MASTER THESIS

Identifying positive aspects, negative aspects and points for improvement of the MATCH self-management intervention in patients with COPD and heart failure

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FEBRUARY – SEPTEMBER 2019

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Abstract

Background: Electronic health (eHealth) may address the problem of increasing patient burdens, increasing costs in health-care and the growing number of people who suffer from chronic diseases, such as Chronic Obstructive Pulmonary Disease (COPD) and heart failure (HF), and may ensure that healthcare services remain providable. A way of using eHealth in COPD and HF is via a digital self-management intervention, such as The Self-Management And Telemedicine in patients with COPD and chronic HF (MATCH) intervention. No qualitative studies on self-management interventions aimed at both COPD and HF have been performed so far. The knowledge and insight from this qualitative study can be used as guidance to furtherly develop future digital self-management interventions to become more useful for patients.

Aim: The main aim of this qualitative study is to identify positive aspects, negative aspects and points for improvement from users' experiences with the different components of the MATCH self-management intervention for COPD and HF that was used in the MATCH study. The usage, appreciation and perceived effectiveness were explored with the four determinants of the Unified Theory of Acceptance and Use of Technology (UTAUT).

Methods: Nine Dutch patients with COPD and HF (seven male, two female) from the Medisch Spectrum Twente (MST) hospital in Enschede and the Ziekenhuisgroep Twente (ZGT) hospital in Almelo and one Dutch informal caregiver who used the MATCH self-management intervention for COPD and HF were interviewed in one-to-one in-depth semi-structured interviews in April and May 2019. Interviews were audio-recorded, transcribed verbatim and analysed by two independent coders.

Results: The participants' were adequately satisfied with the MATCH self-management intervention and with the digital portal. The majority of the patients had used the MATCH self-management intervention for altruistic reasons. But, not everyone had used the digital portal of the MATCH self-management intervention. Various positive aspects, negative aspects and points for improvement of the different components of the MATCH self-management intervention for COPD and HF were mentioned by the participants.

Conclusion: Based on the identified positive aspects, negative aspects and points for improvement, the whole MATCH self-management intervention truly satisfied patients with COPD and HF, especially the digital portal. Therefore, it is advised to use a digital self-management intervention, especially a digital portal. However, improvements are necessary to achieve more patient satisfaction with a digital self-management intervention.

Keywords: COPD, Heart failure, Qualitative research, Interviews, Self-management, User experiences

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1. Introduction

Chronic Obstructive Pulmonary Disease (COPD) is a progressive disease that manifests in respiratory symptoms, which are caused by a persistent airflow limitation [1]. Exacerbations are common in COPD and can be explained as an acute worsening of respiratory symptoms that are beyond day-to-day variations [2]. In order to counteract exacerbations, medical treatment is necessary [2]. Exacerbations increase the risk of hospital admissions, mortality, and directly influences the patient's health status and health-related quality of life (HRQoL) in a negative way [3-5]. Besides exacerbations, patients with COPD frequently suffer from comorbidities, such as cardiovascular diseases, diabetes and mental health issues, which increases all-cause mortality and risk of hospital admissions [6-8]. Cardiovascular diseases like heart failure (HF) are the most common comorbidity in patients with COPD [7, 9]. The coexistence of HF in patients with COPD ranges from 7,1% to 31,3% [9-11]. Smoking is the largest shared risk factor to develop COPD and HF [8]. COPD alone is the third leading cause of death worldwide [12]. Globally, 3,2 million people died from COPD in 2015 which was an increase of 11,6% compared to 1990 [13]. Therefore COPD places a high economic and social burden on patients and society [3]. In many countries, these burdens are increasing because of the increasing prevalence of COPD and its comorbidities around the world [14].

A potential way to address the problem of increasing patient burdens, increasing costs in health-care and the growing number of people who suffer from chronic diseases is to include electronic health (eHealth) in medical services [10]. eHealth may ensure that healthcare services remain providable, by providing someone with health-related information and healthcare services over large or small distances, using electronic information and communication technologies (ICT) [15-17]. This may potentially save patients' visits to healthcare facilities. In addition, eHealth can deliver high-quality care at lower costs, compared to usual care, as costs could be lowered by getting patients more involved into their own disease management, whereas healthcare providers will have supportive tasks [18, 19]. Patients can for instance monitor and self-treat their symptoms by starting to use medication on their own, such as antibiotics. A potential supportive task carried out by healthcare providers might be to remain reachable in case patients need help. Patients might call for help when they for example encounter problems during self-management or when patients have questions. eHealth can be used for diagnosing, telemonitoring, telemedicine and teleconsulting patients in different settings, such as in primary care, hospital care, rehabilitation, mental health and public health [15, 18, 20].

eHealth has multiple applications in HF. A recent systematic review by Pekmezaris et al. (2018) [21] evaluated the effectiveness of home telemonitoring in terms of mortality and hospital use in patients with HF [21]. Essential findings were that home telemonitoring decreases the risk of mortality, but increases the risk of emergency department (ED) visits [21]. An explanation could be that home telemonitoring detects the worsening of symptoms early on, thereby sending patients with acute problems to the ED while facilitating treatment at home for patients with no acute problems [21].

Telemonitoring as applied in HF could be a component of a digital COPD self-management intervention. A digital COPD self-management intervention is one way of using eHealth in COPD [22]. A self-management intervention is structured, personalised and often multi-component, with goals of motivating, engaging and supporting patients to positively adapt health behaviours and develop skills to manage their disease more effectively [1, 20]. In addition, self-management increases awareness and control about diseases, as well as self-treatment among patients [22]. COPD self-management interventions are becoming more important in the disease management of COPD [1]. A Cochrane review of Zwerink et al. (2014) [23] investigated whether COPD self-management interventions lead to improved health outcomes and reduced healthcare utilisation [23]. Essential conclusions were that COPD self-management interventions improved HRQoL, reduced hospital admissions related to respiratory problems and improved dyspnoea [23]. These findings are

supported by a more recent Cochrane review of Lenferink et al. (2017) [1] showing that self-management interventions including a COPD exacerbation action plan improved HRQoL and lowered the risk of respiratory-related hospital admissions [1]. A randomised controlled trial by Jolly et al. (2018) [24] evaluated the effectiveness of telephone health coaching by nurses to support self-management compared to usual care in primary care patients with mild symptoms of COPD [24]. It was concluded that the telephone health coaching intervention delivered by nurses resulted in self-management by participants, because 86% of the scheduled calls were delivered and 75% of the patients received all calls [24]. The intervention did not improve HRQoL of the patients [24]. A study of Tabak et al. (2014) [25] evaluated the use of a COPD telehealth program with decision support and patient satisfaction of the program in primary and secondary care [25, 26]. The COPD telehealth program included four modules: 1) an activity coach that monitored activity and coached participants to increase daily activity behaviour; 2) an exercise program that enabled participants to exercise at home; 3) a web-based diary aimed at self-management, including self-treatment of COPD exacerbations; and 4) teleconsultation [25]. Patients were satisfied with the entire COPD telehealth program [25]. The patient group used the COPD telehealth program 86% of the time [25]. However, the adherence to the exercise program was low, namely 21% [25]. The study concluded that healthcare providers have a crucial role in the adherence of patients to telehealth, because their attitude toward telehealth treatment influences the perception and adherence of patients [25].

Two qualitative studies have recently been added to the evidence that is available on self-management interventions about COPD and HF. Korpershoek et al. (2018) [27] focused on the perceptions of patients with COPD and healthcare providers when using mobile technology (mHealth) for the self-management of exacerbations [27]. One important finding was that mHealth interventions should focus more on the development of self-management skills which can be done by providing adequate information, decision support and feedback on self-management behaviour [27]. mHealth interventions should be attractive, rewarding, safe and tailored to the patient's needs in order to get patients highly motivated to use the interventions, and it should supplement regular care [27]. The qualitative study of Westland et al. (2018) [28] evaluated the nurses' perceptions towards the delivery and feasibility of an intervention to increase physical activity in patients at risk for cardiovascular diseases in primary care as well as to enhance nurses' role in supporting these patients [28]. Delivering a behaviour change intervention is challenged by nurses' adaption of a different consultation style [28]. Nurses thought that they could not adhere to a patient-centred consultation style, which was necessary when they supported patients that used an behavioural change intervention [28]. Hence, healthcare professionals turn out to have an essential role when patients use self-management interventions. Healthcare professionals need to have a pro-active role to motivate patients and healthcare professionals must support and coach patients to achieve positive health outcomes [27].

The study of Sedeno et al. (2009) [29] evaluated the initiatives taken to treat exacerbations and healthcare usage in exacerbations at COPD patients that received a self-management program that also included action plans, compared to usual care [29]. The self-treatment was supervised by patients' case managers and physicians [29]. When compared to the intervention group, patients from the usual care group that already knew how to recognize exacerbations and which actions to take, were less likely to recognize the onset of exacerbations and were less likely to start self-treatment in case of exacerbations [29]. This is illustrative for the benefits that patients may experience from using self-management interventions, thus shows the importance of using self-management interventions by patients. The study of Sedeno et al. (2009) [29] illustrates two problems in patients with chronic diseases like COPD and HF: 1) patients often have little understanding and awareness of their symptoms and of warning signs of exacerbations; and 2) patients do not know and understand which actions to take to counteract exacerbations [29]. The studies of Cameron et al. (1993) [30] and Llewellyn et al. (2003) [31] identified a third problem, the inability to control chronic diseases like COPD or HF [30, 31]. When patients increase their self-

management skills, they will become more adherent to therapy, and can adjust themselves in stressful situations, such as exacerbations more easily [31, 32]. It is understandable that problems with awareness, control and self-treatment among patients worsen when a chronic disease like COPD is accompanied by a comorbidity like HF. There is however a lack of evidence on the effectiveness and usefulness of self-management interventions aimed at both COPD and HF.

The Self-Management And Telemedicine in patients with COPD and chronic heart failure (MATCH) study aimed to help patients with COPD and HF to gain more control over their symptoms of COPD and HF by early symptom recognition of COPD and HF, and by stimulating self-treatment of symptoms. The goals of the MATCH self-management intervention for COPD and HF are aimed at evoking behavioural changes, including the behavioural change techniques goal setting and action planning, which affect patients' health positively [33]. The MATCH self-management intervention for COPD and HF consists of three components: 1) training; 2) a digital portal; and 3) support. During the training patients were informed about the usage of the different components of the MATCH self-management intervention for COPD and HF, and patients learned how to recognize and self-treat the deterioration of COPD and HF symptoms with the help of the different components of the MATCH self-management intervention. The aim of the self-management sessions was to create awareness of COPD and HF and its symptoms among patients. The digital portal that was used by patients consisted of six different modules: 1) self-management; 2) monitoring; 3) inhaler; 4) information; 5) exercises to remain healthy; and 6) physical activity. The aim of the digital portal was to create awareness of COPD and HF and its symptoms, to enable patients to self-treat COPD and HF symptoms and to create feelings of control among patients with COPD and HF. Participants were supported by technical professionals, case managers (medical professionals) and by an avatar (digital person) that was included in the digital portal. Informal caregivers were not intended to be involved in the MATCH self-management intervention as a source of support.

