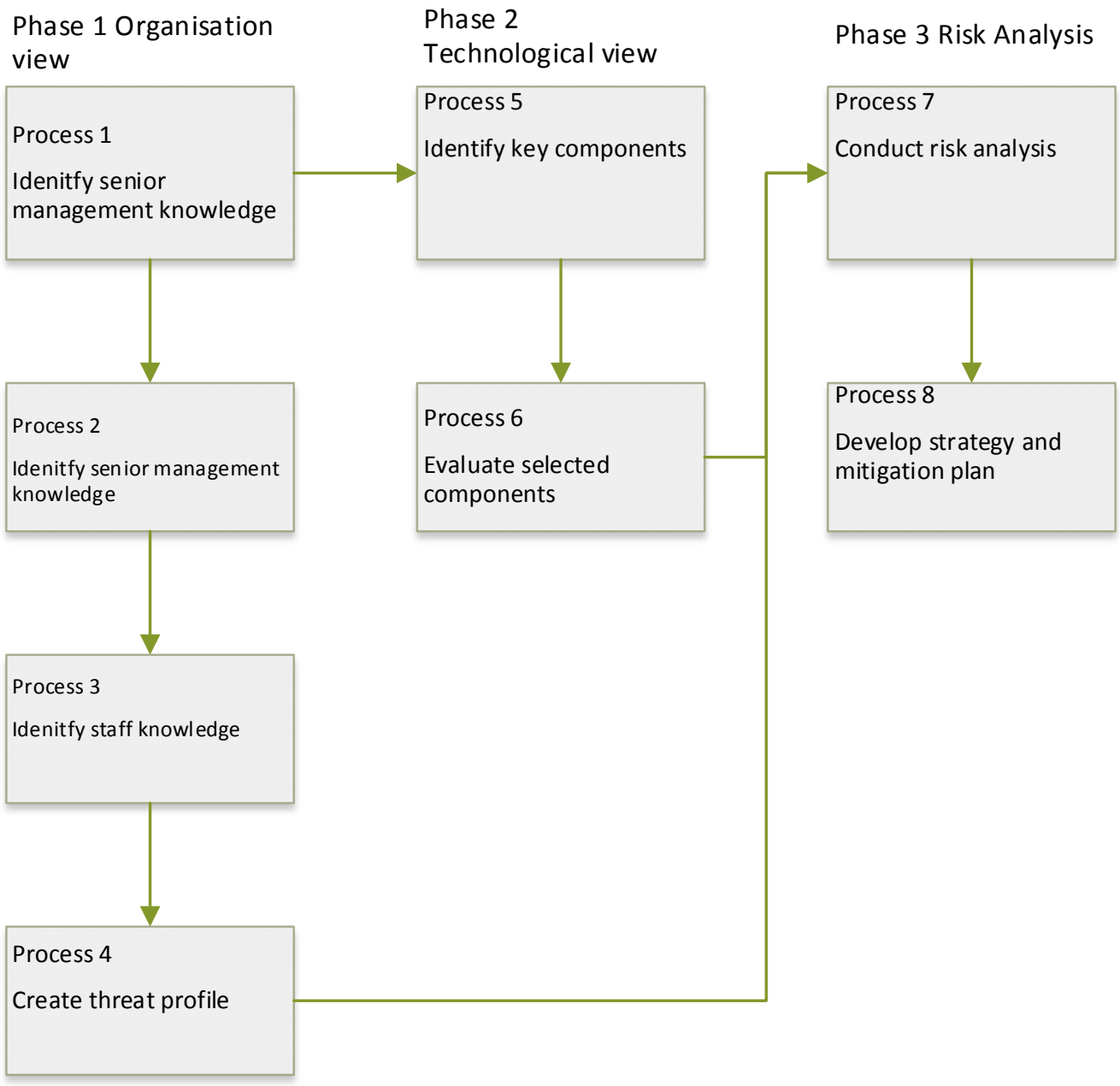


Figure 10 OCTAVE processes

Output Phase 1

- Critical assets
- Security requirements for critical assets
- Areas of concern and impact decisions
- Current security practices
- Current vulnerabilities
- Threat profiles

Output Phase 2

- Key components for critical assets
- Current technological vulnerabilities for key components

Output Phase 3

- Risk Measures
- Risks to critical assets
- Protection strategies
- Mitigation plans
- Next Steps
- Senior Management approval

7.2 Laws and Regulation

Additionally there are laws in place that help to safeguard the privacy and security of patients. It is important to investigate if the mhealth app complies with these laws. The most important laws are the following.

The most important laws are:
1. The medical devices act (Wet medische hulpmiddelen) MED DEV 2.1/6
2. The Dutch care institutions (quality) Act (Kwaliteitswet zorginstellingen)
3. The data protection act (Wet bescherming persoonsgegevens)

Medical device act

The medical devices act is based on the European Medical Devices Directive. Three definitions within this directive are adopted in the Dutch medical devices act.

A medical device is any instrument, apparatus, appliance, software, material or other article, whether used alone or in combination, including the software intended by its manufacturer to be used specifically for diagnostic and/or therapeutic purposes and necessary for its proper application, intended by the manufacturer to be used for human beings for the purpose of:

- Diagnosis, prevention, monitoring, treatment or alleviation of disease,
- Diagnosis, monitoring, treatment, alleviation of or compensation for an injury or handicap,
- Investigation, replacement or modification of the anatomy or of a physiological process,
- Control of conception, and which does not achieve its principal intended action in or on the human body by pharmacological, immunological or metabolic means, but which may be assisted in its function by such means."

A mHealth application is placed under the medical devices act:

- If the application makes a diagnosis;
- Energy is added to the human body by the application (e.g. hearing aid), or;
- If the application monitors vital body functions whereby variations are a direct threat for the live of the patient.

The Dutch care institutions Act

This act ensures that healthcare institutes give quality care to patients. Medical devices are subjected to a bevy of requirements. However, not all mhealh applications are classified as medical

devices. This act guarantees that healthcare institutes use application of a high quality, even though the application is not a medical device.

The data protection act

The data protection act safeguards the privacy of the users of the application. It contains a set of conditions for gathering data. Personal data, which is defined as data, that is about a person or can be used to identify a person (Article 1, Data protection act).

7.3 Conclusion

The Turbuplus program deals with patient information, which makes security a key issue when determining the feasibility of Turbuplus. For Turbuplus the main goal will be determining the organizational and technical vulnerabilities. Weaknesses in policy or security practice that can result in unauthorized actions but also weaknesses in technology infrastructures can lead to unauthorized access. Applying the OCTAVE framework will require an investigation into the management of AstraZeneca the manufacturer of Turboplus. OCATAVE is self-directed which means that the evaluation is led by personnel from within the organization. An analysis team will need to be formed to perform these evaluations. Senior management will need to be identified in order to determine current critical assets, security practices, current vulnerabilities, areas of concern, impact decisions and threat profiles.

By identifying and evaluating these factors risk measures, protection strategies can be made designed. It is however impossible to diminish all information risks. Concerning budget and resources one needs to prioritize. The following questions can be answered to find the most critical assets and vulnerabilities for Turbuplus

Within Phase 1 of OCTAVE the following questions need to be answered by staff

- What are the critical information related assets?
- What or who threatens each asset?
- Which assets do you need to protect?
- What is currently being done to protect these critical assets?

Within Phase 2 of OCTAVE the following questions need to be answered by staff

- How can people access each critical asset
- What infrastructure components are related to each critical asset?
- What vulnerabilities exist in your technology architecture?

Within Phase 3 of OCTAVE the following questions need to be answered by staff

- What will it mean when protection fails?
- What are the highest priority risks to your organization?
- How much protection can you afford?
- What vulnerabilities exist in your organization?
- What are the current security practices?
- Which security policies and practices need to be addressed immediately

Although Turbuplus is made for the healthcare industry Turbuplus cannot be characterized as a mhealth device. This because it does not make a diagnosis and it also doesn't measure vital body

functions or adds energy. It however is important that the application functions properly as patients might rely on the reminder functionality and the information it gives about the amount of inhalations taken.

8. Other factors

As mentioned, the acceptance but also the effectiveness of Turbuplus are key when determining the feasibility of a mhealth device. The following provides a study design that can be used to measure the effectiveness and acceptability of an mhealth device.

8.1 Effectiveness and trend of adherence

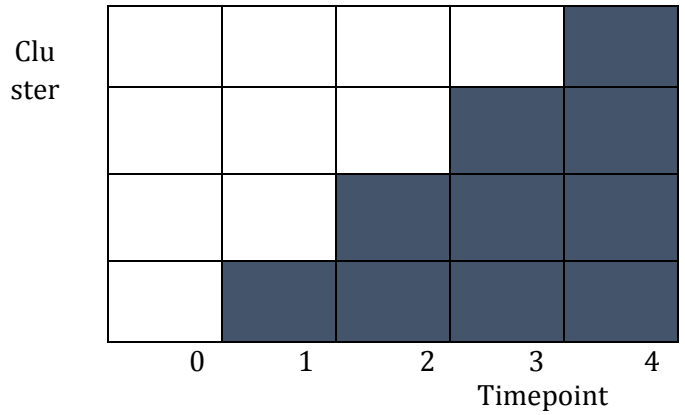
By analysing the log data within Turboplus one can measure the adherence and see if there are specific trends that can be detected. Data collection of feedback messages reminders can give information about actual use. Average daily use of intervention after 3 and 6 months will show if patients continue to use the intervention on a regular basis.

Logs that are available within Turboplus are

- Date
- Time
- Reminders
- Number of times inhaled by day/week/month

8.2 Applying study design

A randomized controlled trial (RCTs) is often considered the standard for establishing a cause and effect relationship between an intervention and an outcome (Torgerson, 2008). The stepped wedge cluster randomized trial CRCTs are being increasing used in healthcare research. The stepped wedge design can be used to evaluate interventions in routine practice and is appropriate to use when there is a lack of evidence of effectiveness. Additionally it will control time effects and maximizes statistical power (Mdege, Man, Taylor Nee Brown, & Torgerson , 2011). A way of performing this study is by using the stepped wedge design. Users would be randomly divided over three clusters. Each group will be using Turbu+ at a different point in time. Each group will consist of 12 patients with 36 users. According to the sample size calculator G* Power of Buchner, Erdfelder, Faul, & Lang (2014) a minimum of 18 users is needed to have a large effect. Both groups will consist out of COPD and asthma patients. All patients receiving the service will be trained in the use of Turbo+® and will be assisted in the initial coupling of the Bluetooth devices with the phone that they intend to use. All patients will be asked to complete a questionnaire about their knowledge of smartphone technology and mhealth applications.



Patients with COPD disease severity (GOLD I, II and III) and patients with asthma meeting the inclusion criteria at enrolment will be identified and recruited from primary care practices.

Patients can be identified against the relevant inclusion and exclusion criteria. The patients meeting these criteria will then be referred to their HCP for inclusion into the study. Only patients approved for enrolment in to the study will then be contacted and asked to provide consent. Patients with the service will be taken through their self-management plan, trained in the use of the service and asked to complete a set of questionnaires at 0, 3 and 6 months of the study. Patients can also be withdrawn at any time at their own request or at their HCP's request. Data collected from these patients will be included in the overall evaluation of the service unless the patient withdraws their consent for their data to be used in this manner.

8.2.2 Inclusion criteria (Template Research Protocol version 2013)

The following inclusion criteria can be needed in order to participate in a study.

- Patients willing and able to comply with study procedures and give written informed consent.
- Patients who have a clinical diagnosis of COPD or asthma and being prescribed
- Patients of either sex
- Patients who are current or former smokers
- Patients with the ability to communicate in English
- Patients who have reported an exacerbation in the last 12 months
- Patients who are judged by their HCP to have suitable hearing, vision, manual dexterity, ability to understand instructions, and suitable attitude towards technology to allow entry in to the study
- The patient is prescribed a medication for which the Bluetooth device is available.
- The patient has had a COPD or asthma review by their HCP in the last 12 months prior to entering the study

8.2.3 Exclusion criteria

The following are considered as criteria for exclusion from the study:

- Planning to be away for a significant part of the study without internet access
- Their HCP deems that they are unable to operate a mobile phone or they do not have access to either a mobile phone or the internet.