No qualitative studies on digital self-management interventions aimed at both COPD and HF have been performed so far. This study will qualitatively evaluate the usage, appreciation and perceived effectiveness of the MATCH self-management intervention by using the four determinants of the widely accepted technology acceptance model called Unified Theory of Acceptance and Use of Technology (UTAUT) introduced by Venkatesh et al. in 2003 [34]. The four determinants of UTAUT [34] are: 1) performance expectancy (i.e. perceived usefulness); 2) effort expectancy (i.e. perceived ease of use); 3) social influence; and 4) facilitating conditions [34]. Usage, appreciation and perceived effectiveness cover these four determinants of UTAUT [34]. The knowledge and insight from this qualitative study can be used as guidance to furtherly develop future digital self-management interventions to become more useful for patients. This may result in better patient motivation to use digital self-management interventions, improved patient adherence, and therefore improved health outcomes [27]. Moreover, patients may become more aware of COPD and HF and its symptoms, may self-treat COPD and HF symptoms, and may feel more control over their COPD and HF.

The main aim of this qualitative study was to identify positive aspects, negative aspects and points for improvement from users' experiences with the different components of the MATCH self-management intervention for COPD and HF that was used in the MATCH study. More specific, the objectives of this study are to explore:

1. The usage of the different components of the MATCH self-management intervention for COPD and HF from users' experiences with the four determinants of UTAUT [34];
2. The appreciation of the different components of the MATCH self-management intervention for COPD and HF from users' experiences with the four determinants of UTAUT [34];
3. The perceived effectiveness of the different components of the MATCH self-management intervention for COPD and HF from users' experiences with the four determinants of UTAUT [34].

2. Methods

2.1. Study design

A qualitative study design was used in this study, namely one-to-one in-depth semi-structured interviews with COPD and HF patients. This method provided freedom and openness for participants to openly deliberate on their opinion, thoughts, feelings and experiences [35].

Participants were interviewed entirely voluntary and participants could stop their participation at any time and did not have to give a reason. The MATCH study and the conducting of interviews was ethically tested and approved by the Medical Ethics Review Committee (METC) Twente.

2.2. Selection and recruitment of participants

The participants of this study were selected from the MATCH study population. In total eleven Dutch patients with COPD and HF (seven male, four female) from the Medisch Spectrum Twente (MST) hospital in Enschede and the Ziekenhuisgroep Twente (ZGT) hospital in Almelo and one Dutch female informal caregiver (spouse of P06) used the MATCH self-management intervention from October 2018 to and including January 2019. The patients of the MATCH study had to meet the inclusion- and exclusion criteria as described in Table 1.

Table 1. *Inclusion and exclusion criteria of the MATCH study.*

Inclusion	Exclusion
• A clinical diagnosis of COPD according to the GOLD criteria FEV1 < 80% of the predicted value and FEV1/FVC < 0.70) [3]. • CHF defined according to the current 2016 ESC guidelines [36]. • ≥ 2 COPD and/or CHF exacerbations[a] and/or ≥1 hospitalisation for COPD and/or CHF in the last two years preceding study entry • ≥ 40 years of age • At least 1 week after prednisolone/antibiotics/furosemide course. At least 1 week after hospitalisation. At least 4 weeks post-rehabilitation. • Able to understand and read the Dutch language • Able to use a tablet • Written informed consent from the subject prior to participation	• Terminal cancer or the end stage of another serious disease • Other serious lung disease (e.g. α1-antitrypsin deficiency; interstitial lung diseases) • Expected cardiovascular intervention within three months • Being currently enrolled in randomized controlled trials or trial with study medication • Waiting for a heart or lung transplantation • Receiving renal dialysis • Diabetes Mellitus Type I • Hospital Anxiety and Depression Scale (HADS)-score of ≥11 for anxiety and/or depression domain symptom scores

Abbreviations: *MATCH,* The Self-Management And Telemedicine in patients with COPD and chronic heart failure; *COPD,* Chronic obstructive pulmonary disease; *GOLD,* Global Initiative for Chronic Obstructive Lung Disease; *FEV1*, forced expiratory volume in one second; *FVC*, forced vital capacity; *CHF,* Chronic Heart Failure; *ESC,* European Society of Cardiology

[a]An exacerbation was defined as a deterioration of symptoms for which treatment with prednisolone (and antibiotics) or furosemide was necessary [3].

The criteria to select participants for the current study were: 1) was willing to participate in an interview; and 2) had used the MATCH self-management intervention during the MATCH study.

The eleven patients and one informal caregiver were asked if they had been using the MATCH self-management intervention during the MATCH study. All eleven patients with COPD and HF (seven male, four female) and one female informal caregiver told that they had been using the MATCH self-

management intervention during the MATCH study. In addition, all eleven patients and one informal caregiver were asked if they were willing to participate in an interview. From the eleven patients, nine patients with COPD and HF (seven male, two female) and one female informal caregiver said that they were willing to participate and were interviewed in April and May 2019. The nine patients that were willing to participate received further study information from the researcher during a telephone call using the informed consent form (Appendix 1). After informing these patients, they were scheduled to an interview by the researcher during the telephone call. After the call ended, patients that were scheduled to an interview received further study information via e-mail. Five participants were interviewed at their homes, four participants were interviewed at the MST hospital in Enschede and one participant was interviewed at the ZGT hospital in Almelo. All participants signed the informed consent form.

2.3. The MATCH self-management intervention for COPD and HF

The MATCH self-management intervention for COPD and HF consists of three components: 1) training; 2) a digital portal; and 3) support. Participants used the MATCH self-management intervention for about 56 till 64 days, which corresponds to two months.

Training

Training was provided during three self-management sessions, two group sessions and one individual session. The self-management sessions were led by two case managers who were nurse practitioners that worked at the Pulmonary Department of the MST hospital and at the Cardiology department of the ZGT hospital. They had knowledge of and experience with self-management in COPD and HF. The case managers were trained to use the different components of the MATCH self-management intervention for COPD and HF. The participants received a weighing scale, a Fitbit, a sensor, and a tablet to be able to use the digital portal.

Digital portal

The digital portal (Figure 1) was built from the existing C3PO (continuous care and coaching platform), that was used in the study of Tabak et al. (2014) [25] for patients with COPD alone [25]. The MATCH platform was developed in collaboration with MST, ZGT, University of Twente (UT) and Roessingh Research and Development (RRD). The digital portal was used by patients via a tablet and by case managers via a computer. The digital portal that was used by patients consists of six different modules. A description is provided in Table 2.

Table 2. *Description of the six modules of the digital portal that was used by patients.*

Modules	Description
• Self-management	Participants had to complete a daily symptom diary and had to measure their bodyweight using a smart scale. In case participants reported deteriorations of symptoms, the portal showed actions for the participant to counteract the deteriorating symptoms of COPD or HF. For example, when to start self-treatment with prednisone or antibiotics, or when to contact a healthcare provider for support. The algorithms of the provided advices from the automated decision support system were based on a paper version of action plans adjusted for COPD and comorbidities, which showed a reduction in COPD exacerbation[a] duration and respiratory-related hospitalisation rates [37].
• Monitoring	A detailed overview of participants' self-engaged bodyweights using a weighing scale, self-reported symptoms, received advices, and performed actions for these advices.
• Inhaler	Showed when the inhalation medication was used and if the correct inhalation technique was used. This was automatically measured and registered by sensors that were attached to the patient's inhaler. Participants received a sensor if it could be attached to the participant's inhaler.
• Information	Information about COPD, HF and comorbidities, like anxiety to help creating awareness of COPD, HF, comorbidities and its symptoms among patients. Some noteworthy examples of the included information are: what is COPD and HF and were does symptoms come from; medication for COPD and HF; how to self-manage COPD and HF exacerbations; physical activity; how COPD and HF influences stress, anxiety and depression and how to self-manage this; and an overview showing the severity of symptoms before participants started to use the MATCH self-management intervention. In this way patients could compare their current symptoms to the symptoms that were described in this overview.
• Exercises to remain healthy	Contained exercise videos to remain fit and for relaxation.
• Physical activity	Graphically showed the amount of steps taken per day and were registered via the Fitbit that participants received.

Abbreviations: *COPD,* Chronic obstructive pulmonary disease; *HF,* Heart failure; *MATCH,* The Self-Management And Telemedicine in patients with COPD and chronic heart failure

[a]An exacerbation was defined as a deterioration of symptoms for which treatment with prednisolone (and antibiotics) or furosemide was necessary [3].

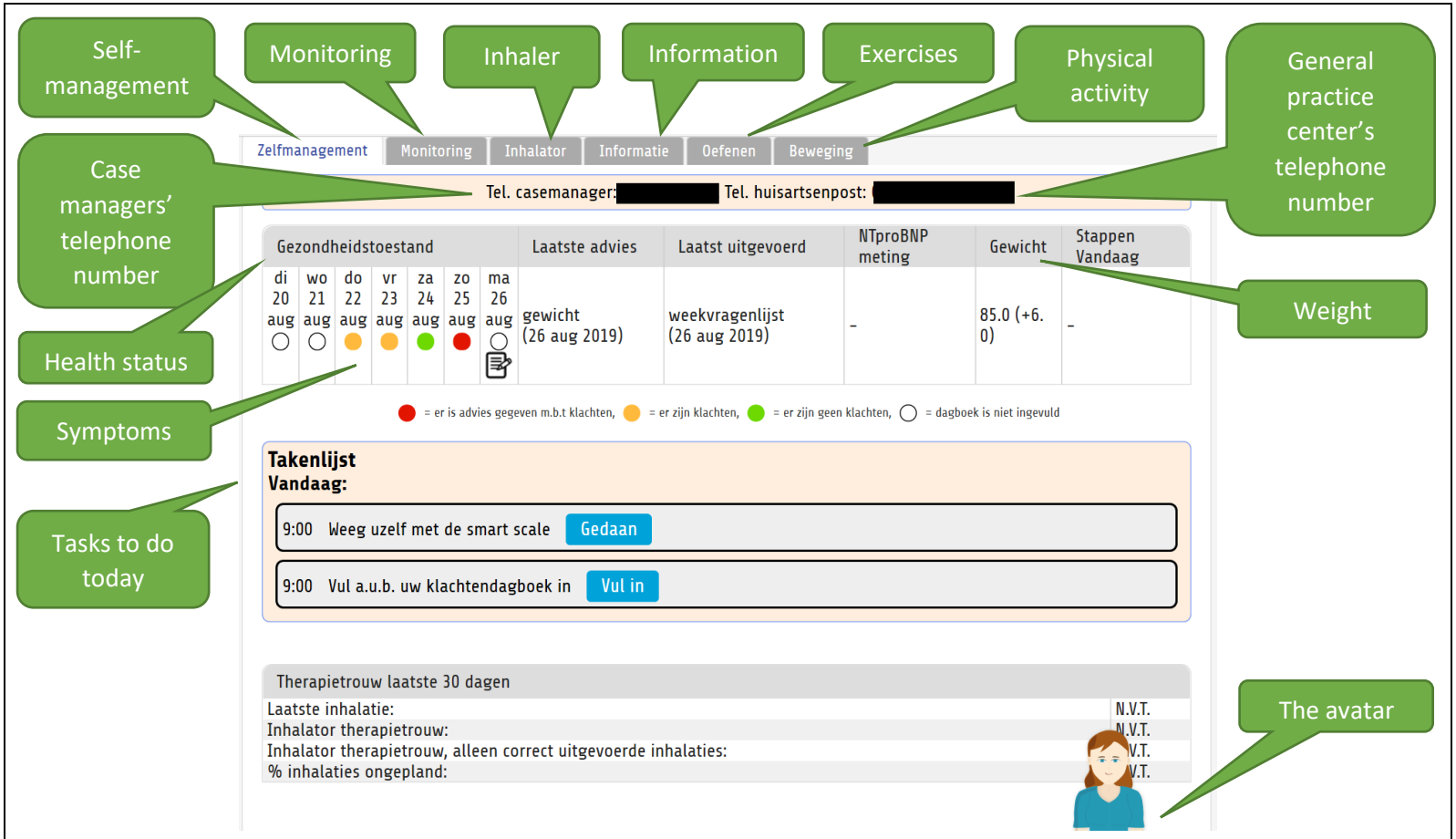

Figure 1. *Screenshot of the homepage of the digital portal that was used by patients when the avatar did not pop-up with individual feedback.* Adapted from 'The digital portal of the MATCH self-management intervention for COPD and HF' by Medisch Spectrum Twente, Zorggroep Twente, University of Twente, and Roessingh Research and Development, 2018, Enschede: Available from: https://portal.rrdweb.nl/mst-match/index.php?user_just_logged_in=true. [38].