8.2.4 Discontinued study subjects

Users may be discontinued from the study at any time from the study. The evaluator will however determine the reason for discontinuing the study as this can provide information about the overall feasibility of the program. Potential reasons for withdrawing from the study can be

- Inability to complete the study because the subject is no longer a member of the GP practice, or because the subject has moved.
- Voluntary discontinuation
- Illness or any other significant burden as judged by the GP or investigator

Subjects who discontinue will not be replaced. A log will document who discontinued the study and why

Other study parameters

Patient characteristics:

- Gender
- Date of Birth
- Ethnicity
- Highest completed education (primary, lower secondary professional education, MBO, HAVO / VWO, HBO / University)
- COPD GOLD stadium
- Medication (type, dose, duration of use)

Study procedures

At the start of the study patient characteristics are determined by medical history

Case history:

- Gender
- Date of Birth
- Ethnicity
- Highest completed education (primary, lower secondary professional education, MBO, HAVO / VWO, HBO / University)
- COPD GOLD stadium
- Medication (type, dose, duration of use)

8.3 Statistical Analysis

Adoption

A survey based on the technology acceptance model and the theory of planned behaviour can provide answers whether users are satisfied with Turbu+ and if they intend to use the product in the future. The following are focus points that will be analysed

- Mean ±standard deviation scores to present satisfaction and intention to use
- Differences in satisfaction and intent to use scores among various patient groups (age, education) will be assessed using one-way analysis of variance (ANOVA)

Demand

Demand refers to the amount of time spent using the application. By analysing the data the usage can be determined. Differences can be measured between the various groups (age, education, etc.) in percentages of usage per time cluster.

Effect

The measurement of adherence will determine if Turbu+ proves effective. Adherence rates will be defined as the number of doses recorded by Turbu+ divided by the total number of doses prescribed during the monitoring period. The effect of dosing frequency on adherence will be evaluated by analysing dosing interval errors. These will be defined as medication doses taken at a time other than that prescribed (and for example < then? hours or >? hours after the previous dose of a medication prescribed every 12 hours).

8.4 Conclusion

The stepped wedge design can provide a way of researching the acceptability and demand among users. This is especially the case with Turboplus. As Turboplus is a mhealth application which has yet to be proven effective. Recent literature has shown that the stepped wedge CRCTs for researching interventions in health care. An integration of TAM and TPB can explain behaviour within the healthcare sector (Wu et al., 2011). By creating a survey based on these models the intent to use, intent to continue use and user satisfaction can be determined. This will provide further answers whether Turbuplus is feasible. Adherence is the key factor when determining the effectiveness of Turbuplus. By researching the dosing interval errors during the time clusters it will be possible to detect an increase or an decrease in adherence.

9 Conclusion

The main goal of this thesis was to investigate how feasibility studies can be designed for mhealth applications aimed at increasing adherence among COPD and asthma patients. A set of research questions were designed to facilitate this research. This thesis comprises a feasibility design and the execution of a usability study, which is a key factor within a feasibility study of a mhealth application.

Our first objective was to gain knowledge about asthma and COPD. This resulted in the following research questions "*What is known about Asthma and COPD", "What is the definition of mhealth and adherence?" and "What is known about mhealth and its effects on adherence"?* A literature study was performed in order to determine the definitions of mhealth and adherence and gain insight into Asthma and COPD. This provided us with the proper context to model our feasibility design. The following is a summary of our findings

Asthma and COPD are both chronic airway diseases that have similar symptoms such as poor airflow and abnormal inflammatory changes in the respiratory tract. Both diseases are treated with inhaled bronchodilators. Proper adherence and correct utilization of inhalation devices are key factor in proper treatment of these diseases. Adherence is defined as " the extent to which a person's behaviour (in terms of medications, following diets, or executing lifestyle changes) coincides with medical or health advice."(Haynes & Sackett, 1979). Our literature study revealed that many factors could influence adherence. This can be patient related factors such as forgetfulness, low motivation or disbelief in the diagnosis. But also social an economic factors such as poverty or low level of education. The most common factors were summarized in the following categories: patient related factors, social and economic factors, healthcare team and system related factors, condition related factors and therapy related factors. Mhealth has the potential to negate some of these factors. The factors that can be negated by mhealth were mostly within the category patient related factors (e.g. forgetfulness or misunderstanding of information). It became clear that the definition of mhealth is still in development. However, there are three fundamental characteristics according to Silberman & Clark (2011) that defines mhealth. It must be a device or a software, be health oriented and have mobile use.

Our second objective was to define the different concepts and assessment criteria's of a feasibility study. This resulted in the following research questions: What types of feasibility studies currently exist? What are their main characteristics or properties? Which properties and characteristics are relevant for the feasibility design of mhealth applications such as Turbu+?

To answer these questions an additional literature study was performed to determine known feasibility study frameworks. TELOS, COrETeST and the eight principles described by Bowen (2010) were identified as key frameworks for determining feasibility. With regard to scope of this research (a mhealth device to support the adherence of COPD patients) the following key aspects were identified that comprised the feasibility design: usability, privacy and security, acceptability, and demand.

The results of the literature study on mhealth for COPD patients and feasibility study design were combined in a framework that is depicted by the following table . This table outlines the focus areas

and the frameworks and their parameters on which to measure these focus areas. The feasibility of a mhealth for adherence of COPD patients device can be determined by determining whether a mhealth application complies with the focus areas.

Focus area	Frameworks / Research methods	Parameters	Description
Technology/Usability	Think aloud, Cognitive walkthrough, Heuristic evaluation	Task success	Task success measures how many tasks were successfully completed. It measures if users can successfully accomplish their goals
	Think aloud, Cognitive walkthrough, Heuristic evaluation	Task time	Task time measures the efficiency part of usability
	Think aloud, Cognitive walkthrough, Heuristic evaluation	User satisfaction	Measures patient perception of overall use
Privacy and security	OCTAVE, STRIDE	Security protocols	Specification for encryption and secures communication
	AES	Encryption techniques	Technique used for encryption
		Storage of data	Information about where data is stored
Acceptability	Stepped wedge random control trial	Perceived ease of use	the degree to which a person believes that using a particular system would enhance his or her job performance" (Davis, 1989)
	Stepped wedge random control trial	Perceived usefulness	the degree to which a person believes that using a particular system would be free from effort" (Davis, 1989).
Demand	Stepped wedge random control trial	Intent to use	the degree to which a person believes that they will use a product
	Stepped	Intent to continue use	the degree to which a

	wedge random control trial	person believes that they will use a product for a long period of time

Table 12 Feasibility study design framework

As can be seen in the framework, the first column describes the four focus areas that were identified during this research. The second column describes the frameworks that can be used to evaluate the focus areas. The third column gives a list of parameters that are related to the focus area. And the last column gives a description of the corresponding parameter.

Usability is one focus area within our framework for the feasibility design of mheath for COPD patients. Collaboration with the University Medical Centre Utrecht provided us with the ability to perform a usability study on a mhealth application for COPD and asthma patients named as Turbu+. Turbu+ is a mhealth application developed by AstraZenaca.

A usability study was performed to determine the feasibility of this application. This was done in collaboration with the University Medical Centre Utrecht. Five users were selected from a general practioner to participate in a usability study. These users were required to perform 21 tasks. Two methods were used to evaluate the usability: the think aloud method and a heuristic evaluation. Additionally, users were required to fill in a set of questionnaires and answer some interview questions. During the usability study several usability problems were identified, these were related to: visibility, lack of consistency and language. The usability problems were not severe. The think aloud sessions revealed some design issues. In some cases users were unable to locate certain functions. There was one specific task that took a considerable amount of time to complete. Furthermore, the oldest users took the longest time to complete the tasks as the youngest user needed a lot lesser time to complete all tasks. All users expressed enthusiasm about the application and stated that they believe that the Turbu+ program is a great initiative, which they would use in the future.

This usability study demonstrated that a usability study is a relevant way of determining usability and patient perception towards a mhealth device. Usability assessment is critical to the success of a mhealth device. Heuristic evaluation and the think aloud method has proven to produce useful context for determining and interpreting the usability problems related to a system's design. Heuristic evaluation is a quick and easy method to apply and is executable at rather low costs. The think aloud's strength lies in the collection of data on cognitive processing of end users and interactions with the system. Each of these methods has their advantages and disadvantages. Therefore, it is recommended using a combination of usability methods that are available.

It is also recommended to include at least four skilled usability professionals to evaluate a mhealth device. In practice the choice of an usability assessment design will depend on a number of factors such as the availability of usability reviewers, the availability of end users and of course time and financial constraints.

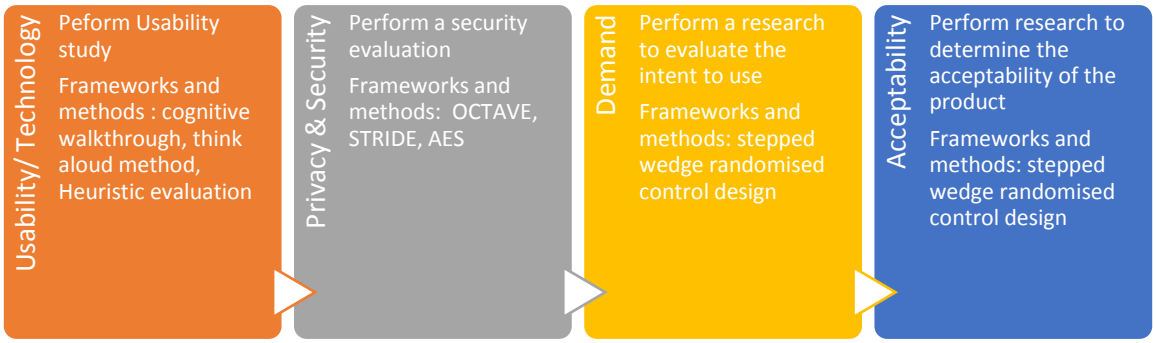
With regard to the other dimensions of our framework for the feasibility of mhealth for COPD patients, we were not able to perform practical research and apply them. In this thesis we therefore reasoned what the implications of the focus areas are if they would be applied in practice.

With regard to the focus area patient privacy and security are very important factors that can determine the feasibility of Turbu+. While we were unable to research the security practices of AstraZeneca in practice we were able to research what is needed to determine if current security practices are enough to ensure the safety and security of patient information. The OCTAVE approach can provide tools with which you can determine current critical assets as well as security vulnerabilities. The OCTAVE approach is self-directed which means that people within the organization are best suited to lead the evaluation. The first step will be to form an analysis team. This analysis team will need to collect information about important assets, threats, current organizational strengths, vulnerabilities and security requirements. Information is collected from senior managers, general staff, IT staff and managers from selected operational areas. Based on the information that was collected, threat profiles are created for the most critical assets and an approach for evaluating these assets will need to be defined. After the evaluation of all active risks, an organization can determine whether it the product is indeed secure. If this is not the case a determination must be made whether it is feasible to improve security practices as well as mitigation plans in order to reduce the risks that are currently present.

Acceptability is important when determining the feasibility of mhealth for asthma and COPD patients. Variables from the technology acceptance model and the theory of planned behavior model should be used to determine acceptability. These variables are related towards the adoption rate and demand from patients. By measuring these variables, a determination can be made about the acceptability of mhealth devises. The stepped wedged design method is an excellent way of researching these variables. The stepped wedge design provides before and after observations because of the use of time clusters. Within the stepped wedge design the number of clusters and length of steps and participants will be influenced by logistical considerations. It is recommend to have a minimum of 18 participants. The measurement of adoption should be performed by evaluating available log data in order to retrieve the actual adoption rates. The evaluation on "intention to use" should be done by developing a questionnaire based on technology acceptance model.

9.2 Recommendations

All focus areas are important when determining the feasibility of an mhealth device however some factors should be performed at the beginning of the feasibility study. We recommend starting with the usability of an mhealth device. This focus area is reasonably quick to measure and it can be measured with small amount of users. The usability problems that are detected can also be revised in a reasonable amount of time. When all usability problems are resolved, the acceptability, demand and effectiveness of the device can be investigated concurrently following the research design stated in chapter 8. By starting with usability one can be sure that all other aspects are researched on a device that has been evaluated and determined to be a user friendly device. This makes for a more accurate effectiveness and acceptability testing. The following figure illustrates the steps to be taken.



9.3 Limitations.

There are some limitations in this study. The usability test was evaluated by one person. The results may therefore be influenced by the evaluators experience and could show a form of bias. Literature states that different evaluators observe different problems. Some usability problems may not have been detected by this evaluator. Additionally, the evaluator has limited experience in the field of usability.

Another limitation in this study is related to the number of participants. This is a common problem within usability studies involving real users. Although literature states that five participants are a large enough pool for usability testing. All but one patient was over the age of 50, it could be that other usability problems would arise in younger patients. Measuring the task times was not always accurate. Some patients tend to talk more than others they were however always in the process of completing the task. Nevertheless, this might have influenced their task times.

9.4 Future research

Future research on mhealth can provide more evaluation about the concepts of the feasibility design. The concepts here were focused specifically on mhealth application for COPD and asthma patients. The focus if this thesis was on the technical and operational aspects of feasibility. A more elaborate feasibility design can be constructed that can provide a framework that can be tailored around a more broader spectrum. Additionally more feasibility studies can be conducted in practice. This will provide results about the feasibility of mhealth applications over time.

Furthermore this thesis was scoped to research the feasibility among users. However hospitals, nurses and general practioners could also be subject of research. They will also use sections of mhealth applications and it is unclear whether there is a difference between adoption by care givers and care takers.

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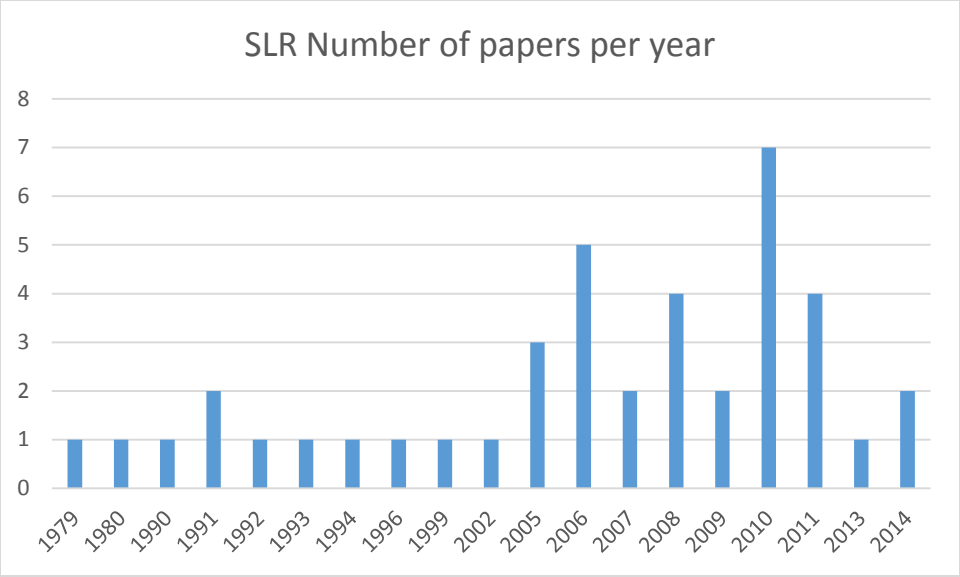
APPENDIX A _ Literature study Results

Scholar Keyword	Result	Title/Abstract	PDF available	Content
feasibility mobile health asthma adherence	8480	10	9	4 -5 not relevant
feasibility mobile health COPD adherence	4660	4	4	-4 not relevant
Feasibility,mhealth,adherence	2740	14	13	1 -3 too much focus on particular disease -9 not relevant

Scholar Keyword	Result	Title/Abstract	PDF available	Content
mhealth	48.500	1	1	1
Mobile health	4.500.00	6	6	1 -5 not relevant
Smartphone healthcare	33.400	6	5	2 -3 not relevant

Scholar Keyword	Result	Title/Abstract	PDF available	Content
Adoption mobile health	654.000	6	6	3
Implementing mobile health	669.000	4	4	0 -4 not relevant

Scholar Keyword	Result	Title/Abstract	PDF available	Content
Adherence COPD Asthma	30.200	9	9	5 -4 not relevant
adherence to medication	659.000	11	9	3 -4 too much focus on particular disease -5 not relevant


SLR Number of papers per year
8
7
6
5
4
3
2
1
0
1979
1980
1990
1991
1992
1993
1994
1996
1999
2002
2005
2006
2007
2008
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2013
2014

APPENDIX B – Interview Transcripts

Interview AD01

Interviewer- Wat is uw eerste reactie op de app zoals uw hem dan gebruikt heeft?

AD01-Uhm ik zal er even aan moeten wennen, maar ik denk wel dat het. Het moet gewoon lukken

Interviewer- Stel nou dat de zorgverlener, Dokter # of de praktijkondersteuner tegen u zegt van goh we kunnen de app gaan gebruiken in de praktijk ook voor thuis om te zien hoe dat gaat. Wat zou u daar van vinden?

AD01-Nou ja het zou voor andere mensen ook een uitkomst zijn. Want ja mensen denken hoera ik gebruik hem goed. Maar zelfs ik gebruik hem niet altijd goed. Want anders had ik er geen last van. Maar ik denk dat het voor andere mensen ook wel eens een keer wel goed is om zoiets te doen.

Interviewer- Waar denkt u dat ze dan vooral baat bij hebben met die app?

AD01-Nou om te kijken of ze de medicijnen inderdaad goed gebruiken. Want als je niet goed gebruikt krijg je er alleen maar last van. Vaker benauwd, ik zie het aan mezelf. Dat ik het meer benauwd krijg. Dan moet toch meer medicijnen gebruiken. Dat is ook niet altijd even..

Interviewer- Dus echt om de inzicht te krijgen in het eigen gebruik zegt u.

Ja

Interviewer- En u zegt het kan voor veel mensen heel nuttig zijn. Zou u het zelf ook gebruiken

AD01-Ik denk het wel, ja. Ik denk wel dat ik zou willen gebruiken. Het is altijd handig om het een beetje bij te houden.

Interviewer- Wat vindt u dan het nuttigste aan de app?

AD01-Je leert er toch wel weer wat van. Gewoon over de gebruik van je medicijnen, doe ik het wel goed. En vooral wat ik niet moet doen. Niet bij rokende mensen in huis zijn.

Interviewer- Vooral de informatie die erop staat

AD01-Ja vooral de informatie die erop staat. Mensen begrijpen het soms niet

Irrelevante verhaal over famillie

Interviewer- Even terug naar de app

ADO1-Die app is gewoon, ik denk dat die app andere mensen ook kan helpen. Ik vind het gewoon heerlijk. Ik ben ook zeer nieuwsgierig en ik wil een hele hoop leren dus ook van de app.

Interviewer- Wat vindt u het minst nuttig van de app? Is er iets bij van waar u zegt dat zit erop maar dat zou ik eigenlijk niet gebruiken.

ADO1-Ow dat weet ik nog niet. Het is voor mij nog van ik gebruik het misschien allemaal nog wel

Interviewer- Dus niet gelijk iets waarvan u zegt dat lijkt mij nou een heel overbodig onderdeel.

ADO1-Nee, maar die algemene voorwaarden. Ik vond het wel goed dat die erop staat. Want wat gaan mensen er soms mee doen. En wat als mijn telefoon gehacked word. Of kan dat niet. Ik neem aan van wel het is toch een computertje. En dan denk ik van wat als ik nou gehacked word op mijn eigen telefoon .

Interviewer- Dus u zegt het is wel goed dat dat soort dingen er op staan, want dat hoort er wel bij.

ADO1-Ja dat vind ik wel een hele belangrijke

Interviewer- Even een voorbeeld. Stel u puft 10x per dag. Veel meer dan dat u normaal doet. En de app die geeft u een waarschuwing om contact op te nemen met uw zorgverlener. Wat doet u dan?

ADO1-Ik denk wel dat ik dat doe, want dan moet het weer eens gecontroleerd worden. Van werkt het of doe ik het wel goed.

Interviewer- Dus u zou na aanleiding van zo'n bericht contact opnemen met de huisarts

ADO1-Ja of met de longarts want ik ben ook in Leiden bij het LUMC. Die houden me toch wel een beetje in de gaten

Interviewer- En als u dat bericht krijgt en het is midden in de nacht het is vier uur s'nachts. En u bent, u voelt zich niet goed, u heeft heel veel extra gepuft en u krijgt dat bericht.

ADO1-Ik kan ook de huisartsen post bellen, en die krijgen dan wel een verwijzing via de huisartsenpost. Dan denk ik dat die wel zeggen van ga jij maar eventjes naar de longarts.

Interviewer- Dus u zou in ieder geval daar wel wat mee doen met dat bericht

ADO1-Jawel, maar ik heb zelf wel in de gaten van het gaat niet goed ik moet contact gaan opzoeken. Want als ik het benauwd krijg en ik moet meer gaan gebruiken, dan zit ik al weer hier.

Interviewer- En neemt u dan contact op, op basis van hoe u zich voelt of omdat u dat bericht heeft gekregen.

AD01-Hoe ik me voel

Interviewer- Daar gaat u vanuit

AD01-Ja want als ik dus me eigen niet goed voel. Als ik niet voor mezelf zorg kan ik ook niet voor een ander zorgen. Dus ik moet goed voor mezelf zorgen

Interviewer- En dan neemt u contact op

AD01-Ja

Interviewer- Ander voorbeeld stel u moet 2x per dag inhaleren en u bent het deze week al een heleboel keer vergeten. Of u had er eventjes geen zin in. En de app geeft u het bericht "Het lijkt erop dat u deze week minder dan de helft van het aantal voorgeschreven inhalaties van Symbicort Turbuhaler heeft geïnhaleerd. Gebruik iedere dag uw medicatie zoals u heeft afgesproken met uw zorgverlener. Dit is belangrijk om uw symptomen onder controle te houden." Wat vindt u daarvan van zo'n bericht

AD01-Ik vind het wel een goede. Ik vergeet hem niet zo gauw want hij staat voor me neus dus ik denk niet dat ik hem vergeet. Maar het is wel goed dat het door gegeven word.

Interviewer- En vindt u het duidelijk de boodschap

AD01-Ja

Interviewer- En de manier waarop u aangesproken word in de boodschap

AD01-Het is wel goed dat ik erop aangesproken word. Van joh gebruik is even je medicijnen want het gaat niet goed

Interviewer- U zou het prima vinden om zo'n bericht te krijgen.

AD01-Ja want stel dat ik het een keer vergeet. Je weet het soms niet

Interviewer- Dan krijgt u in ieder geval een boodschap

Interviewer- Stel de app wil niet koppelen of niet synchroniseren met de telefoon. U heeft wel gepuft het komt maar niet in beeld op uw telefoon. Wat doet u dan?

AD01-Ik denk dat ik dan ga bellen. Ik doe iets niet goed

Interviewer- En wie zou u dan gaan bellen

AD01-Ik denk dat ik dan naar jullie moet bellen. Het komt van jullie vandaan. Ik neem aan dat Dokter # het niet weet. Ik doe het dan via het bedrijf

Interviewer- Dus u zegt ik zou dan het bedrijf bellen. Daar komt het vandaan dus die weten ook waarom het niet werkt. Dus u zou niet de zorgverlener bellen.