Support

Participants were supported by technical professionals, case managers and by an avatar (Figure 1 and Figure 2) that was included in the digital portal. Informal caregivers were not intended to be involved in the MATCH self-management intervention as a source of support.

Technical professionals and case managers

For safety reasons case managers checked their portal once a week to see whether patients with significantly increased symptoms did improve. However, participants had their own responsibility to call the case managers if symptoms did not improve after starting self-treatment, if patients encountered technical problems when using the MATCH self-management intervention or if participants had questions regarding the MATCH self-management intervention. If case managers could not come up with a solution to technical problems, they could advice participants to call the technical professionals to solve the problem.

Avatar

The avatar provided participants with individual feedback via pop-ups, regarding: technical support about the inhaler's data registration; behavioural instructions about taking inhalation medication, self-treatment of deteriorating symptoms and physical activity; or small talk about the avatar's personal life. Most behavioural instructions provided by the avatar are related to taking inhalation medication. The content of individual feedback provided by the avatar with examples of related pop-are presented in Table 3.

Table 3. *Content of individual feedback provided by the avatar with examples of related pop-ups.*

Content of individual feedback[a]	**Examples of pop-ups**[b]
Technical support about the inhaler's data registration	• *It is important that your inhaler is closer to your tablet so that the data can be transferred. Do you want to do this?* (– In case the inhaler's sensors did not register data for 24 hours about inhalations) • *Your inhaler has not been connected to the tablet for 72 hours. Move your inhaler closer to the tablet. If no connection is made after this, call your case manager.* (– In case the inhaler's sensors did not register data for 72 hours about inhalations)
Behavioural instructions about taking inhalation medication, self-treatment of deteriorating symptoms and physical activity	• *The position of your inhaler is not entirely correct during inhalation. Try to hold the inhaler straight. View the instructional video about the use of your inhaler.* (– In case the inhaler's sensors registered a suboptimal positioning of the inhaler) • *Try to use your inhalation medication at the same times every day.* • *I have seen that you have not taken your inhalation medication at least twice in the last days. It is important that you do not forget your inhalations.* • *You have taken an extra inhalation a few times in the last few days, why is this?* • *You have not taken your inhalation a few times in the last few days. Try to be careful to take your inhalation medication at the right times.* • *To inhale your medication as good as possible, it is important that you take a long and vigorous inhalation.* • *You have been advised to take action in response to the worsening of your symptoms. Have you already done so?* • *Look at the activity meter to see how many steps you take each day (measured by your Fitbit) and try to increase the number of steps per week!*
Small talk about the avatar's personal life	• *Nice to meet you! My name is Sylvia de Ridder. I am 32 years old and will help you with the use of the portal in the coming period. I will help you to remember when you need to take actions, but you can always come to me for a chat!* • *Nice to see you again. Shall I tell you about my living situation today?* • *How are you doing? I can tell you something about my husband Eric today, enough to talk about!* • *Nice to see you again. Like I said, I can tell you about Sem (avatar's son).* • *Today I can tell you about our neighbour, I am sure you would like each other!* • *Good to see you, it is time to catch up. Where were we again last time? I believe at walking or not?* • *Nice to see you again. I just went out with Buddy (avatar's dog). I think I promised to tell you more about him today, right?* • *I think you know the most important things about me. I do not have much more to add at the moment. I enjoyed talking to you, thanks!* • *As I said, I will tell you something new tomorrow. See you tomorrow!*

[a]The avatar provided participants with individual feedback via pop-ups and addressed various topics;
[b]All different pop-ups that the avatar could provide participants with.

Figure 2. *Screenshot of the avatar when popping-up with individual feedback.* Adapted from 'The digital portal of the MATCH self-management intervention for COPD and HF' by Medisch Spectrum Twente, Zorggroep Twente, University of Twente, and Roessingh Research and Development, 2018, Enschede: Available from: https://portal.rrdweb.nl/mst-match/index.php?user_just_logged_in=true. [38].

Informal caregivers

Informal caregivers were not intended to be involved in the MATCH self-management intervention as a source of support. However, it became apparent during the interviews that a number of patients had received support from informal caregivers. The first researcher (AR) had anticipated on this by including prepared questions to the interview guide about the support provided by informal caregivers.

2.4. Procedures

Individual in-depth semi-structured interviews were performed by the first researcher using an interview guide (Appendix 2) containing prepared questions about the training, the digital portal and support when using the MATCH self-management intervention. The prepared questions were mostly open questions [35]. The interviews were conducted at a location suitable for the participant, since every participant could choose the location of the interview. That could be at the patients' home, at the MST hospital in Enschede or at the ZGT hospital in Almelo. Participants that had travelled to one of the hospitals were given the option to be reimbursed for their travel expenses. The interviewer explained the informed consent form to participants and this was signed if everything was clear to the participants. Via this procedure the participants' consented to audio-record the interview and declared that they voluntarily participated. During the interviews, participants were asked about their thoughts, opinion, experiences, and feelings in order to get knowledge and insight in patients' adherence to and the feasibility of a digital self-management intervention, and to evaluate the satisfaction of patients with this intervention [35]. All interviews were audio-recorded with the Zoom H4nPro and anonymised by replacing participants names by a random, meaningless combination of numbers. All documents related to this study were stored on a secured location at the MST hospital in Enschede.

The interviewer asked questions, encouraged participants to share their thoughts, opinion, experiences and feelings and asked probes to get participants' full statements. The interviewer strived for data saturation. This meant that participants were included as long as new information was brought-up during the interviews [35, 39]. When data saturation was reached or when no more participants were available to include, the interviewer stopped the inclusion of new participants. When all the prepared questions from the interview guide were discussed, when participants stopped bringing up new information, or when participants wanted to stop the interview, the interviewer brought the interview to an end. The ten interviews that were coded had an average duration of about 100 minutes.

Patients' baseline characteristics on gender, age, smoking status, educational level, having a partner, Global Initiative for Chronic Obstructive Lung Disease (GOLD) stage, New York Heart Association functional classification (NYHA) score, number of exacerbations of COPD and HF during the last year and experience with the use of digital devices were already collected in the MATCH study.

2.5. The interview guide

The interview guide (Appendix 2) was written in Dutch, because only Dutch participants were included in the current study. The prepared questions were developed and structured by evaluating the usage, appreciation and perceived effectiveness of the different components of the MATCH self-management intervention for COPD and HF from users' experiences. In addition to that, UTAUT [34] was used to develop the questions and probes, because UTAUT [34] captures four determinants that play a significant role in user acceptance of technology and user behaviour [34]. These four determinants are: 1) facilitating conditions; 2) social influence; 3) effort expectancy; and 4) performance expectancy [34]. In the current study, facilitating conditions and social influence was

defined as who supported participants (i.e. participants were supported by technical professionals, case managers, an avatar that was included in the digital portal and by informal caregivers) when using the MATCH self-management intervention, which knowledge about self-management of COPD and HF was attained, and what digital devices participants had received [34]. Effort expectancy is connected to the perceived ease of use [34]. The perceived ease of use of the MATCH self-management intervention was defined as how easy it was for participants to use the MATCH self-management intervention [34]. Performance expectancy is connected to the perceived usefulness [34]. The perceived usefulness of the MATCH self-management intervention was defined as how the MATCH self-management intervention had helped participants to self-manage their COPD and HF [34]. These four determinants served as basis for the questions and probes that are included in the interview guide. Facilitating conditions and social influence can be seen as a measure of the usage of the whole MATCH self-management intervention, in particular to training and support. It was considered to be relevant to explore the usage of the whole MATCH self-management intervention from users' experiences. Hence, the usage of the different components of the MATCH self-management intervention for COPD and HF from users' experiences was explored. Ease of use can be seen as a measure of the appreciation of the whole MATCH self-management intervention, in particular the digital portal. It was considered to be relevant too, to explore the appreciation of the whole MATCH self-management intervention from users' experiences. Hence, the appreciation of the different components of the MATCH self-management intervention for COPD and HF from users' experiences was explored. Perceived usefulness can be seen as a measure of the effect of the whole MATCH self-management intervention. Hence, the perceived effectiveness of the different components of the MATCH self-management intervention for COPD and HF from users' experiences was explored. Furthermore, information about each specific component of the MATCH self-management intervention was included in the interview guide, so that participants were better able to recall the specific components of the MATCH self-management intervention for COPD and HF.

Two experts who were experienced with interviewing techniques gave feedback on the prepared questions, probes and information, so that only relevant questions and information were included in the interview guide. Using the experts' feedback almost all components were adjusted, only the questions, probes and information related to monitoring, inhaler and the end of the interview were not specifically adjusted. By using the experts' feedback about sentence structure, some specific questions, probes and information were re-formulated, making them more clear. In addition, the questions, probes and information were arranged in a logic order and some questions and probes were also added. Some examples of the adjustments are that patients' opinion was asked about: the received information during the self-management sessions; the perceived benefits of the MATCH self-management intervention; if and why patients considered it easy to use the portal; the usage of the to-do-list that was included in the self-management module of the digital portal; which modules of the portal were not used; and the appearance of the avatar. In addition, questions, probes and information about the usage, appreciation and perceived effects of the sensor and support of case managers, family or friends were added. For instance, a question about what case managers and informal caregivers could have done for patients was added. Also, questions and probes regarding general points for improvement for the whole MATCH self-management intervention and for the digital portal on the tablet were added. For example, patients were asked which parts of the MATCH self-management intervention or digital portal satisfied them and which parts were missing. In addition to the prepared questions and probes as described in the interview guide, patients could bring-up other topics as well.

In addition, the interviewer was trained before the interviews took place. The training consisted of two practice sessions with two researchers who had experience with interviewing techniques. The feedback from these practice sessions was used to improve the interviewer's interviewing techniques, the informed consent form and the interview guide. To prevent that filling-in the informed consent form would take too much time and effort from participants at the beginning of

the interview and to sufficiently inform participants upfront about the current study, as much information as possible was provided via telephone. Also, the participant and interviewer sat in a ninety degree angle relative to each other during the interviews. This is described as being an averagely direct sitting position [40]. After discussing the sitting position of a ninety degree angle with one of the researchers (i.e. one of the experts), it seemed not likely that the ninety degree sitting position would affect the conversation during the interview. The interviewer also asked more in-depth questions, which made it easier to obtain all relevant information from patients during the interviews. In addition, some fictional data was filled-in upfront so that an actually overview could be presented during the interview. The interviewer asked participants to speak up if they fully discussed a specific topic.

The interview guide that eventually was used during the interviews (Appendix 2) contains the complete overview of all the prepared questions, probes and information. The structure of the interview guide is described in Table 4. The interview guide consisted of five parts: 1) introduction; 2) whole MATCH self-management intervention; 3) specific components of the MATCH self-management intervention; 4) general points for improvement; and 5) end. In the first part an introduction of the interviewer was given, participants were also informed about the objectives of the study and about the course of the interview. In addition, information about the MATCH self-management intervention was given, to help participants to better recall information about the MATCH self-management intervention about COPD and HF. In the second part participants were asked about their impression of the whole MATCH self-management intervention (i.e. training, digital portal and support together). Questions about usage, appreciation and perceived effectiveness were asked. In the third part, participants' opinion and experiences with the specific components of the MATCH self-management intervention were asked, namely training with self-management meetings, the whole digital portal (i.e. all six modules together, see Table 2), each specific module of the digital portal, and support by the avatar, case managers and informal caregivers. Per component, questions were asked about usage, appreciation and perceived effectiveness. In the fourth part, participants were asked for general points for improvement for the whole MATCH self-management intervention (i.e. training, digital portal, and support together) and specifically for the digital portal. Participants were asked to: give a score on a scale from zero to ten for the whole MATCH self-management intervention and for the digital portal; were asked how the MATCH self-management intervention and the digital portal could be improved; whether participants would recommend the MATCH self-management intervention and digital portal to others with COPD and HF; whether participants would use the MATCH self-management intervention and digital portal for a longer period of time; and which parts of the MATCH self-management intervention and the digital portal would participants like to use again and which parts would participants not want to use again. Finally, the interview was rounded-up.

Table 4. *Structure of the interview guide.*

Parts	Related components	Content	Most important questions or provided information
Introduction	Do not apply	• Introduction of the interviewer	• *Name, educational programme, role in the current study.*
		• Informing about the objectives of the study and course of the interview	• *We as researchers wonder what the MATCH project for COPD and HF has brought you (participant) for your symptoms of COPD and HF. I (interviewer) would like to ask questions about this during the interview. First we (interviewer and participant) will discuss the project in general and then we will run through each part with you.*
		• Information about the MATCH self-management intervention	• *You (participant) have participated in the MATCH project for COPD and HF. You have worked with the various components of the project. It consisted of: training in the hospital, a digital portal that you have used on the tablet for a few months, and support. Self-management was important in the project and that is how you deal with the consequences of your COPD and HF.*
Whole MATCH self-management intervention	Training, digital portal and support	• Usage of the MATCH self-management intervention	• *Have you used the MATCH project every day? If so, what did you do every day?*
		• Appreciation of the MATCH self-management intervention	• *What did you think of the MATCH project for COPD and HF in general (so the training, the portal and the support, all together)?*
		• Perceived effectiveness of the MATCH self-management intervention for COPD and HF separately	• *Has the MATCH project for COPD and HF in general (so the training, the portal and the support, all together) brought you something for your COPD symptoms? If so what then?* • *Has the MATCH project for COPD and HF in general (so the training, the portal and the support, all together) brought you something for your HF complaints? If so what then?*
Specific components of the MATCH self-management intervention	Training[a]	• Participation during the training	• *Were you present at all self-management meetings?*
		• Appreciation of the training	• *What did you think of the self-management meetings?*
		• Perceived effectiveness of the training	• *Had the self-management meetings brought you anything? If so what then?*
	Whole digital portal[b]	• Usage of the whole digital portal	• *What did you do on your tablet?* • *How did you use the MATCH portal on your tablet in general?*

		• Appreciation of the whole digital portal	• *What did you think of the MATCH portal on your tablet in general (so all parts together)?*
		• Perceived effectiveness of the whole digital portal	• *In general, had the MATCH portal on your tablet brought you anything? If so what then?*
	Each specific module of the digital portal	• Usage of the six different modules of the digital portal	• *What did you do with the self-management component?* • *How did you use the self-management component?*
		• Appreciation of the six different modules of the digital portal	• *What did you think of the self-management component?*
		• Perceived effectiveness of the six different modules of the digital portal	• *Had the self-management component brought you anything? If so what then?*
	Support by the avatar, case managers and informal caregivers	• Received support from the avatar, the case managers and the informal caregivers	• *How did the case managers support you?*
		• Appreciation of the received support from the avatar, the case managers and the informal caregivers	• *What did you think of the support provided by the case managers?*
		• Perceived effectiveness of the received support from the avatar, the case managers and the informal caregivers	• *Had the support from the case managers yielded you anything? If so what then?*
General points for improvement	Whole MATCH self-management intervention[c]	• Give a score for the whole MATCH self-management intervention on a scale of zero to ten	• *What score would you give for the MATCH project for COPD and HF on a scale from zero to ten? Where zero means "It has not brought you anything " and ten means "It has brought you extremely much ".*
		• How the MATCH self-management intervention could be improved	• *What improvements do you suggest for the MATCH project for COPD and HF in general?*

		• Recommend the MATCH self-management intervention to others with COPD and HF	• *Would you recommend the MATCH project for COPD and HF to others with COPD and HF?*
		• Use the MATCH self-management intervention for a longer period of time	• *Would you participate in the MATCH project for COPD and HF for a longer period of time?*
		• Which parts of the MATCH self-management intervention would be preferred to use again and which parts would not be preferred to use again	*If you would participate once again in the MATCH project for COPD and HF.* • *Which parts do you want to use again?* • *Which components do you not want to use again?*
	Digital portal	• Give a score for the digital portal on a scale of zero to ten	• *What score would you give for the portal on the tablet on a scale from zero to ten? Where zero means "It has not brought you anything " and ten means "It has brought you extremely much ".*
		• How the digital portal could be improved	• *What improvements do you suggest for the portal on the tablet in general?*
		• Recommend the digital portal to others with COPD and HF	• *Would you recommend the MATCH portal on the tablet to others with COPD and HF?*
		• Use the digital portal for a longer period of time	• *Would you use the MATCH portal on the tablet for a longer period of time?*
		• Which parts of the digital portal would be preferred to use again and which parts would not be preferred to use again	*If you would use the portal on the tablet again.* • *Which parts do you want to use again?* • *Which parts do you not want to use again?*
End	Do not apply	• Round up the interview	• *I (interviewer) would now like to finish the interview.* • *Do you (participant) have anything else to tell me or ask?* • *Thanks for your (participant's) time.*

Abbreviations: *MATCH,* The Self-Management And Telemedicine in patients with COPD and chronic heart failure; *COPD,* Chronic obstructive pulmonary disease; *HF,* Heart failure
[a]with self-management meetings;

[b]is all six modules together;
[c]is training, digital portal, and support together.

2.6. Data-analysis

The audiotapes of the interviews were transcribed verbatim using Amberscript and the data analysis was supported by AtlasTI software (Cleverbridge AG Inc. Version 8.1, 2017). Two researchers (AR and JS) coded the first three interviews independently. Because of time constraints, seven interviews were coded by the first researcher only. The transcripts were read to code relevant text fragments. Later on, these codes were categorized and citations were searched for to support the codes and categories. All the codes from seven interviews were structurally brought together into categories. Due to time constraints, from three interviews only the most important codes, codes that added extra information to the codes and categories obtained from the seven interviews, were brought together into categories as well or were added to the already obtained categories. The codes of these three interviews were developed by the first researcher only. During the entire data-analysis it was strived to full-fill the study objectives.

When analysing the data, the entire transcripts were read five times in total to obtain a sense of the perceived positive aspects, negative aspects and points for improvement related to the usage of the MATCH self-management intervention for COPD and HF as were mentioned by the participants during the interviews [27, 41]. A code tree was developed by the first researcher using MindMeister software (MindMeister - Online Mind Mapping software). The final version of the code tree includes the feedback of the second researcher and a third researcher. The code tree served as a guidance when labelling all relevant text fragments using codes. A code included the specific part of the MATCH self-management intervention, then if the text fragment was about usage, appreciation or perceived effectiveness. When the text fragment was about usage, the code included if the specific part was used or not and if so, if it was a motivation to use the specific part or if it was a way of using the specific part. If the text fragment was about appreciation or perceived effectiveness, the code included if the specific part was positive, negative or a suggestion for improvement. The code ended with a short description of the specific information given by participants as reported in the transcripts. The researchers decided which text fragments were labelled with words originating from the transcripts [35, 41], and when new overarching codes were used to label text fragments. Overarching codes were only chosen if this was considered to be more appropriate, however the researchers strived to use as many words originating from the transcripts in the codes as possible in order to develop authentic codes. Next, all codes were compared on differences and similarities and clustered into overarching categories [35, 41]. When creating the categories, the text fragments, codes and categories were continuously compared in order to build authentic codes and categories [35].

The codes from the first three interviews that were created by the two researchers were compared and discussed among the two researchers. Codes or selected text fragments were discussed among the researchers in case one of the researchers felt not confident about a code or a selected text fragment or if codes or selected text fragments differentiated. A process of reflection and discussion between the two researchers about the similarities and differences of the codes resulted in agreement about the final coding of the relevant text fragments. When the two researchers had not reached consensus, a third independent researcher became involved to help to reach an agreement about the final coding of the relevant text fragments.

Two questions from the interview guide were quantitative measures: 1) *"What would you give as a score for the MATCH project for COPD and HF on a scale from zero to ten? Where zero means 'It has not brought you anything' and ten means 'It has brought you extremely much'."* and 2) *"What would you give as a score for the portal on the tablet on a scale from zero to ten? Where zero means 'It has not brought you anything' and ten means 'It has brought you extremely much'."* These questions contributed to the availability of data about three continuous variables: 1) the scores of participants to express their satisfaction about the usage of the whole MATCH self-management intervention (i.e.

training, digital portal, and support together); 2) the scores of participants to express their satisfaction with the digital portal that was used in the MATCH self-management intervention; and 3) the age of participants. Per continuous variable the data was plotted into a histogram in Excel (Microsoft® Office 365, 2016) in order to check if the data was normally distributed. If the data was not normally distributed, the median with the accompanying 25-75 interquartile range (IQR) were presented. If the data was normally distributed, the mean ± standard deviation (SD) were presented.

3. Results

3.1. Characteristics

Baseline characteristics of the ten participants that were interviewed are presented in Table 5. The mean age of the participants that were interviewed is 67 years (SD =9.7). Most participants were male, lived with a partner, and were aged between 56 and 83 years. Most participants had moderate to severe COPD, with GOLD stages two or three, and zero till three self-reported exacerbations for COPD in the past year. In addition, most participants had mild HF symptoms, with NYHA class two, and zero till two self-reported exacerbations for HF in the past year.