ADO1-Ja ik weet niet in hoever Dokter # het nog weet.

Interviewer- Ja ok prima antwoord

Interviewer- In de eerste periode zijn de gegevens zoals die verzameld worden u zag alle grafiekjes die zijn aan de patient gekoppeld dat is logisch. Die zijn in de eerste periode ook voor de zorgverlener in te zien. Dus uw huisarts uw praktijk ondersteuner die kunnen dat ook zien. Maar in de toekomst moet u als patient toestemming geven voordat de zorgverlener die gegevens mag bekijken. Wat vindt u daarvan?

ADO1-Dat vind ik wel een goede

Interviewer- Waarom

ADO1-Ik vind niet dat iemand zomaar eventjes naar mijn gegevens kan kijken. Zoals een bedrijfsarts ofzo.

Interviewer- Dus u vind het goed dat u daar actief toestemming voor zou moeten geven. En dat u zelf die keuze heeft of u dat doet of niet

ADO1-Ja ik wil niet dat iedereen zomaar mijn gegevens kan inzien. Ik wil daar zelf toestemming voor geven

Interviewer- Even een paar vragen over de website , dat we op het eind gedaan hebben. Wat vond u daarvan?

ADO1-Lekker helder.

Interviewer- U vond het duidelijk, wat vond u daar helder aan?

ADO1-Nou ik kan eens wat opzoeken, en dan staat er uitgebreid beschreven over wat is astma wat doet het en medicijn gebruik alles. Alles

Interviewer- De informatie vond u uitgebreid en duidelijk en u zou er wel naar kijken

ADO1-Ja, ik kan via het longfonds wel wat opzoeken maar daar vind ik ook niet alles. Niet over de medicijnen. Ik vond dit wel makkelijk om het even op te zoeken. Dat ik eventjes denk van hoe was het ook al weer.

Interviewer- Gebruik het al zo'n tijd eventjes terug van hoe was het ook alweer

ADO1-Ja, want ik ben een keer bij iemand geweest en die vroeg weet je wel wat er in zit in die inhaler. Ik zeg van een onstekingsremmer. Dat weet ik wel en nog wat maar dat weet ik niet uit me hoofd. En dan zeggen ze van ben je niet nieuwsgierig. Ik zeg ik ben super nieuwsgierig maar ik hoor wel van de huisarts wat er in zit. Of van andere mensen die het gebruiken

Interviewer- En dan is het nog eens leuk om het zo te bekijken. Vond u het logisch ingedeeld. Kon u de gegevens goed vinden op de website

ADO1-Ja, ik denk dat als ik het vaker ga gebruiken dat het makkelijker het gaat. Hoe vaker je op zo'n website kijkt hoe makkelijker het word.

Interviewer-De laatste vraag dit alles word nu en als het in de toekomst helemaal ingezet gaat worden dan maakt de patient daar geen kosten aan. Het is gratis voor de patient. Maar stel nou dat de dokter aan u vertelt dat het 100 euro per patient achter te schermen voor Turboplus betaald word. Niet dat de patient dat moet betalen . Maar dat achter de schermen per patient 100 euro beschikbaar is gesteld om dit mogelijk te maken Zou dat iets veranderen hoe u dan met de app om zou gaan of hoe u er naar zou kijken.

ADO1-Nee ik denk het niet. Nee ik vind geld niet zo heel erg belangrijk. Ik geef het ook weer heel makkelijk uit haha.

Interviewer- Dus dat zou niet veranderen hoe u

ADO1-Nee

Interview AD02

AD02- Ik vind de app op de mobile best gebruikersvriendelijk vind. Het is altijd wennen, je moet met een nieuwe mobiel moet je ook wennen moet je ook zoeken. Ja ik vind hem gebruikers vriendelijk. Zoeken moet je altijd even. Het is altijd even wennen

Interviewer- Dat vindt u niet vervelend

AD02- Nee, nee niet. Kijk als ik een nieuwe mobiel aanschaf dan moet ik ook alles weer even gaan nakijken.

Interviewer- Ik ga u even mondeling wat vragen stellen. Daarna krijgt u een vragenlijst die u op uw gemak op papier mag invullen.Even te beginnen met de webportal. Dus wat we als laatste hebben gedaan de website zelf. Wat vond u daarvan.

AD02- Het is eigenlijk een beetje hetzelfde als de app op de mobiel. Precies hetzelfde ook wennen. Hij is wel uitgebreid, je kunt er een hoop vinden. En het is op een website makkelijker lezen vind ik. Als dat je gebruikersvoorwaarden of adviezen moet gaan lezen via een mobieltje.

Interviewer- Kon u de informatie goed vinden op de website?

AD02- Tot op het laatste ja. Die kon ik vinden. Tot op het laatst

Interviewer- Vond u de informatie nuttig die op de website stond. Over het ziekte beeld en de andere dingen die erop stonden.

AD02- Het is altijd nuttig om te weten wat er speelt.

Interviewer- Was er iets wat u miste?

AD02- In de website?

Interviewer- Ja

AD02- Nee, nee niet. Nou dan had ik hem echt helemaal door moeten lezen.

Interviewer- Ja als u de onderwerpen had moeten doorlezen. Er is niet iets waarvan u nu dacht van he dat is nou jammer dat er daar niets over staat.

AD02- Nee want er stond duidelijk alleen over astma. En de Turbuhaler die ik heb is niet echt voor mijn astma. Dus dat is weer een ander ziektebeeld

Interviewer- Want u gebruikt hem voor de?

AD02- Ik ben heel erg allergisch en zodra ik allergisch word krijg ik het benauwd. Vandaar dat ik dus nu de symbicort gekregen heb. Maar het is niet echt een. Mijn allergoloog zei ooit het is een astmatische allergie of iets dergelijks.

Interviewer- Dus u heeft geen onderhouds dosering maar u gebruikt hem op het moment dat u hem nodig hebt

ADO2- Nee ik heb nu voor een jaar hem echt gekregen. Om te kijken of het helpt. Maar ik heb altijd periodes ook erbij dat helemaal niet benauwd ben. Dus dan zou ik hem dan eigenlijk niet hoeven gebruiken. Daar staat niets van het is alleen op astma gebaseerd deze app.

Interviewer- Dat is waar ja klopt. Even terug naar het geheel de app en alles bij elkaar. Als u zorgverlener om deze app te gaan gebruiken. U bent op het spreekuur en de zorgverlener zegt van goh we hebben wat nieuws en zus en zo is het geval. Wat zou daar van vinden?

ADO2- Ik zou het zeker leuk vinden. Fijn vinden. Ik best wel hectisch druk. En als het allemaal precies gaat zoals je werkweek. Dan neem je hem in 's ochtends en 's avonds. Maar je hebt ook wel eens met vakantie of dat je is weg bent, of het is druk in huis en dan vergeet ik hem wel eens. Dat ik denk o jee. En dan zou ik best wel een app willen hebben dat je even een melding krijgt van je moet je puf in nemen. Ja ik zou hem nemen

Interviewer- Waarin denkt u dat de app u het meest kan ondersteunen in uw behandeling? Is dat wat u daarnet noemt die herinnering.

ADO2- Voor mij in mijn geval de herinnering. Ik vergeet hem niet doorlopend maar af en toe is het wel eens van o jee vergeten.

Interviewer- Dat is voor u de belangrijkste

ADO2- Ja

Interviewer- Als u dan kijkt naar bijvoorbeeld de naleving. U kunt uw naleving terug zien. Is dat iets waar u dan ook naar zou kijken. Vindt u dat interessant

ADO2- Nou in mijn geval niet maar ik denk inderdaad dat als je astma patiënt bent en je neemt hem niet op gezette tijden in maar ook daar tussen in. Dat je dan een aanval krijgt en je neemt hem in. Dat je inderdaad kan zien van ik heb er zoveel ingenomen. Dan zou ik het zeker doen. Want je kan wel nakijken hoeveel je per dag in inhalaties genomen hebt.

Interviewer- Wat vindt u het minst nuttig van de app?

ADO2- Dan moet ik terug denken

Interviewer- U kan anders nog wel even..- Geeft telefoon aan patiënt

ADO2- Ik vind ze goed.

Interviewer- Er is niet iets van waar u zegt dat kan er wel uit.

ADO2- Nee instellingen heb je nodig, zorgplan. Ik vind het wel mooi zo

Interviewer- Is nog iets wat u zou willen toevoegen.

ADO2- Zou ik op dit moment niet weten. Wat ik hier zie wat je nodig hebt, wat je wil weten. Dat kan je vinden

Interviewer- Stel u heeft een slechte dag en u puft ontzettend veel vaker dan u normaal gesproken zou doen. En u krijgt een waarschuwing dat u teveel gepuft heeft en dat u contact moet op nemen met uw zorgverlener wat doet u dan.

ADO2- Nou contact op nemen met mijn zorgverlener

Interviewer- En als het nou vier uur 's nachts is en u krijgt die melding

ADO2- Dan zou ik, ligt er aan hoe je je voelt. Als je echt helemaal niet goed voelt dan zou ik contact opnemen met huisartsen post. Dan zou ik toch even vragen en zeggen ik heb die melding en die krijg ik nu. Ik weet niet of je midden in de nacht die melding krijgt. Wel als misschien een overdosis neemt ofzo

Interviewer- Wel als u dan op dat moment heel vaak gaat puffen

ADO2- Dan zou ik toch de huisartsen post in kennis stellen. Even vragen

Interviewer- En als u de melding krijgt maar u voelt zich niet heel erg beroert.

ADO2- Dan zou ik toch even contact opnemen om te vragen. Kijk je krijgt die melding niet zomaar. Neem ik aan.

Interviewer- Nee dan heeft u boven u maximale gepuft

ADO2- Dan zou ik toch wel even informeren. Even contact opnemen.

Interviewer- Stel u moet twee keer per dag inhaleren. Een beetje zoals die is in gesteld. En u bent het vergeten of u denk nou laat maar ik voel me wel ok ik heb er niet zo zin in. En de app geeft u het bericht dat zegt. Ik lees het even voor u voor "Het lijkt erop dat u deze week minder dan de helft van het aantal voorgeschreven inhalaties van Symbicort Turbuhaler heeft geïnhaleerd. Gebruik iedere dag uw medicatie zoals u heeft afgesproken met uw zorgverlener. Dit is belangrijk om uw symptomen onder controle te houden." Wat vindt u daarvan van zo'n bericht

ADO2- Nou is kort maar krachtig. Je bent het vergeten je moet hem nu in nemen. Je hebt afspraken die moet je wel nakomen en doe je dat niet dan verpest je jezelf denk ik.

Interviewer- Stel de app wil niet koppelen of synchroniseren met de Turbu+. Wat doet u dan?

ADO2- Dan gaan we naar de website. En dan kijken of dat via de website wel kan?

Interviewer- En u komt er helemaal niet uit u wilt met iemand contact opnemen. Met wie zou u dan contact opnemen.

ADO2- Nou met iemand van de website zelf, er stond ergens bij. Ik weet het niet moet ik even zoeken. Nummer van het bedrijf. Patient is opzoek naar het nummer gaat naar het nummer. Gaat naar naleving,advies. Bij de vragen was ie. Wat doe ik als hij niet werkt. Je kan een mail sturen of je kan belllen.

Interviewer- In de eerste periode zijn de gegevens die op de website staan ook in te zien voor de zorgverlener. Als zo meteen de grote studie gaat lopen hun gegevens kunnen direct door de zorgverlener ingezien worden. Maar de bedoeling is dat in de toekomst de patient toestemming moet geven voordat de zorgverlener die gegevens mag inzien. Wat vindt u daarvan?

ADO2- In mijn geval vind ik het niet zo'n probleem.

Interviewer- Vindt u het gek dat u er toestemming voor moet geven. Of vindt u het logisch

ADO2- Nee ik vind wel dat het logisch is. Kijk ik werk niet meer. Ik vind het niet prettig dat zeg maar twintig jaar geleden dat mijn hele medische gegevens voor "iedereen" zichtbaar zou zijn. Maar op dit moment is het voor mij geen probleem

Interviewer- U zou daar wel toestemming voor geven

ADO2- Ja wat kun je er mee

Interviewer- De Turbu+ word nu en in de toekomst kostenloos aangeboden aan patiënten. Dus die maken daar zelf geen kosten aan. Als de zorgverlener vertelt aan u dat eigenlijk dit 100 euro per patiënt kost om dit te kunnen aanbieden. Dit hele programma dat u daar gebruik van kunt maken. Zou dat iets veranderen aan hoe u naar de app kijkt. Als u dat zou weten

ADO2- Wat bedoelt je? Of ik bereid zou zijn om dat geld te betalen.

Interviewer- Nee de patiënt hoeft dat geld sowieso niet te betalen. Maar zou het iets veranderen in hoe u hem zou gebruiken. Of hoe u ermee zou werken op het moment dat u zou weten dat daar dus ergens achter schermen 100 euro per patiënt voor betaald word.

ADO2- Dat is wel een heleboel geld. Kijk je kunt ook je alarm zelf zetten op je mobiel . Daar hoef je in principe geen app voor te hebben. Ik denk voor mensen die het heel benauwd hebben en gewoon veel meer inhaleren dat wat ik doe. Daar zou ik het

dan eerder voor zien dan voor mij. Ik zou het veel geld vinden. Dan vraag ik me af of dat. Het zijn een heleboel mensen die dat gebruiken symbicort.

Interviewer- Heeft u nog suggesties om de app te verbeteren.

ADO2- Nee, kijk als ik in een app ga en ik wat ik al zei je zit er net in. Je moet hem toch proberen. Ik vind hem logisch gebruiksvriendelijk. Misschien als je met dingen komt van zou dat erin moeten misschien dat ik dan zeg van dat zou ook handig zijn. Maar voor mij zelf nee.

Interview - AD03

Hoe zou je reageren als de zorgverlener tegen je zou zeggen, nou ik wil dit graag gaan gebruiken. Wat zou je daarvan vinden?

> *AD03- Alleen maar handig ja ook om bij te houden hoe vaak je het inneemt, is misschien ook wel goed om te weten. Ook eh ja het is alleen maar om je te helpen en zo kan de zorgverlener ook natuurlijk vinden van werkt zo'n medicatie wel goed genoeg om moet de inhalering omhoog dat soort dingen.*

Waarin zou de app je het meest kunnen ondersteunen als je hem zou gebruiken, al je ziet wat de functionaliteiten zijn wat erop zit?

> *AD03- Ja bijhouden zelf ook, uhm ik het is een automatische geworden. Ik heb ook heel vaak dat ik hem heb ingenomen ga ik liggen en dan denk ik heb ik hem nou ingenomen of moet ik hem nou als nog doen. Dan kan het best eens gebeuren dat ik hem nog een keer inneem terwijl dat helemaal niet moet. Wat dat betreft kan ik dat bijhouden. En ook meer met dat alarm erbij op wat meer regelmatige tijden te gaan doen. Dat varieert nog weleens.*

Dus dat zou een beetje ritme geven

> *AD03- Ja*

Wat vind je het minst nuttige van wat je gezien heb wat de app kan? Is er iets van waar je zegt dat zou ik niet gebruiken of waarom zit dat erin.

> *AD03- Nee niet echt, ik denk dat alles wel erg handig is om bij te houden constant. En ook wat ook gezegd is dat er berichten gestuurd kunnen worden als je teveel neemt. Dat is ook wel ja zo staat de dokter ook meer in aanraking met wat je precies doet.*

Het is nu in de begin periode, nu er hiermee gestart word zegmaar nog zo dat de zorgverlener automatisch kan meekijken wat er dus gepuft word. Dus wat er in de webportal staat, in de toekomst is het de bedoeling dat de patient daar toestemming voor moet geven voordat de zorgverlener dat mag zien.

> *AD03- Ja dat ik denk dat het per persoon varieert. Kijk mij maak het niet van mij mag die lekker meekijken en ik ben er niet zo moeilijk in. Maarja er zullen vast mensen die zullen daar wel wat moeilijker over doen qua privacy dingentjes enzo. Kijk mij maak het echt he nee, ik vind het alleen maar handig. Het helpt je alleen maar*

Dus jij zou daar wel toestemming voor geven dat de zorgverlener kan meekijken?

> *AD03- Ja ik zou daar wel toestemming voor geven*

Stel je puft heel veel keer per dag, veel meer dan normaal. En de app geeft een waarschuwing waarin staat neem contact op met de zorgverlener want u heeft veel meer gepuft dan u eigenlijk zou moeten doen. Wat zou u dan doen?

AD03- Nou contact op nemen met de zorgverlener, want dan is het ook dan geeft die app aan der is iets mis met jou of met de medicatie dus daar moet gewoon wat aan gedaan worden. Het word niet voor niets aangegeven.

En als het nou 4 uur 's nachts is

AD03- Dan word het niet direct, maar de eerst volgende ochtend.

Dan zou je even wachten tot het kantoor uren zijn , en dan

AD03- Nou ik moet wel zeggen ik heb wel een keertje, ik heb ook klaplongen gehad zegmaar door astma en toen had ik eigenlijk natuurlijk wel met de huisarts (lachen) en toen heb ik ook gewacht tot de volgende ochtend. Dus wat dat betreft.

Dus misschien een beetje opgeleide van hoe erg de klachten zijn dan

AD03- Ik denk dat als ik weer wat pijn in mijn borst krijg dat toch wel zeg ik ga eventjes naar huisartsen post

Stel je moet 2 keer per dag inhaleren wat je normaal ook doet, en je bent het een heleboel keer vergeten, of je had er deze week niet zoveel zin in geen aandacht voor. En de app geeft u het bericht dat zegt. Ik ga het even voorlezen "Het lijkt erop dat u deze week minder dan de helft van het aantal voorgeschreven inhalaties van Symbicort Turbuhaler heeft geïnhaleerd. Gebruik iedere dag uw medicatie zoals u heeft afgesproken met uw zorgverlener. Dit is belangrijk om uw symptomen onder controle te houden." Wat vind je daarvan van zo'n bericht

AD03- Eigenlijk wel handig want je word eigenlijk en beetje op je vingers getikt van joh ja het is wel echt nodig. Ik vind het alleen maar handig

En de manier waarop je word aangesproken in het bericht

AD03- Ja netjes tis niet, het is gewoon een herinnering

Stel de app will niet koppelen of het wil niet synchroniseren. Wat doe je dan?

AD03- Als ik het meerdere keren geprobeerd heb?

Ja je hebt het al een aantal keer geprobeerd en ja als je gaat puffen dan registreert die het niet en je hebt een gevoel van het werkt allemaal niet wat doe je dan.

AD03- Ik denk in eerste de app even opnieuw erop doen zegmaar , kijken of het daar misschien aanligt. Dat die bij downloaden verkeerd gegaan is. En anders als het echt nog niet werkt contact opnemen en vragen ik krijg hem niet aan de praat. Hebben jullie een idee

Met wie zou je dan contact opnemen?

AD03- Hoe heet dat, dat is geen makkelijke naam.

Met het bedrijf?

AD03- Met het bedrijf van wat het uitgegeven heeft.

De webportal waar we daarnet ook naar gekeken hebben. Wat vind je daarvan?

AD03- Ik vind dat makkelijker zelf, wat overzichtelijker en wat uitgebreider toch nog wel. Kijk daar kan je wel de informatie vinden natuurlijk. Maar ik zou dat alsnog op mijn telefoon op gaan zoeken. Dus zou je dat net zo goed in de app kunnen doen zegmaar. Dan je heb je het allemaal op één dingetje staan in plaats van dat je weer.

En het feit dat daar langer terugkijk mogelijk is. Is dat wel gewoon meerwaarde.

AD03- Dat is interessant, maar ja ik denk dat het voor de zorgverlener meer waarde heeft om alles terug te kunnen zien van de afgelopen 30 dagen. Omdat het voor mij als ik gewoon weet op een dag van ok 2 inhalaties of op zaterdag een keertje 3, dan heb ik zoiets van ok duidelijk.

Dus je zou de webportal minder gebruiken en de app meer gebruiken

AD03- Ja dat weet ik wel zeker

Kon je de informatie wel goed vinden in de webportal?

AD03- Ja nou ja het was eventjes kijken, je bent in een keer die app gewent en dan ga je in één keer naar. Het lijkt wel op elkaar maar toch is het een ander overzicht. Dus daar moet je wel eventjes naar zoeken

Vond je de informatie die er instond over het ziekte beeld wel nuttig.

AD03- Het ziektebeeld heb ik natuurlijk eventjes doorgespit. Het is wel handig om heel goed door te nemen wat je zelf hebt. Je wilt toch wel duidelijk hebben van waar leef je mee

Zou je het een keer lezen

AD03- Ik zou het zeker een keer lezen , ja het is alleen maar interessant voor jezelf natuurlijk.

Vond je de webportal logisch ingedeeld. De indeling was een beetje anders dan in de app.

AD03- Ja het was wel logisch ingedeeld. Maarja de app vond ik toch makkelijker werken op een of andere manier. Het is en sneller want dat staat natuurlijk in de app al. Dat gaat via het internet. Maar opzich het menu ziet er vrijwel hetzelfde uit.

Dus dat is wel fijn dat je niet in één keer iets heel anders krijgt dan wat je op de app ziet.

Heb je nog suggesties van dit zou wel beter kunnen?

AD03- Nee ik vind het eigenlijk wel handig zo, ook gewoon dat je hier bijvoorbeeld ziet(zit in naleving). Hoeveel heb je in de ochtend genomen, hoeveel heb je in de avond genomen? Dat je dat gewoon zo alles bij kan houden. Vooral die herinnering daar ben ik wel een fan van.

Een laatste vraag. De Turboplus straks inderdaad in de praktijk gebruikt gaat worden dan is dat kostenloos voor patienten. Dus dan word dat vanuit de zorgverlener word dat aan de patient aangeboden. De patient hoeft daar niets voor te betalen aan het begin niet aan het eind niet. Maar stel nou dat de zorgverlener op moment van starten zegt nou per patient kost dit 100 euro. Niet dat de patient dit moet betalen maar dat jij weet van ergens achter de schermen word er 100 euro beschikbaar gesteld zodat ik deze app kan gebruiken. Zou dat iets veranderen van hoe je naar de app kijkt. Begrijp je de vraag

AD03- Het is een ingewikkelde vraag. Ik moet eventjes. Ja nou ja kijk het is tuurlijk sowieso dat die app erbij komt is echt heel handig. Maar die puffer zelf zijn ook niet goedkoop. Als je eigen risico hebt is toch 50 euro per puffer.

Je hoeft het dus niet te betalen

AD03- Nee maar dat bedoel van er gaat sowieso best wel wat geld om met dat astma medicatie en het is echt iets dat alleen maar gaat helpen om duidelijkheid te krijgen in hoe mensen hun medicijnen innemen en of het werkt of niet werkt. Of mensen toch iets omhoog moeten gaan, ik zou zeggen van ja tis wel een goeie investering wat dat betreft. Het zou geen ander beeld van mij krijgen. Kijk ik vind het nog steeds een handige app en ik zal het echt wel gaan gebruiken, maar kijk mijn puffer staat op mijn nachtkastje hij beweegt niet. Ik zou er niet zuiniger mee doen.

Interviewer- Hoe zou uw u reageren als uw zorgverlener zou zeggen van nou we gaan de app gebruiken? Die stelt aan u voor om dit te gaan doen. Stel nou dat die tijd aanbreekt, en dat ze inderdaad zeggen van nou we willen graag met u met die app gaan werken wat vindt u daar van.