Table 5. *Baseline characteristics of MATCH participants (n=10) that were interviewed.*

ID	Gender	Age	Smoking	Education level	Partner[a]	GOLD stage[b]	NYHA[c]	Exacerbations COPD last year[d]	Exacerbations HF last year[e]	Experience with the use of digital devices
P01	Male	56	Former	University	Yes	3	2-3	3	–	Smartphone, tablet and PC
P02	Male	72	Former	Secondary vocational education	Yes	2	–	3	1	Smartphone and PC
P03	Male	67	Former	High school	Yes	3	1	0	1	Smartphone, tablet and PC
P04	Female	71	Former	High school	No	2	1	0	0	Smartphone and PC
P05	Male	64	Former	Secondary vocational education	No	2	2	1	1	Smartphone and PC
P06	Male	68	Former	Secondary vocational education	Yes	2	2	1	1	Smartphone
P07	Female	48	Former	Secondary vocational education	Yes	2	2	1	1	Smartphone, smartwatch and PC
P08	Male	75	Former	Secondary vocational education	Yes	3	3	2	2	Tablet
P09	Male	83	Former	Secondary vocational education	Yes	3	2	2	1	Tablet and PC
CG01[f]	Female	66	–	–	Yes	–	–	–	–	Tablet and PC

Abbreviations: *MATCH,* The Self-Management And Telemedicine in patients with COPD and chronic heart failure; *GOLD,* Global Initiative for Chronic Obstructive Lung Disease; *NYHA,* New York Heart Association functional classification; *COPD,* Chronic obstructive pulmonary disease; *HF,* Heart failure

[a]Wheter participants had a partner or not;

[b]According to FEV1 % predicted using Global Initiative for Chronic Obstructive Lung Disease (GOLD) criteria (2019)[3];

[c]Based on patients' symptoms as reported in the medical status;

[d]Number of self-reported exacerbations defined as the number of antibiotics and/or prednisone taken during last year to treat the worsening of lung symptoms;

[e]Number of self-reported exacerbations defined as the number of extra diuretics taken during last year to treat the worsening of heart failure symptoms;

[f]This participant is the informal caregiver for P06;

– = missing data.

3.2. Evaluation of the MATCH self-management intervention by patients

In the following paragraphs, only the most important categories and codes that are derived from the one-to-one in-depth semi-structured interviews with patients with COPD and HF are described and highlighted with participants' quotes. A comprehensive description of the categories and codes that are derived regarding the three components of the MATCH self-management intervention: 1) training; 2) the digital portal; and 3) support are presented in each paragraph. In addition, the results are structured using usage, appreciation, perceived effectiveness, perceived ease of use, facilitating conditions and social influence, and perceived usefulness [34].

Nine participants provided scores on a scale from zero to ten to express their satisfaction about the usage of the whole MATCH self-management intervention (i.e. training, digital portal, and support together) (Table 6). The median score was a 7 (IQR 4.5-8.0). In addition, all ten participants separately scored the digital portal that was used in the MATCH self-management intervention, on a scale from zero to ten (Table 6). The median score was also a 7 (IQR 6.0-8.6).

Table 6. *Scores for the whole MATCH self-management intervention[a] and for the digital portal, provided by the MATCH participants (n=10) that were interviewed.*

ID	Scores for whole MATCH self-management intervention (n=9)[a]	Scores for digital portal (n=10)[b]
P01	1	6
P02	8	9
P03	7	4
P04	7	7
P05	8.5	8.5
P06	4	8
P07	8	6
P08	5	6
P09	5	9
CG01[c]	–	7
Median score (IQR)	7 (4.5-8.0)	7 (6.0-8.6)

Abbreviations: *MATCH,* The Self-Management And Telemedicine in patients with COPD and chronic heart failure; *IQR,* interquartile range

[a]participants provided scores on a scale from zero to ten to express their satisfaction about the usage of the three components of the MATCH self-management intervention: 1) training; 2) the digital portal; and 3) support;

[b]participants separately scored the digital portal that was used in the MATCH self-management intervention, on a scale from zero to ten;

[c]this participant is an informal caregiver;

– = missing data.

3.2.1. Reasons for patients to participate

Appreciation – perceived usefulness

Participants had various reasons to participate in the MATCH study and were mostly altruistic. For the majority, the most important reason was to help other patients to get relief from their diseases (P06,P04,P09,P07,P03). *"But if you can build a program for other people to lighten the matter (COPD and HF). Yes, why not? That was my motivation [P09].*" Other altruistic motives were: to help other patients to create healthy behaviour and to motivate them (P04,P09); to provide researchers with data, so that other patients can be helped (P04,P09,P03). *"I felt more or less obliged to participate, because I also benefit from people who have participated in research before me, so that I actually have benefits. If it is just about medication or an investigation. No, I think research is very important.*

That is why I feel obliged to participate, well where I can contribute to the health of someone else. That is actually the reason [P04]."

Other reasons were related to an experienced pressure: a spouse motivated a participant to use the MATCH self-management intervention for COPD and HF (P06). *"It is my wife who wanted me to participate. But I think it was not necessary for me [P06]."* Also, feeling obligated to participate (P09,P07). In addition, a participant had promised to participate (P01). *"And if I promise something, I will do it. [...] I had promised to participate in this study, so I will finish it [P01]."*

A more self-centred reason was the expectation to learn new things (P07,P01,P09).*"I am not going to let it go with the thought that it will not bring me anything. Moreover, you always have hope of becoming better next time. So, that is the reason [P01]." "What did I expect from the system? A little bit maybe that I could improve my symptoms [P09]."*

3.2.2. Training

A comprehensive description of the positive aspects, negative aspects and points for improvement from users' experiences with the training is provided in Table 7. All patients (n=9) were present during the self-management sessions at which they were trained. Seven types of positive aspects were identified: 1) information was easy to understand and useful; 2) having peer groups; 3) patient empowerment; 4) expert-led sessions; 5) current preparation; 6) received personal attention; and 7) took no effort to attend. Four types of negative aspects were identified: 1) insufficient verbal information; 2) financial and time effort; 3) no heterogeneous groups of participants; and 4) organisation. Two types of points for improvement were identified: 1) provide only information that is perceived useful by participants; and 2) organize training differently.

Table 7. *Positive aspects, negative aspects and points for improvement from users' experiences with the training[a] (n=9).*

Structure	Positive aspects	Negative aspects	Points for improvement
Usage – perceived ease of use	• Were not identified	<u>*Financial and time effort (n=2)*</u> • *N1:* Takes money and free time to be present (P06,P01) • *N2:* A not fully prepared training takes time from participants (P06,P01)	• Were not identified
Appreciation – perceived ease of use	<u>*Information was easy to understand and useful (n=5)*</u> • Difficulty of information must be subsequent to patient level (P06,P04) • Clear and detailed explanation (P09,P03) • Information about the self-management of COPD and HF was usefulness, interesting & recognizable for patients (P04,P07,P03,P09) • Repetitive information increases awareness and refreshes knowledge of COPD and HF (P04,P09) <u>*Took no effort to attend (n=1)*</u> • Takes no effort of patient to attend the self-management sessions (P04) • Participant does not mind putting effort into project (P04)	• Were not identified	• Were not identified
Appreciation – facilitating conditions and social influence	<u>*Expert-led sessions (n=4)*</u> • Training lead by experts (P04,P03) • Enthusiast attitude of medical professional[b] (P06,P09,P04) • Experts demonstrated breathing exercises (P03) <u>*Current preparation (n=3)*</u> • Notify patients upfront of training programme (P04,P03,P01) <u>*Received personal attention (n=1)*</u> • Personal attention (P07)	<u>*Insufficient verbal information (n=4)*</u> • Insufficient explanation on connectivity of digital devices (P04) • *N6:* Information was superficial (P07) • *N7:* Patient forgets verbal information (P04,P07) • *N8:* Too much information at once (P07,P01) • *N9:* No explanation in which order devices should be used (P03) <u>*Organisation (n=2)*</u> • *N10:* Project abruptly ended (P07) • Participant was critical about the experience of younger healthcare providers (P06)	<u>*Provide only information that is perceived useful by participants (n=5)*</u> • Provide information that is tailored to the patient's interests, is useful and recognizable to patient (P04) – *Linked to N7 and N18* • Inform participants about the goal, and added value of the project (P09, P01) – *Linked to N14, N15 and N28* • Give more detailed information that is spread across a longer period of time (P07) – *Linked to N6, N8 and N25* • Explain clearly who is monitoring which data, who takes action whenever necessary and explain when patients

need to take on action by themselves (P07, P01) – *Linked to N69*
• Include an explanation about the order in which devices should be used (P03) – *Linked to N9*
• Instruct participants to keep the tablet horizontally so that text is readable on the tablet (P03)
• Give information about the goal of the project (P01)
• Only give an instruction about the usage of the tablet (P01)

Organize training differently (n=3)
• Fully prepare training (P06) – *Linked to N2*
• Offer free parking ticket (P06) – *Linked to N1*
• Hook-up participants from the same area to enable them to travel together and to discuss information from the self-management sessions (P04) – *Linked to N3*
• Make it possible to follow training nearby (P04)
• Distribute heart- and lung patients harmoniously between participant groups (P07) – *Linked to N4 and N5*
• Create participant groups based on age (P07) – *Linked to N5*
• Include a final meeting to end-up the project to show some results of the project, to give information about implementation and to discuss experiences with other participants (P07) – *Linked to N10*
• Follow-up the project (P07)
• Start a self-management intervention and give information at consultations with a nurse if patients are recently diagnosed (P07) – *Linked to N21 (see Table 8)*

Perceived effectiveness – perceived usefulness	<u>*Patient empowerment (n=5)*</u> • Empower patient to self-recognize, self-monitor and self-treat symptoms (P06,P04,P07,P03) • Empower patient to increase self-efficacy (P06,P07) • Support positive attitude about diseases (P04) • Increases understanding of symptoms and treatments of COPD and HF (P06,P09,P07,P03) • Yield knowledge & skills to self-manage diseases (P04,P09,P07,P03) • Creates a stable reference level to look back to (P07)	• Were not identified	• Were not identified
Perceived effectiveness – facilitating conditions and social influence	<u>*Having peer groups (n=6)*</u> • Gives confirmation and recognition of diseases and symptoms (P04) • Create connection with other patients so that there is more personal contact and to learn from other patients' experiences (P06,P04,P09,P07,P03,P05) • Creates discussion with others to ask advise (P04) • Participants recognize added value, dangers and difficulties for other patients with less self-management (P09,P07,P03) • Participant does not want to bother others (P09)	<u>*No heterogeneous groups of participants (n=2)*</u> • *N3:* Knowing nobody during training (P04) • *N4:* A lot of variation in severity of patients with COPD (P04) • *N5:* Felt as being in the wrong group (P07)	• Were not identified

Abbreviations: *COPD,* Chronic obstructive pulmonary disease; *HF,* Heart failure; *N1-N10,* Negative aspect one till ten is linked by its number to specific points for improvement
[a]With two self-management sessions in groups that were given in the hospital by one nurse practitioner Chronic obstructive pulmonary disease (COPD) and one nurse practitioner heart failure (HF) and one individual self-management session in the hospital with one nurse practitioner COPD or one nurse practitioner HF;
[b]The medical professionals that informed patients during the training and supported patients when using the MATCH self-management intervention.

Usage – perceived ease of use – negative aspects

One of the least frequently mentioned negative aspects was that it took financial- and time effort to be present during the self-management sessions. *"Because if I have to go to the hospital and I have to park the car. I think the costs are bizarre. [...] You have to pay the parking costs every time. [...] We have had an exit card once in Hengelo I think. After that we just had to pay it every time. Well, if you sit there for a few hours. Then you will easily lose eight or nine euros [P06]." "I believe I have been there during two consultations. But it had not brought me anything. Look, to come to Enschede to hear the question, are you okay? To answer, yes I am doing well. And then we are finished. That is also a bit of a waste of energy and time [P01]."*

Appreciation – perceived ease of use – positive aspects

One of the second most frequently mentioned positive aspects was that the provided information was easy to understand and useful. Four participants added that the information about the self-management of COPD and HF was interesting and recognizable for patients. *"I found that interesting. Because I do find it interesting and it is also useful for me. Then you remember it. And then you recognize it much earlier. [...] Because that (information during self-management meetings) is usable and is applicable to me. Look, and you recognize that and you can remember that. You can use that yourself [P04]."*

One of the least frequently mentioned positive aspects was that the self-management sessions took no effort to attend to. *"It took me very little effort to drive to Hengelo and Enschede. I have no problems with that [P04]."*

Appreciation – facilitating conditions and social influence – positive aspects

Some participants thought it was a positive aspect that the case managers had an enthusiast attitude during the expert-led sessions. *"The introduction (expert-led sessions), it was very enthusiastic. They (case managers) did their best to explain it clearly. That was very good. […] They (case managers) adjusted themselves to the people, responded to questions, gave their opinion very enthusiastically. Those case managers really did their best to enthusiastically tell their story [P09]."*

The second least frequently mentioned positive aspect was that the current preparation facilitated the self-management sessions, considering that participants were notified of the training programme upfront. *"I received an invitation for the training programme. At the start of the program they had just determined what the program would be and where it would be. Therefore, I could arrange to be present [P04]."*

The other least frequently mentioned positive aspect was that the personal attention participants received was also helpful. *"Yes, that it was personal perhaps, talking about yourself for a moment [P07]."*

Appreciation – facilitating conditions and social influence – negative aspects

The most frequently mentioned negative aspect was that verbal information given during the self-management sessions was deemed to be insufficient. Two participants acknowledged that they had forgotten the verbal information that they received during the self-management sessions. *"If you start such a self-management program, I think it's very handy to have breathing exercises for an hour and a half, how you can relax and so on. Look, now it's very brief. Now, you have one afternoon and then equipment had to be explained. Everything had to be set. And then everything is briefly explained. […] Give the information about breathing exercises and HF, but not in one afternoon. Not in a very short session. Because those things are often things that you will forget again. Look, if you*

just start with such a management program, but after a while. Then I think you should not want that anymore [P07]."

One of the least frequently mentioned negative aspects was about the organisation of the self-management sessions. An example of this critical attitude is focused on the experience of younger medical professionals and was mentioned by one participant. "*Maybe it is just because it is a younger person. That he does not know too much yet. They think so. And whether they are graduates or not. They know a lot in a certain area, but they do not know how society works [P06]."*

Appreciation – facilitating conditions and social influence – points for improvement

The most frequently mentioned point for improvement was that only information that is perceived useful by participants should be provided during the self-management sessions. *"Then I used that inhaler and then I placed the Fitbit on the portal. But there was no indication in advance whether you should do that and in which order. Maybe it was easier. That there is an instruction in which order you should do such things [P03]. "*

The least frequently mentioned point for improvement was that the training should be organised differently. For example, one participant mentioned that participants from the same area should be hooked-up together to enable them to travel together and to discuss information from the self-management sessions. *"I would have just liked it that you have someone in the neighbourhood that you know. With whom you can go through things, with whom you can travel together and things like that [P04]."*

Another participant said that it would be helpful if the HF- and COPD patients would be harmoniously distributed between participant groups. *"Perhaps that is also the case in the group in which I was involved, that they were all really heavy lung patients. But maybe I would have liked it better if there were more. Well, fewer lungs and more heart patients [P07]."*

Perceived effectiveness – perceived usefulness – positive aspects

The second most frequently mentioned positive aspect was that half of the participants felt empowered during the self-management sessions. More specifically, an example provided by four participants is that they were empowered to self-recognize, self-monitor and self-treat their symptoms. *"The information from the training was interesting, because I could use it. […] For example, you can adjust your breathing. For instance, if you start to get tired, you can, or at least I can do that, take a rest. Then I will do a few breathing exercises and that relaxes me. And from relaxation you can always do much more than when you are stressed [P04]."*

Perceived effectiveness – facilitating conditions and social influence – positive aspects

The other most frequently mentioned positive aspect was that peer groups helped to connect with other patients, so that there is more personal contact and experiences could be shared. *"I also saw that others had a lot of trouble. Who had much worse health problems than I did. They became happy, because they were heard and seen in the project. [...] That made me happy too [P05]."*

Perceived effectiveness – facilitating conditions and social influence – negative aspects

The other least frequently mentioned negative aspect was that there were no heterogeneous groups of participants. One participant for example felt as being in the wrong group. *"I thought I had more problems with my heart failure and all the rest had more problems with the lungs. Another group. [...] Well you are a lonely [P07]. "*

3.2.3. Digital portal

A comprehensive description of the positive aspects, negative aspects and points for improvement from users' experiences with the digital portal is provided in Table 8. All patients (n=9) used the digital portal of the MATCH self-management intervention for COPD and HF. Nine types of positive aspects were identified: 1) having a daily routine and being reminded to perform actions; 2) patient empowerment; 3) being a responsible and motivated patient; 4) already experienced in self-monitoring; 5) already experienced in self-treatment; 6) already experienced with digital devices; 7) easy to use digital devices and clearly presented data and information; 8) already being physically active; and 9) positive appearance of avatar. Thirteen types of negative aspects were identified: 1) impeding personality of patients; 2) technical problems regarding design and functionality of digital devices; 3) negative appearance of the avatar; 4) providing unnecessary information; 5) no experience with digital devices and doubt of patient; 6) limited recognition of symptoms; 7) participant sees no added value; 8) physical limitations of participant; 9) participant postponed or delayed self-treatment and were not open for self-treatment; 10) patient is not open to use digital devices; 11) unpersonal; 12) time and effort; and 13) insufficient source of information. Eight types of points for improvement were identified: 1) fix technical problems and make adjustments in digital portal; 2) present and provide information in other ways than currently has been done; 3) adjust digital avatar; 4) provide immediate advice and notifications about changes or abnormalities regarding patients' health status; 5) adapt way of communicating with patient; 6) tailor to patients needs; 7) lower hurdles for participants; and 8) perform self-management on paper.

Table 8. *Positive aspects, negative aspects and points for improvement from users' experiences with the digital portal[a] (n=9).*

Structure	Positive aspects	Negative aspects	Points for improvement
Usage – perceived ease of use	<u>*Having a daily routine and being reminded to perform actions (n=7)*</u> • Have the project integrated in their daily life as an automated daily routine (P06,P04,P05,P09,P07,P03,P01) • Integrating the project into daily routine takes no effort (P09,P07) • The weighing scale was a reminder to weigh yourself every day so that it became a routine (P07) • Using the tablet triggers to take inhalation medication (P03) • The integrated digital avatar triggered to read information that the avatar referred to (P03)	• Were not identified	• Were not identified
Appreciation – perceived ease of use	<u>*Easy to use digital devices and clearly presented data and information (n=5)*</u> • Easy and clear to fill in data (P04,P09,P07) • Easy that data was automatically registered (P06,P04,P07,P03) • Easy to use (CG01,P09,P07) • Handy to place comments (P09) • Clear overview of telephone numbers and health status with the automatic registered data (P09,P07) • Digital devices that actually work (P09,P07) • Provided concise information (P06) • Questions were clear (P09) • A well programmed and well designed system (P09) • Useful to have information all together (P07,P03)	<u>*Time and effort (n=2)*</u> • *N59:* The project took too much effort and time (P01,P07)	<u>*Lower hurdles for participants (n=3)*</u> • The project should take less time than now was the case (P01) – *Linked to N27 and N59* • Participant should put more effort into project (P04) – *Linked to N22, N23 and N24* • Calling case managers is a hurdle (P07)
Appreciation – facilitating conditions and social influence	<u>*Positive appearance of the avatar (n=1)*</u> • Nice for patients who are lonely (P07)	<u>*Impeding personality of patients (n=6)*</u>	<u>*Adapt way of communicating with patients (n=3)*</u>

• Was friendly (P07)
• Being reliable (P07)

• *N22:* Participant takes not all actions to be able to self-treat symptoms (P04)
• *N23:* Participants are impatient (P04,P01)
• *N24:* Only do things when it suits participants (P04,P07,P01)
• Not tell doctor everything (P06)
• Unconcerned about disease management (P06)
• Reserved mindset towards medication (P06,P09,P03,P01)
• The project has to full-fill patients' expectations (P06,P09)
• Participants only uses what participants think is relevant (P04,P09,P07,P03,P01)
• Participants do not trust the advice of the digital portal and sensor on inhaler (P07,P03,P01)

No experience with digital devices and doubt of patient (n=5)
• *N31:* Patient has to little experience in the usage of digital devices and in the solving of technical problems (P06,P04,P09)
• *N32:* Patients does not know how to use digital devices (P09)
• Limited ability to solve technical problems by themselves (P09)
• *N33:* Patients did not grew up with digital devices (P09)
• Patient doubts using the sensor on inhaler correctly and doubts that the patient inhaled correctly (P07)
• *N34:* Patient doubts tapping tablet correctly (P07)
• *N35:* Interpretation of data is difficult (P03)

Participant postponed or delayed self-treatment and were not open for self-treatment (n=4)
• Participant does not want to go to doctor too quickly in general (P06)

• Patient is willing to follow and listen to advice of people instead of listening to advices of digital devices (P06) *Linked to N29, N30, N58, N68 and N77 (see also Table 10)*
• Start a forum during the project with patients and case managers from the project to discuss experiences and to answer questions (P07) – *Linked to N25*
• Use one word for one component in the digital portal (P03) – *Linked to N44*

		• Participant avoids unnecessary use of medication (P04) • Participant did not take medication on its own (P09) • Broken routine (P07) • Participants have unhealthy behavioural patterns (P06,P09) • Body should be given time to be able to heal itself, thus not taking action too quickly (P04,P06) <u>*Limited recognition of symptoms (n=5)*</u> • *N11:* Difficult to differentiate between lung- and heart problems when symptoms deteriorate (P06,P04,P01,P03) • Difficult to assess where COPD symptoms come from (P07) • *N12:* Difficult to specify severity of symptoms (P01) • Hard to remember health status before deterioration of symptoms began (P01)	
Appreciation – perceived usefulness	• Were not identified	<u>*Technical problems regarding design and functionality of digital devices (n=6)*</u> • *N36:* Difficult to read text given by the avatar and there was no audio on the tablet (P04,P03) • Empty batteries (P06,P04,P01) • *N37:* Unpleasant design of sensor that hindered inhalation of medication (P04,P03) • *N38:* It was a slow system (P03) • Avatar should not have an annoying voice (P06) • A not working self-management system (P09) • *N39:* Malfunctioning weighing scale: not automatically registered weights (P09) • *N40:* Unclear overview of data (P07) • Malfunctioning or broken Fitbit: battery went empty in couple days, stopped working after update, steps were not registered (P09,P07,P01) • *N41:* Tablet did not respond upon patients' touch (P09,P07,P03)	<u>*Fix technical problems and make adjustments in digital portal (n=5)*</u> • Redesign not user friendly features of devices (P04,P03) – *Linked to N36 and N37* • Create a fast digital portal (P03) – *Linked to N38* • Remove redundant devices (P09) • Having one application on smartphone containing everything that is necessary instead of using a tablet (P07) – *Linked to N46, N47, N48 and N57* • Ability to connect the application to the patient's smartwatch (P07) • Adding an integrated messaging function to ask questions to a real person when having medical and technical problems and show a photo of the person who is on duty to support patients (P07,P01) – *Linked to N42*