CD01-Ik vind het wel een heel goed idee, en ik denk dat Dokter # er ook wel voor te vinden is. Dus..

Interviewer- Waarom vindt u het een goed idee?

CD01- Ik denk dat als je hem geïnstalleerd hebt, en je krijgt een belletje dat je dan.. Het komt bij mij best nog wel eens voor dat ik denk owja dat heb je nog niet gedaan. En daarvoor vind ik het toch wel handig. Ik denk dat het wel goed is.

Interviewer- Dat u een herinnering krijgt.

CD01- Ja en het op tijd ook doet.

Interviewer- Wat vindt u het nuttigst van de app is dat ook de herinnering. Of is dat wat anders.

CD01- Herinnering wel heel belangrijk, en of je inhaler wel goed werkt. Want dat krijg je dan ook als je het niet goed gedaan hebt. Soms moet ik wel eens bij denken heb ik wel ver genoeg geinhaleerd. Want je proeft het niet hé.

Interviewer- Nee, je wilt echt die klik horen en de bevesting op de app dat je het echt gedaan hebt.

CD01- Ja of ie het echt wel gedaan heeft vind ik wel heel belangrijk.

Interviewer- U zou ook in die zin terugkijken naar wat er bij de naleving staat, naar die cijfertjes dat u kan zien of ie wel gewerkt heeft.

CD01- Ja

Interviewer- en dan in combinatie met de herinnering.CD01– Ja ja. Wat vindt u het minst nuttigst van de app? Van wat u gezien heeft

CD01- Ik zou dus niet al mijn ziektebeelden gaan bekijken van als ik hier last van heb. Dat hele verhaal dat zo ben ik dan niet.

Interviewer- Daar zou u geen gebruik van maken

CD01- Nee, of je moet nou heel erg benauwd hebben, maar zo erg heb ik het dan niet. Misschien wel maar ik zou dat niet helemaal na gaan zitten pluizen.

Interviewer- Stel u puft heel veel extra omdat u heel erg benauwd bent. En de telefoon heeft u een berichtje waarin staat dat u teveel gepuft heeft en dat het verstandig is om contact op te nemen met uw zorgverlener wat doet u dan.

CD01- Nou het is me nooit overkomen dus, ik zou tot de volgende dag wachten. Kijken of het dan goed gaat. Ik neem niet zo snel contact op denk ik.

Interviewer- Uw zou het ter kennis lezen, even wachten hoe u zich voelt. Als u de volgende dag toch nog

CD01- Dan zou ik misschien wel contact op nemen

Interviewer- Als u het bericht midden in de nacht krijgt?

CD01- Dan is het wel een beetje angstig. Maar nee ik zou geloof ik niet gelijk contact opnemen

Interviewer- Stel u moet twee keer per dag inhaleren. Een keertje in de ochtend, een keertje avond en u bent het al tijdens de week een aantal keer vergeten, of u had er geen zin in. In ieder geval u heeft het een aantal keer niet gedaan en de app geeft u een bericht waarin staat. Ik ga het letterlijk voor u voorlezen. "Het lijkt erop dat u deze week minder dan de helft van het aantal voorgeschreven inhalaties van Symbicort Turbuhaler heeft geïnhaleerd. Gebruik iedere dag uw medicatie zoals u heeft afgesproken met uw zorgverlener. Dit is belangrijk om uw symptomen onder controle te houden." Wat vindt u hiervan zo'n bericht

CD01- Wel goed. Daar moet je je wel aanhouden vind ik. Dus

Interviewer- Is het duidelijk

CD01- Ja

Interviewer- Stel de app wil niet koppelen of niet synchroniseren. U bent mss naar het buitenland geweest u bent terug en nog steeds is ie niet gesychroniseerd. Wat doet u dan? Wat zou u dan doen?

CD01- Ik zou proberen opnieuw in te stellen. Of ik zou de hulpverlener vragen hoe het zit.

Interviewer- Wat bedoelt u met de hulpverlener

CD01- De assistent van de dokter

Interviewer- Dan zou u eventjes bellen

CD01- Ja van hoe kan dat nou

Interviewer- Heeft u suggesties om de app te verbeteren. Zijn er dingen waarvan u zegt nou dat zou ik anders doen.

CD01- De vragen op de papiertjes dat u mij voorgelegd heeft zou ik liever overeen hebben op die app. Dan is het makkelijker zoeken denk ik. Maar dan word het natuurlijk wel een uitgebreide

Interviewer- En als u de app thuis gebruikt, en als u dan kijkt waar de dingen staan. Uiteindelijk heeft u het wel allemaal gevonden.

CD01- Jawel, maar ik zou wel blijven zoeken.

Interviewer- Is het dan zo dat u wel vond dat het op een logische plek stond. OF zijn er dingen van waar u zegt, dat zou ik op een andere plek zetten of meer nadruk op leggen.

CD01- Ja, maar hij blijft wel zo de vragen over de app

Interviewer- De vragen blijven zo het gaat met name om of u thuis straks met die app kan werken dat u het kan vinden. En nu waren er een aantal dingen waar u meer moeite mee had om te goede plek te vinden waar het stond. Zijn er dingen waarvan u zegt nou dat vind ik moeilijk te vinden.

CD01- Dat vind ik lastig te zeggen, want nu weet ik niet meer goed wat.

Interviewer- U mag ook terug in het menu kijken hoor. Waar zoekt u nu naar

CD01-

Zit in het menu, Dit moest ik dus hebben.

Zorgplam. Ik zou wel doorblijven gaan om te zoeken, ik zou er wel uitkomen

Interviewer- Als u het kopje zorgplan ziet wat verwacht u dan?

CD01- Nou ja het zorgplan, hoe het met de inhalator gaat en dat soort dingen

Interviewer- Mag ik tussendoor een vraag stellen was het duidelijk dat je in het zorgplan naar meerdere paginas kon toegaan.

CD01- Hoe bedoel je zo, owja medische gevens, ow dat is wel handig

Interviewer- Dat was u niet direct opgevallen dat je pijltjes kon gebruiken om naar een andere pagina te gaan

CD01- Nee, dat ik die moest gebruiken. Ow is eigenlijk wel logisch

Interviewer- Nou het is maar hoe je het ervaart

CD01- Ja ik denk dat je er wel uitkomt, als even goed nadenkt en je hebt een paar keer gedaan. Het is nu nog allemaal vreemd met de vragen enzo.

Interviewer- Dat is inderdaad ook het geval. Wat de bedoeling is dat het zo snel mogelijk duidelijk is voor de degene die het gebruikt wat waar staat.,

CD01- Ja zo is het. Maar ik denk niet dat je er elke dag op kijk toch. Als je wat wil weten

Interviewer- Ligt er een beetje aan hoe je het gebruikt, het misschien niet dagelijks zijn.

Interviewer- Bij advies, daar heeft u ook een aantal keer gekeken wat verwacht u daar te vinden.

CD01- Dat advies van…. Leest een advies voor- "Het lijkt erop dat u deze week minder dan de helft." Ok dan geven ze advies dat je eigenlijk beter gebruik moet maken.

CD01-Ja ok. Nou herinnering is wel duidelijk. Tijd verzetten is ook wel duidelijk

Interviewer- Nog even over de website waar we net op waren wat vindt u daar van?

CD01- Mooie website , groot wel veel berichten. Ja ik geloof wel dat het een goede uitleg is. Dus die kan ik ook op mijn laptop zetten.

Interviewer- Ja als u in het programma zit dan zit de hele website bij.

Interviewer- Kon u de informatie goed vinden op de website.

CD01- Ja ik denk ook dat het een gewenning moet zijn. Zo is het ook met het appen met mijn kleinzonen dat gaat nu goed. Dus ik denk dat het net zo is.

Interviewer- In de eerste periode zijn de gegevens die op de website staan ook in te zien voor de zorgverlener. Als zo meteen de grote studie gaat lopen hun gegevens kunnen direct door de zorgverlener ingezien worden. Maar de bedoeling is dat in de toekomst de patient toestemming moet geven voordat de zorgverlener die gegevens mag inzien. Wat vindt u daarvan

CD01- Ik vind het eigenlijk wel goed. Ik denk dat de dokter of zorgverlener daar ook veel aan hebben

Interviewer- Wat vindt u ervan dat u daar actief toestemming voor moet geven.

CD01- Ik zou niet weten waarvoor je het niet zou doen.

Interviewer- Vindt u het nodig om toestemming te geven

CD01- Ik vind het eigenlijk niet, ik vind dat de dokter dat gewoon zou moeten zien. Als je bloed prikt komt dat ook gewoon bij de dokter

Interviewer- Laatste vraag als de turboplus straks in de praktijk gebruikt gaat worden. Dan word hij gratis aan de patient verstrekt die kunnen daar gratis gebruik van maken. Maar stel

nou dat de zorgverlener aan u vertelt dat het 100 euro per patient achter te schermen voor Turboplus betaald word. Veranderd dat iets hoe u met de app zou omgaan, als u dat wist.

CD01- Dus het kost honderd euro per jaar,

Interviewer- 1x per patient 100 euro

CD01- Ja we betalen al zoveel aan de ziekenfonds

Interviewer- U hoeft het niet te betalen dit word achter de schermen betaalt voor dit programma. Heeft dat invloed over hoe u met de app zou omgaan

CD01- Nee.

Interview-CD03

Interview- We zullen beginnen met de webportal, dat is het stuk dat we als laatste hebben gedaan. Wat vond u daarvan?

CD03- Ik vond het ja je moet even weten hoe het werkt natuurlijk, maar ik vond het wel vrij overzichtelijk.

Interview- Kon u de informatie goed vinden?

CD03- Ja, als ik met dat pijltje naar beneden ga dan .. (onhoorbaar)

Interview- Als u op die manier kijkt of er meer staat dan kon u het wel goed vinden

CD03- Als je effe de link aangeeft, de link legt dan eh, maar als je dat een keer gedaan hebt of twee keer, dat je dat de volgende keer natuurlijk niet meer vergeet. Neem ik aan

Interview- U heeft het gevoel dat als u het één keer gezien heeft dat u het daarna ook wel weet.

CD03- Ja

Interview- Vond u het ook nuttig wat erop zat

CD03- Ik vond het wel nuttig ja, Wat is COPD dat word dan gezegd dat je dat hebt. Dat is een longaandoening. Je haalt er toch wel wat meer informatie uit.

Interview- Zou het lezen, wat er aan informatie. U bent er al doorheen gescrolled. Zou het doorlezen

CD03- Ja ik zou het wel doorlezen ja

Interview- Vond u de webportal ook logisch ingedeeld. Met die tabjes en het menu

CD03- Ja, voor een leek zoals ik ben dan ja. Ik vond het er wel aardig uitkomen.

Interview- Als uw zorgverlener nou zou voorstellen aan u om in de toekomst de app te gaan gebruiken echt voor thuis. Wat zou u daarvan vinden?

CD03- Ik zou geen bezwaar tegen hebben. Kijk het maakt mij niet uit of ik het nou zo doe of dat het geregistreerd word dat eh. Kijk als je daar een ander mij helpen kan om informatie in te winnen.

Interview- Nou het gaat vooral voor u zelf.

CD03- Nou dat maakt me dan niet uit of ik dat ding bij me heb of niet.

Interview- Zou u het handig vinden als u de app had en het word geregistreerd dus u kan terugkijken. Zou u dat handig vinden of zegt u nou daar zou ik eigenlijk niet naar kijken.

CD03- Nou nee want ik, kijk je gebruikt dat ding of je gebruikt hem niet. Dus dat weet je, dus ik hoef dat niet terug te zien.

Interview- U gaat dat niet terugkijken.

CD03- Nee

Interview- Wat vindt u het handigst van de app als u hem zou hebben thuis. Wat zou u er handig aan vinden. Of zou u hem op uw telefoon zetten en verder niet meer naar kijken.

CD03- Nee dat geloof ik niet. Maar ik neem aan dat een ander daar wat mee kan. Denk ik. Een ander

Interview- Nou het is dus zo dat met uw toestemming de zorgverlener ook de informatie kan bekijken met uw toestemming. En dus ook die tijd terug kan zien. Dus dat is inderdaad de tweede kant

CD03- Het is alleen natuurlijk als je ergens bent, kijk als dat om 1 uur in moet nemen en dat kan natuurlijk ook alle drie (of om 3, *slecht hoorbaar*) worden. Ik bedoel eh daar kan je dus nu (onhoorbaar). Dat is dus nu niet mogelijk dan gaat de dokter zeggen van eh.

Interview- De app gaat het zeggen die gaat u een bericht sturen.

CD03- Nou ja goed, hij heeft natuurlijk dan die informatie dat je niet altijd

Interview- Netjes op tijd inneemt

CD03- Nee

Interview- U krijgt dan ook een herinnering van de app waarin staat let op u heeft nog niet ingenomen vandaag. Wat vindt u daarvan als u dat krijgt?

CD03- Ja ik zelf vergeet het natuurlijk niet

Interview- U neemt het altijd op vaste tijden en u vergeet het eigenlijk niet

CD03- Zoveel mogelijk op vaste tijden. Maar bijvoorbeeld als je dat normaal om tien uur doet ik noem maar effe een zijstraat 's avonds. En je gaat om acht uur naar bed dan neem ik hem om acht uur. Dat bedoel ik. Dan ga ik niet de wekker om tien uur dat ik weet ik veel he ik moet effe gaan lurken aan dat ding.

Interview- U verwacht dat u die herinneringen dus ook niet nodig heeft?

CD03- Voor mij persoonlijk niet, maar ik kan best begrijpen dat er mensen zijn die daar graag aan herinnerd willen worden. Kijk als mijn verstand een klein beetje achteruit gaat en ik hoor dat piepje dan denk ik hé er is wat aan de hand.

Interview- Dan zou u het wel handig vinden

CD03- Daar vind ik het wel handig voor. Maar zolang jij bij je volle verstand bent neem ik aan dat je dat zelf wel weet.

Interview- Wat vindt u het minst nuttig van de app van wat u gezien heeft. U heeft natuurlijk een heleboel dingen gezien. Zijn er nou dingen van waar u zegt dat dat er nou waarom dat er nou op zit.

CD03- Nee, niets dat ik zeg dat heb geen zin. Ik bedoel het staat er niet voor niets op neem ik aan. Als het geen zin zou hebben dan zet je het er niet op.

Interview- Dat hoop je dan maar hé

CD03- Of je moet je niet goed verstaanbaar

Interview- Zou u de app aan andere mensen aanbevelen.

CD03- Ja

Interview- Dus als er mensen in uw omgeving zijn die zeggen van ik vergeet hem nog weleens

CD03- Dat bedoel ik, dus dat wat ik net zei van als je een klein beetje van het pad af bent ofzo dan is een herinnering altijd goed natuurlijk.

Interview- Stel u puft veel vaker dan dat u normaal zou doen omdat u zich niet goed voelt en u gaat extra pufjes nemen. U krijg dan een waarschuwing dat u teveel gepuft. Hij geeft een waarschuwing dat u contact opnemen met de zorgverlener. Wat zou u dan doen

CD03- Dan zou ik effe bellen van ik had het benauwd ik heb er zoveel genomen en ik krijg een waarschuwing.

Interview- Ja dus ik bel nog even

CD03- Ik bel nog effe. Dan zou hij wel zeggen dat ik mijn kop onder de kraan moet houden ofzo.

Interview- Zegt ie dat

CD03- Dat weet ik niet , ik zeg ook maar wat

Interview- En als het nou midden in de nacht is en u krijgt zo'n bericht

CD03- Als het midden in de nach is en ik krijg zo'n bericht. Ja ik denk dat ik dan zou wachten tot de ochtend. Ik ga geen 112 bellen om eh

Interview- Omdat u een beetje benauwd bent

CD03- Nee

Interview- Stel u moet twee keer per dag inhaleren en u bent het toch een aantal keer vergeten. Of u had er de afgelopen week niet zoveel zin in. U gaf al aan dat zal niet zo gauw gebeuren. Maar stel dat en de app geeft het bericht ik ga het even voorlezen. "Het lijkt erop dat u deze week minder dan de helft van het aantal voorgeschreven inhalaties van Symbicort Turbuhaler heeft geïnhaleerd. Gebruik iedere dag uw medicatie zoals u heeft afgesproken met uw zorgverlener. Dit is belangrijk om uw symptomen onder controle te houden." Wat vindt u daarvan van zo'n bericht. Als u dat krijgt

CD03- Ja maar beetje opletten dat de nodige inhalaties neemt op een dag. Je bouwt een beetje een achterstand op dan. Hoewel ik als ik dat van mijn eigen praten ook als ik het dan benauwd zou hebben. Dan zei dan die dokter pakweg een jaar terug dat ie zeg van nou je mag er dan meer dat staat dan weer niet bij een bijsluiter ofzo. Kijk ik krijg van de doktersadvies 2x per dag inhalen. Maar als je het benauwd hebt dan zegt ie dan mag je meer. Maar dat vind ik dan weer raar dat het daar weer dan niet opstaat. Want dan zou je in wezen tis dat ie dat zegt anders ga je dus niet meer. Toch

Interview- Nee dat begrijp ik . Dat is goed omdat ergens te hebben staan. Dat u dat weet, dat u dat mag.

CD03- Ja kijk dat is ook weer dat je daar zo'n app voor hebt.

Interview- Dan zou daar wel kijken?

CD03- Dan zou ik daar kijken ja

Interview- Dus als ik het goed begrijp dan heeft u met name het informatie gedeelte van de app. De informatie op de website en de vragen dat is waar u zou kijken voornamelijk. Daar zou u de app voornamelijk voor gebruiken

CD03- Ja

Interview- Dat bericht dat ik net aan u voorlas, de manier waarop u in dat bericht wordt aangesproken wat vindt u daar van. Wat ik net aan u voorlas

CD03- Een waarschuwing is een waarschuwing ik bedoel daar moet je wat meegaan doen dan. Ik krijg geen waarschuwingen zomaar. Daar ga je wat mee doen

Interview- Stel de app will niet koppelen of synchorniseren, wat zou u dan doen?

CD03- De app doet het niet hé

Interview- Ja de app doet het niet, u puft wel maar u ziet er niets van terug in de app.

CD03- Wat zou ik dan doen. Er zal hier wel een telefoonnummer staan ofzo. Kijken of de internet goed is. Ja noem maar wat.

Interview- En wat voor telefoonnummer verwacht u dat er instaat

CD03- Nou misschien van het bedrijf wat ik net

Interview- Wat het gemaakt heeft, daar zou u contact mee opnemen

CD03- Ja

Interview- Ik zei net al de zorgverlener kan ook meekijken. In de eerste fase kan de zorgverlener sowieso meekijken. Maar in de laatere fase moet u als patient toestemming geven voordat de zorgverlener het kan bekijken. Wat vindt u daar van.

CD03- Daar zou ik geen moeite mee hebben. Ik bedoel hij schrijft het voor. Dan is het aan mij om het in te nemen. Of hij dat controleert dat he

Interview- Zou je daar toestemming voor geven

CD03- Ja hoor

Interview- Vindt u het goed dat u daar toestemming voor moet geven. U zegt u nou dat is eigenlijk overbodig dat zou niet nodig hoeven zijn.

CD03- Dat had voor mij (niet verstaanbaar). Als ik natuurlijk die inhaler niet goed gebruik en ik kom voor een herhaal recept en dat is dan de maand langer als

Interview- Als het eigenlijk had gemoeten

CD03- Dan komt ie vanzelf aan van wat ben je aan het doen. Dus of ie nou meekijkt of er nou zelf achter komt met het recept uit schrijven. Toch.

Interview- Nee dat begrijp ik.

Interview- In principe als ie straks in de toekomst beschikbaar komt voor patienten dan kost dat de patient geen geld. Dat word gewoon gratis aangeboden

CD03- Zo je krijgt wat gratis

Interview- Maar achter de schermen is het zo dat daar 100 euro kost dat om dat aan een patient beschikbaar te kunnen stellen. Stel nou dat de zorgverlener dat tegen u zou zeggen. Van he u krijgt dat gratis maar het kost ergens hier achter de schermen wel 100 euro. Wat vindt u daar van veranderd het dan iets aan hoe u met de app om zou gaan.

CD03- Nee alles wat je doet kost achter de schermen geld.

Interview- Zou u niet uitmaken

CD03- Nee, je doet wat of je doet het niet

APPENDIX C Tasks Usability Study

Taken Usability Study

Scenario 1.
U heeft zojuist een nieuwe Symbicort Turbuhaler bij uw apotheek gehaald.
Taak: Bevestig de TurbuPlus op uw nieuwe TurbuHaler.

Scenario 2.
U gaat starten met de TurbuPlus app. U heeft deze app op uw telefoon gezet en met uw zorgverlener de TurbuPlus gekoppeld aan uw smartphone.
Taak: Open de TurbuPlus app op uw telefoon.
Taak: Open het menu. Welke opties ziet u?
Taak: Kijk of u berichten heeft.

Scenario 3.
U wilt kijken of u de medicatie inneemt zoals de zorgverlener het heeft voorgeschreven.
Vraag: Waar bekijkt u dit?
Vraag: Hoeveel inhalaties had u vanmorgen moeten nemen?
Vraag: Hoeveel inhalaties heeft u vanmorgen genomen?
Vraag: Wat is de maximale periode waarover u uw naleving kunt bekijken in de app?

Scenario 4.
Het is tijd om uw medicatie in te nemen.
Taak: Activeer de de Turbuhaler en wacht 1 minuut. (Let op: u hoeft daarna niet daadwerkelijk te inhaleren)
Vraag: Is er iets veranderd op de pagina 'naleving'?

Scenario 5a
U voelt zich niet goed en gaat vaker inhalaties nemen.
Taak: Activeer 4 keer de Turbuhaler en wacht 1 minuut.
Vraag: Wat gebeurt er?

Scenario 5b Astma (SMART).
U voelt zich niet goed en gaat vaker inhalaties nemen.
Taak: Activeer 8 keer de Turbuhaler en wacht 1 minuut.
Vraag: Wat gebeurt er?
Taak: Activeer nog 4 keer de Turbuhaler en wacht 1 minuut.
Vraag: Wat gebeurt er?

Scenario 6.
De app geeft u een herinnering om uw medicatie te nemen. U wilt de tijd van deze herinnering in de ochtend een uur later krijgen.
Taak: Verander de tijd van de herinnering naar een uur later en sla dit op.

Scenario 7.
Uw turbuhaler werkt niet.
Vraag: Met wie neemt u contact op?
Vraag: Wat is het nummer?
Scenario 8.

U vraagt zich af hoe u kunt controleren of de TurbuPlus uw inhalatie heeft geregistreerd.
Taak: Zoek het antwoord.

Scenario 9.
Taak: Bekijk de Algemene Voorwaarden.

Scenario 10.
Uw Symbicort Turbuhaler is leeg.
Taak: Vertel wat u dan doet.

Scenario 11.
U wilt uw gegevens bekijken via de webportal.
Taak: Open de web-portal
Taak: Bekijk hoe uw naleving van het medicatievoorschrift geweest is.
Vraag: Wat is de maximale periode waarover u uw naleving kunt bekijken?

Scenario 12.
U wilt informatie opzoeken over uw ziektebeeld via de webportal.
Vraag: Waar vindt u informatie over uw ziektebeeld?
Taak: Noem de verschillende onderwerpen met betrekking tot uw ziekte waarover u informatie kunt vinden.