• Inhalation medication did not fit into sensor (P09)
• Malfunctioning sensor on inhaler: problems with empty batteries, did not what it supposed to do and gave wrong feedback or no feedback at all (P07,P03,P01)
• Participants were bound by a fixed time to answer questions (P07)
• *N42:* Participant missed an integrated messaging function (P07)
• *N43:* Not all weights came into the graphs if manually entered (P07)
• *N44:* Two different words are used by the avatar and the portal, but refer to the same component of the digital portal (P03)
• The alarm of the sensor was annoying (P03)
• *N45:* There was no option to correct an incorrect entry of data (P03)
• *N46:* Participant was bound by tablet (P07)
• *N47:* Participant was bounded by connecting Wi-Fi to tablet (P07)
• *N48:* Participant forgot Fitbit, because it needed to be attached to trousers (P07,P01)
• Impossible to take digital weighting scale with you on vacation (P01)

Negative appearance of the avatar (n=6)
• *N49:* Vaguely formulated answers and tasks (P04,P01)
• *N50:* Unpleasant and annoying to work with (P04,P06,P03,P01)
• *N51:* An unnecessary function (P06, P09,P01)
• *N52:* The avatar felt as unwanted interference and gave irrelevant and standardised information or advice (P06,P07,P03,P01)
• *N53:* The avatar gives information patients already knew and applied (P04,P09,P01)
• Participants did not take the avatar seriously (P09,P03,P01)
• Childish advices (P09,P01)

• Make the buttons and tiles of the portal bigger, so that the portal immediately responds upon patient's touch (P03) – *Linked to N34 and N41*
• Include an uninterrupted overview of data of at least one week, instead of starting a new overview every Monday (P07)
• Include an option to correct an incorrect entry of data (P03) – *Linked to N45*

Adjust digital avatar (n=4)
• When reminders are given by the avatar, it should show what patient did not do, before asking why patient did not do that (P04) – *Linked to N49 and N55*
• Remove current avatar (P07) – *Linked to N50 and N51*
• Avatar must rather contain a question and answer function (P07) – *Linked to N54*
• Make it possible to turnoff the avatar (P07) – *Linked to N50 and N51*
• Make the avatar more authoritative (P03)
• Formulate more clear what the avatar means (P01) – *Linked to N49*

Present and provide information in other ways than currently has been done (n=4)
• Give a more clear overview of data about health status (P07,P09) – *Linked to N40*
• Add links to reliable websites, forums and add information from the hospital about diseases (P07) – *Linked to N17, N18 and N25*
• Indicate the amount of occurrences of symptoms (P01) – *Linked to N12 and N17*
• *B26:* Include the possibility to look up all the information from the training to refresh memory (P04) – *Linked to N26*

Provide immediate advice and notifications about changes or abnormalities regarding patients' health status (n=3)

		• No interest in avatar and it was not appealing (P07,P01) • *N54:* No added value of avatar (P07,P03,P01) • The popping up of the avatar was annoying and too often (P07,P03,P01) • Avatar lacked an authoritative attitude (P03) • *N55:* The avatar reminded the participant to complete tasks the participant already did (P04) • The avatar popped up too early in the morning with reminders to complete tasks (P01) <u>*Unpersonal (n=4)*</u> • *N56:* The project was not patient-tailored (P09,P07,P01) • *N57:* The portal did not contain everything that was needed (P07) • *N58:* Using a tablet and receiving advice via a computer is unpersonal (P03,P01) <u>*Insufficient source of information (n=2)*</u> • *N25:* It is insufficient only to have information and videos on portal (P07) • *N26:* Information about COPD and HF is to be read once (P07) • *N27:* Instruction movies take more time than reading text (P01) • *N28:* Videos and information on portal have no added value (P07)	• Give notifications and advice immediately in case of changes or abnormalities in health status (P07,P09) – *Linked to N16 and N19* • If weight is gained or participant is physically inactive than receive an advice to call medical professional[b] to help you with it (P09) • Include the monitoring of blood pressure and automatically registering it to be able to take immediate action if necessary (P03) <u>*Tailor to patients needs (n=3)*</u> • Avoid unnecessary repetition of information (P09) – *Linked to N20, N52 and N53* • Participant wants to answer questions only if the participant is not feeling well instead of answering the same questions every time (P07) • Participant wants to read experiences of others instead of medical facts (P07) • Tailor the project to patients' needs (P01) – *Linked to N13 and N56* • Type and moment of treatment should be adapted per patient (P01) • Decide on your own which information you see and what information is necessary instead of receiving irrelevant information (P07) – *Linked to N52 and N53* <u>*Perform self-management on paper (n=1)*</u> • Receive a decision tree on paper or add a decision tree as extra tab in the digital portal in order to know what to do when having symptoms (P07)
Perceived effectiveness – perceived usefulness	<u>*Patient empowerment (n=7)*</u> • The project gave insight in their diseases, disease progression, treatments and constraints in daily life (P06,P04,P09,P07,P03) • The project gives insight in the daily amount of activity, weight gain or weight	<u>*Contained unnecessary information (n=5)*</u> • *N17:* The digital portal contained unnecessary information (P07,P01) • *N18:* The provided information was already known by participants (P06,P04,P09,P07,P01)	• Were not identified	

	loss, current health status, inhalation technique and cause of symptoms by displaying patients' data (P04,P09,P06,P07,P03,P08) • The overview of data about physical activity stimulates to be more physically active (P07) • Enables patients to compare symptoms, recognize changes and to decide what actions to take (P07,P03) • Gives awareness on deterioration of symptoms (P07,P03) • Enthusiast attitude of medical professional[b] and yield skills motivates (P09) • Yielding skills motivates patient (P09) • Exercises during the project were useful (P04) • Breathing exercises enabled participant to walk further (P03) • The Fitbit stimulates to exercise more (P03,P01) • Information helps to recognize and monitor symptoms (P04) • Information on portal was used as a source of information to improve inhalation techniques (P03)	• *N19:* The system asked irrelevant and standardised questions, but gave no advice regarding participants' symptoms (P09,P07,P01) • *N20:* Unnecessary repetition of information and questions (P09,P07,P01) • *N21:* Do not start a self-management programme with patients who have their illnesses for a longer time and are experienced with it (P07,P01) *Participant sees no added value (n=5)* • *N13:* Participants see no need to participate in complete project (P04,P01) • The system took participants more effort than it was helpful (P09,P01) • *N14:* Unclear how system might improve participants' current health status (P09,P01,P07) • *N15:* Unclear how system might help participants who are already physically active (P07) • *N16:* Participants filled in data, but the system did not gave advice to improve health status (P09,P03,P01) • The sensor does not improve the inhalation of medication (P03) *Physical limitations of participant (n=5)* • Participants are forgetful (P06,P09) • Participant has poor hearing (P06) • Participants have no medical complaints to improve (P06,P04,P03,P09,P07) • Participants have poor eyes (P06) • Being an elderly patient (P09,P06)	
Perceived effectiveness – facilitating conditions and social influence	*Already experienced in self-monitoring (n=6)* • Patients already estimate whether self-treatment or taking immediate action is necessary based on symptoms (P06,P04,P03,P01)	*Patient is not open to use digital devices (n=3)* • Patient has no interest in digital devices (P06, P04) • *N29:* Patient is not willing to follow or listen to advice of digital device (P06,P04,P01) • *N30:* Patient is not willing to take advice or information from avatar (P06,P01)	• Were not identified

• Patients already recognized and monitored symptoms by themselves in order to get insight in their health status (P06,P04,P09,P07,P03,P01)
• Patients already search the internet to find answers to questions and to recognize symptoms and how to overcome those symptoms (P04,P09,P07)

Being a responsible and motivated patient (n=7)
• Patients are willing to save visits or calls to the medical professionals[b] (P07)
• Patient is willing to create healthy habits and willing to get rid of unhealthy habits (P04)
• Patients are curious and want to understand and learn new skills and knowledge (P04,P06,P09, P07,P03)
• Patients are consciously and enthusiastically engaged with the project (P01)
• Patients have an optimistic mindset (P06,P04)
• Patients are carefree about their diseases (P06,P03,P01)
• Patients accept their diseases (P06,P07,P01)
• Patients understand the limitations of pilot projects in healthcare (P06,P09)
• Patient knows that expectations might not be realistic (P09)
• Patients must have medical complaints to help them with (P09, P07,P03,P01)
• Patient enters data truthfully (P09)
• Patient already learned how the be disciplined during hobbies and work (P09)
• Patient thinks analytically (P09)
• Patients think self-management is pleasant and taking action on your own appeals (P07,P03)

• Patient thinks that self-management gives independence (P07)
• Patients wanted to do things correctly and as intended (P01,P04,P09,P07,P03,P05)
• Patients take their own responsibility whenever it is possible (P09,P07)
• The project meted patient's interest (P03,P01)
• Participant is loyal and pushes through (P01)
• Patient already lives healthy (P09)
• Patients take medication because they know it helps and has no side-effects (P06,P04,P07)

Already experienced in self-treatment (n=5)
• Participants have insight in diseases, disease progression, treatments and constraints in daily life (P06,P04,P09,P07,P03)
• Participants self-treat symptoms or self-treated symptoms before by taking medication or prevented symptoms by exercising (P06, P04,P09,P07,P03)
• Assertive attitude (P06,P04,P09,P07,P03)
• Participant has knowledge about medication (P09)

Already experienced with digital devices (n=5)
• Being experienced or skilled with digital devices (P06,P04,P09,P07,P03)
• Patient understands connection between devices and tabs within portal (P09)
• Participants solve technical problems by themselves (P04,P09,P07)
• Already used smartwatch (P07)

Already being physically active (n=4)

	• Participants know that they are physically active already (with extra help of a physiotherapist) (P06,P04,P09,P07)

Abbreviations: *COPD,* Chronic obstructive pulmonary disease; *NT-proBNP*, the fysiological inactive adjunct product of Brain Natriuretic Peptide; *HF,* Heart failure; *N11-N59,* Negative aspect eleven till 59 is linked by its number to specific points for improvement

[a]MATCH programme that participants used on the tablet and included the support that participants received from the avatar;

[b]The medical professionals that informed patients during the training and supported patients when using the MATCH self-management intervention.