APPENDIX D Questionnaire

Proefpersoonnummer: _____

Vragenlijst TurbuPlus-app

Uw proefpersoonnummer:

_____

U heeft nu alle opdrachten met de TurbuPlus-app uitgevoerd. Op de volgende pagina's vindt u een vragenlijst bestaande uit algemene vragen en 31 stellingen. Deze vragenlijst geeft u de mogelijkheid om aan te geven wat u van de app vond. Uw antwoorden zullen ons inzicht geven in welke dingen u goed vond en welke dingen we aan moeten passen.
Denkt u tijdens het beantwoorden van de vragen alstublieft aan alle taken die u net met de app heeft gedaan.
Het zou fijn zijn als u uw mening verduidelijkt door opmerkingen op te schrijven. Op die manier weten wij precies wat er goed en niet goed is aan de app. Het invullen van deze vragenlijst duurt ongeveer 10 minuten.
Er zijn geen goede of foute antwoorden. Het gaat ons alleen om uw mening! Proefpersoonnummer:

_____

Algemeen

Uw geslacht man / vrouw
Leeftijd ____ jaar

Uw ziektebeeld □ astma □ COPD

Wat is de dosering van uw Symbicort Turbuhaler? □ 100/6 □ 200/6 □ 400/12
Hoe vaak gebruikt u Symbicort Turbuhaler? ___x daags ___ inhalaties

□ zo nodig ___x daags extra

Is dit ook zo voorgeschreven door uw □ minder dan voorgeschreven arts of verpleegkundige? □ gelijk aan voorschrift □ meer dan voorgeschreven

Bezit u een smartphone en/of tablet? □ smartphone □ tablet

Hoe vaak gebruikt u uw smartphone of tablet? □ minder dan 1 keer per week □ wekelijks, enkele keren per week □ dagelijks, enkele keren per dag □ dagelijks, zeer regelmatig
Installeert u zelf wel eens een app? Ja / nee
Gebruikt u speciale apps op uw telefoon?[1] Ja / nee

[1] zoals bijvoorbeeld WhatsApp, Facebook, Google Maps, YouTube, Twitter, Skype, Instagram, Buienradar, NU.nl, et cetera.

Vragenlijst

Zou u zo vriendelijk willen zijn om de stellingen goed te lezen en aan te geven in welke mate u het met iedere stelling eens of oneens bent. U kunt dit aangeven door een nummer van 1 t/m 7 te omcirkelen. De nummers betekenen het volgende:
1 = Helemaal niet mee eens 2 = Oneens 3 = Beetje mee oneens 4 = Neutraal 5 = Beetje mee eens 6 = Mee eens 7 = Helemaal mee eens

1. Over het algemeen, ben ik tevreden met het gebruiksgemak van de app.

Helemaal Helemaal niet mee eens 1 2 3 4 5 6 7 mee eens
Opmerkingen: _____
_____
_____

2. De app op de mobiele telefoon was gemakkelijk te gebruiken.

Helemaal Helemaal niet mee eens 1 2 3 4 5 6 7 mee eens
Opmerkingen: _____
_____
_____
_____

3. Ik kon de opdrachten die ik kreeg, uitvoeren met de app.

Helemaal Helemaal niet mee eens 1 2 3 4 5 6 7 mee eens
Opmerkingen: _____
_____
_____

4. Ik kon de opdrachten die ik kreeg *snel* uitvoeren met de app.

Helemaal Helemaal niet mee eens 1 2 3 4 5 6 7 mee eens
Opmerkingen: _____
_____
_____

5. Ik kon de opdrachten die ik kreeg *efficiënt* uitvoeren met de app.

Helemaal Helemaal niet mee eens 1 2 3 4 5 6 7 mee eens
Opmerkingen: _____
_____
_____

6. Ik voelde me op mijn gemak tijdens het gebruik van de app.

Helemaal Helemaal niet mee eens 1 2 3 4 5 6 7 mee eens
Opmerkingen: _____
_____
_____

7. Het was gemakkelijk om te leren hoe ik de app moest gebruiken.

Helemaal Helemaal niet mee eens 1 2 3 4 5 6 7 mee eens
Opmerkingen: _____
_____
_____
8. Ik geloof dat deze app snel nuttig voor mij kan zijn.

Helemaal Helemaal niet mee eens 1 2 3 4 5 6 7 mee eens
Opmerkingen: _____
_____
_____
9. De app gaf mij berichten die me goed vertelden hoe ik een probleem kon oplossen.

Helemaal Helemaal niet mee eens 1 2 3 4 5 6 7 mee eens
Opmerkingen: _____
_____
_____
10. Als ik een foutje maakte, kon ik dit snel en gemakkelijk recht zetten.

Helemaal Helemaal niet mee eens 1 2 3 4 5 6 7 mee eens
Opmerkingen: _____
_____
_____
11. De informatie die ik via de app kreeg (zoals herinneringen en berichten) was duidelijk.

Helemaal Helemaal niet mee eens 1 2 3 4 5 6 7 mee eens
Opmerkingen: _____
_____
_____
12. Het was gemakkelijk om de juiste informatie te vinden die ik nodig had.

Helemaal Helemaal niet mee eens 1 2 3 4 5 6 7 mee eens
Opmerkingen: _____
_____
_____
13. De informatie die ik via de app kreeg over mijn naleving was gemakkelijk te begrijpen.

Helemaal Helemaal niet mee eens 1 2 3 4 5 6 7 mee eens
Opmerkingen: _____
_____
_____
14. De informatie die ik via de app kreeg hielp bij het uitvoeren van de taken.

Helemaal Helemaal niet mee eens 1 2 3 4 5 6 7 mee eens
Opmerkingen: _____
_____
_____
15. De indeling van de informatie op het scherm van de mobiele telefoon was duidelijk.

Helemaal Helemaal niet mee eens 1 2 3 4 5 6 7 mee eens
Opmerkingen: _____
_____
_____
Informatie: met de *interface* wordt bedoeld "alle items die je kunt zien om de app te gebruiken". Bijvoorbeeld: het menu, het scherm (inclusief het gebruik van plaatjes, de taal en de kleuren).
16. De interface van de mobiele telefoon zag er aangenaam uit.

Helemaal Helemaal niet mee eens 1 2 3 4 5 6 7 mee eens
Opmerkingen: _____
_____
_____
17. Ik vond het fijn om de app te gebruiken.

Helemaal Helemaal niet mee eens 1 2 3 4 5 6 7 mee eens
Opmerkingen: _____
_____
_____
18. De app heeft alle functies die ik ervan verwacht.

Helemaal Helemaal niet mee eens 1 2 3 4 5 6 7 mee eens
Opmerkingen: _____
_____
_____
19. Over het algemeen, ben ik tevreden met de app.

Helemaal Helemaal niet mee eens 1 2 3 4 5 6 7 mee eens
Opmerkingen: _____
_____
_____
Graag willen we van u weten hoe tevreden u bent over de app.
1= Zeer ontevreden 2= Ontevreden 3= Neutraal 4= Tevreden 5= Zeer tevreden
20. Bent u tevreden over de uitleg die u heeft gekregen over de mogelijkheden van de app?

Zeer Zeer ontevreden 1 2 3 4 5 tevreden
Opmerkingen: _____
_____
_____
21. Bent u tevreden over de brochure die u heeft gekregen van uw zorgverlener over de mogelijkheden van?

Zeer Zeer ontevreden 1 2 3 4 5 tevreden
Opmerkingen: _____
_____
_____
22. Vormgeving - hoe tevreden bent u over de *gebruikte kleuren* in de app?

Zeer Zeer ontevreden 1 2 3 4 5 tevreden

Opmerkingen: _____
_____
_____

23. Vormgeving - hoe tevreden bent u over de *grootte van de letters* in de app?

Zeer Zeer ontevreden 1 2 3 4 5 tevreden
Opmerkingen: _____
_____
_____

24. Vormgeving - hoe tevreden bent u over de *duidelijkheid van de afbeeldingen* in de app?

Zeer Zeer ontevreden 1 2 3 4 5 tevreden
Opmerkingen: _____
_____
_____

25. Tekst in de app - hoe tevreden bent u over de *hoeveelheid tekst* in de app, met name in de berichten?

Zeer Zeer ontevreden 1 2 3 4 5 tevreden
Opmerkingen: _____
_____
_____

26. Tekst in de app - hoe tevreden bent u over de *woordkeuze* in de app?

Zeer Zeer ontevreden 1 2 3 4 5 tevreden
Opmerkingen: _____
_____
_____

27. Tekst in de app - hoe tevreden bent u over de *manier waarop u wordt aangesproken* in de app?

Zeer Zeer ontevreden 1 2 3 4 5 tevreden
Opmerkingen: _____
_____
_____

28. Technische functionaliteit - hoe tevreden bent u over *het scrollen (doorklikken) door het menu* van de app?

Zeer Zeer ontevreden 1 2 3 4 5 tevreden
Opmerkingen: _____
_____
_____

29. Technische functionaliteit - hoe tevreden bent u over *hoe logisch de opbouw is* van de app? Vindt u bijvoorbeeld een pagina eenvoudig terug die u eerder heeft bekeken?

Zeer Zeer ontevreden 1 2 3 4 5 tevreden
Opmerkingen: _____
_____
_____

30. Technische functionaliteit - hoe tevreden bent u over *het eenvoudig terugkeren naar het hoofdmenu* van de app?

Zeer Zeer ontevreden 1 2 3 4 5 tevreden
Opmerkingen: _____
_____
_____
31. Technische functionaliteit - hoe tevreden bent u over *de mogelijkheid de ingevoerde gegevens aan te passen* in de app? Bijvoorbeeld het aanpassen van het tijdstip van een inhalatieherinnering.

Zeer Zeer ontevreden 1 2 3 4 5 tevreden
Opmerkingen: _____
_____
_____
Hartelijk dank voor uw feedback

Open vragen (interview)
Wat vindt u van de webportal?
o Bent u over het algemeen wel of niet tevreden over de webportal?

o Kunt u de informatie goed vinden?

o Vond u de informatie van de webportal nuttig?

o Vindt u de webportal logisch ingdeeld?
Hoe zou u reageren als uw zorgverlener voorstelt om de app te gaan gebruiken?
o Waarom?

o Indien nee: zou u iets aan de app willen veranderen zodat u deze wel wilt gebruiken?

o Indien nee: zou u de app wel aan andere adviseren? Waarom?
Waarin denkt u dat de app u kan ondersteunen in de behandeling? Kunt u uitleggen waarom?

Welk onderdeel van de app vindt u het nuttigst? En het minst nuttig?

Stel, u puft 14 keer per dag en de app geeft een waarschuwing contact op te nemen met de zorgverlener. Wat doet u? En als het 4 uur 's nachts is?

Stel, u moet 2 keer per dag inhaleren en u bent niet zo trouw, of u vergeet het. De app geeft het volgende bericht: 'Het lijkt erop dat u deze week minder dan de helft van het aantal voorgeschreven inhalaties van Symbicort Turbuhaler heeft geïnhaleerd. Gebruikt iedere dag uw medicatie zoals u heeft afgesproken met uw zoegverlener. Dit is belangrijk om uw symptomen onder controle te houden'. Wat vindt u daarvan?

Stel, de app wil niet koppelen of synchroniseren met de Turbuhaler. Wat doet u?

Welke suggesties heeft u om de app te verbeteren?

In de eerste periode zijn de gegevens over het gebruik van de Turbuhaler ook in te zien door de zorgverlener. In de toekomst is dit afgeschermd en moet u als patiënt *toestemming* geven aan de zorgverlener om deze mee te kunnen laten kijken. Wat vindt u daarvan?

De Turbuhaler wordt nu en in de toekomst kosteloos aan patiënten aangeboden. De daadwerkelijke kosten ervan zijn dan niet bekend. Als de arts u zou vertellen dat de app in feite 100 euro per patiënt kost, zou dat invloed hebben op de manier waarop u de app zou gebruiken? Zou u er ander tegenaan kijken? Waarom?