Usage – perceived ease of use – positive aspects

One of the most frequently mentioned positive aspects was that having the MATCH self-management intervention integrated in their daily life as an automated daily routine and being reminded by the MATCH self-management intervention to perform actions facilitates the self-management of COPD and HF. *"I just let it integrate into my life. [...] You just have to get used to that, a fixed pattern and that is also the case with the MATCH project and then it does not cost extra attention. Then it falls into your life easily. [...] If you have done that for two days then it is already a pattern in your life [P05]." "You get up, you go to the toilet, you weigh yourself. And then you shower. And then I went downstairs and there was the tablet. Normally, when I took time to have breakfast I filled in the tablet while I had my breakfast. It sometimes happened that I rushed out of the house, because I had to leave. Then I filled in the questionnaire from the tablet when I came back home in the afternoon. And that was the routine. [...] And that was reasonably structured. Look if you don't take a fixed time. Yes, then it will be a mess [P01]."*

Appreciation – perceived ease of use – positive aspects

Ease of use of digital devices and presentation of data and information in a clear way was important too according to half of the participants. An important example mentioned by four participants was that is was easy that data was automatically registered. *"That the weight was automatically entered in the system and that your weight is monitored. I found that very useful. That the weight was entered automatically [P07]."*

Appreciation – perceived ease of use – negative aspects

One of the least frequently mentioned negative aspects was that the project also took too much effort and time. *"Look, at that time I was still working full-time. So, I had to do it all in between. Shower in the morning, dress up, well, weight yourself first. Then going downstairs, oh wait, fill in the list. Meanwhile, making sandwiches for work, having breakfast and then go to work. Then you invest a lot [P01]. "*

Appreciation – perceived ease of use – points for improvement

The other second least frequently mentioned point for improvement was that hurdles for participants should be lowered. For example, one participant said that the project should take less time than now was the case. *"So I think, the portal should take less time to fill in [P01]."*

Appreciation – facilitating conditions and social influence – positive aspects

The least frequently mentioned positive aspect was about some positive features of the avatar. One participant said for example that the avatar was friendly. *"Sylvia (avatar), was just friendly [P07]."*

Appreciation – facilitating conditions and social influence – negative aspects

One of the most frequently mentioned negative aspects was that certain personalities of patients were hampering the self-management of COPD and HF. For example, five participants only used components if they found them relevant. Three of them only did things when it suited them. Four participants also had a reserved mindset towards medication. *"I have the experience that you should not shout too loudly if you have an inflammation or have a bronchitis. Then you should not immediately start asking for medication. Because, that prednisolone is crap. Antibiotics can make you resistant. So, you should not use that like a biscuit [P09]."*

One of the second most frequently mentioned negative aspect was having no or too little experience in the usage of digital devices and the solving of technical problems, but also doubts of the patient are unhelpful when using a digital portal to self-manage COPD and HF. One participant doubted if she did anything wrong when the tablet was not responding upon her touch. *"What is he doing now?*

(tablet does not respond to participant's tab) Look, it is my fault [P07]." In addition, two other participants mentioned that the tablet did not respond when they tapped it.

A couple participants gave examples in which patients postponed or delayed self-treatment and were not open for self-treatment. Two participants believed that the body should be given time to be able to heal itself, thus not taking action too quickly. *"Well recently I have had another period, because I was more short of breath. And in fact I did not do anything with that. Look, you also ask yourself "Do I need to take medication?" And I did not take it. Because I also have a little faith in the self-regulation of the body. The body itself dissolves a number of things. For example, if I have a wound on my leg, I do not always have to go to the doctor, because it will heal by itself. That is what I mean. So, the body can also solve some things itself. Look, if you have a cold you do not always have to go to the doctor. And in the end, you will be fine. But if you have the feeling, well I will not get through this. Then you go to a doctor or you start taking medication [P04]."*

Also, a limited recognition of symptoms makes self-management difficult as was mentioned by some participants. Four participants found it difficult to differentiate between lung- and heart problems when symptoms deteriorate. *"What I still find extremely difficult is if I am not feeling well, is that originating from the heart or from the lungs? Well, when I am very tired, then I do not know, is that originating from my lungs or is it originating from my heart? But that feeling, if you feel nothing. And another person who has heart problems or whatever. I just do not feel that. And maybe that is strange, but I hear that from several people who feel nothing and yet have heart problems. I say well I have had a heart rhythm disorder. I just do not feel it [P06]." "Because I sometimes find it hard to recognize what heart failure is or what COPD is. Lately, I was very short of breath. And I think that could be originating from heart failure, but could also be originating from COPD [P04]."*

Appreciation – facilitating conditions and social influence – points for improvement

One of the second least frequently mentioned point for improvement was that the way of communicating with patients should be adapted. One patient for instance was willing to follow and listen to advice of people, but did not want to listen to advices of digital devices. *"I do not listen to a device. I listen to people, but not to a device. [...] I do not follow the advice of a device [P06]. "*

Appreciation – perceived usefulness – negative aspects

Another most frequently mentioned negative aspect was that technical problems regarding the design of digital devices and functionality were a negative aspect when self-managing COPD and HF. Two participants also mentioned that the design of the sensor was unpleasant and hindered their inhalation of medication. *"You often have the problem that the corner of your mouth gets stuck on this (on the corner of the sensor). As a result, you have opened your mouth too far. And if you then inhale, you draw more air past the device than from the device itself [P03]."*

The other most frequently mentioned negative aspect was that the avatar had some downsides. One of the most mentioned problems was that the avatar was unpleasant and annoying to work with, as was mentioned by four participants. *"At one point I was very annoyed, because of Sylvia [P01]." "Someone like Sylvia who always popped up. I found that a very annoying person. [...] And then Sylvia should not be such a smart-ass to ask me things like "Did you execute your breathing exercises well?" [P03]."*

The least frequently mentioned negative aspect was that the digital portal was an insufficient source of information. To give an example, one participant considered it insufficient only to have information and videos on a digital portal. *"It was all very briefly, was it not? [...] The things I can read, what was on the tablet or on the short movies. That is actually insufficient for me [P07]."*

Appreciation – perceived usefulness – points for improvement

The most frequently mentioned point for improvement was that technical problems should be fixed and that the digital portal should be adjusted. One example was mentioned by two participants, namely redesigning features of devices that are not user friendly. *"Just make this flatter (corner of the sensor) or place it anywhere else on the sensor [P03]."*

One of the second most frequently mentioned points for improvement was that the digital avatar should be adjusted. One participant even said that the current avatar should be removed and that this person would like it if the avatar contained a question and answer function instead. *"I did not do anything with Sylvia. Sylvia is not necessary for me. I would rather have had her excluded from the portal. [...] No, if Sylvia had been a person who would ask, "Do you have a question?" And she would answer my questions then I think oh, then I see it as an added value. But I would not include her (Sylvia) in the portal [P07]."*

Furthermore, the other second most frequently mentioned point for improvement was that information should be presented and provided in other ways than currently has been done. Two participants mentioned that a more clear overview of data about health status should be given. *"So, it would be more convenient for me to, well. You need to make this (distribution of numbers on the vertical axis) slightly larger. Because of course it (the numbers) are very close to each other now. Look, if you assume that difference is one kilo, that is quite a lot [P07]. "*

One of the second least frequently mentioned point for improvement was that the digital portal should be tailored to the needs of patients. To give an example, one participant said that it would be better for participants to decide on their own which information they want to see and what information is necessary instead of receiving irrelevant information. *"I do not want to get unwanted information. I want to click on it myself. [...] Because I am someone who asks everything myself, discover it myself. If I want information about something, I go after it myself. [...] I only want to hear information if I am interested in it [P07]. "*

The least frequently mentioned point for improvement was that self-management could be performed on paper as well, one participant said for example that a decision tree on paper would be helpful, so that this person would know what to do when having symptoms. This participant also mentioned that the decision tree could be added as an extra tab to the digital portal. *"It may be very handy, I think, that instead of answering all the questions you can also make a decision tree, which is actually the same of course. But if I have such a thing on paper, then I also see "Oh, what should I do or do I still have to wait?" That is actually the same idea. Maybe it is possible to include it as an extra tab in the portal [P07]."*

Perceived effectiveness – perceived usefulness – positive aspects

Another most frequently mentioned positive aspect was that participants felt empowered by the digital portal. An example for this was mentioned by six participants. They saw their data displayed in the digital portal which gave participants insight into their daily activity, their weight gain or loss, current health status, inhalation technique and cause of symptoms. *"It is a nice overview. You can see whether you inhaled on time and if you skipped [P08]." "Nice. Then you just know how much you move in a day [P04]." "It was only about whether I got heavier or lighter. [...] And I just kept stuck on the same weight during the training. Sometimes there could be a kilo in between, but in essence I kept the same weight [P06]."*

Perceived effectiveness – perceived usefulness – negative aspects

Another second most frequently mentioned negative aspect was that the digital portal contained unnecessary information, for example because the provided information was already known by five

participants. *“There were of course moments when some more mucus was given up. Then Sylvia complained that I had to take prednisone. [...] But by the time the mucus turns green. Yes, then I know that I need antibiotics. You do not have to tell me that. […] Yes, I know al these things by now [P01].” “I have a smartwatch and I am very happy with it, because I just see what I do and I just know if I have done too little or not. And then the Fitbit is not necessary. [...] I do not need that, I have my smartwatch [P07]."*

Furthermore, several participants did not see any added value of the MATCH self-management intervention. Three of them denoted that it was unclear to them how the system might help them to improve their current health status. *“We eat healthy, lots of vegetables, few potatoes, regular fruit, we do not drink. Yes, tea, coffee and a glass of red wine once a day. So, what do I have to improve? And what else can that system help me with? So, it cannot bring me anything else. [...] So, personally for me I do not know. What should the system bring me that would benefit me? You name it. I do not know [P09]."*

Half of the participants were physically limited in their self-management of COPD and HF. All of these participants said that they had no medical complaints to improve. *"Well, if I indicate that I have no complaints, there is little to help [P03]."*

Perceived effectiveness – facilitating conditions and social influence – positive aspects

The second most frequently mentioned positive aspect was to be already experienced in self-monitoring. To give an example, six participants mentioned that they already recognized and monitored symptoms by themselves in order to get insight in their health status. *“If I get short of breath, I recognize that. Well, when I get swollen legs, I recognize that. If I cough a lot, I recognize that too. Maybe there are more things that I just unconsciously monitor myself. [...] At some point you will already recognize that yourself [P04]." “Because by the time the mucus turns green. Yes, then I know that I need antibiotics [P01]."* Their experience made it easier for them to recognize and to monitor symptoms by themselves using the MATCH self-management intervention.

Furthermore, the other most frequently mentioned positive aspect was that it was an advantage if patients showed to be responsible and motivated. For example, six participants told that they wanted to do things correctly and as intended, which facilitates the self-management of COPD and HF**.** *“Look, if I do something, then I want to do it as well as possible. That has been my whole life. I want to do the few things I can do as well as possible. I cannot do much. And I am not in the mood to do everything. But that is not the point. If I start with those projects then I will do everything. Look, but if I do not like something, then I do not start at all [P05]." "Every day, I filled in the tablet, the things that were asked of me [P04]. "*

Several participants said that they already were experienced in self-treatment and already had an assertive attitude. This made self-management easier for them. *“But yes, I have to say, I am probably a bit more assertive. That as soon as there are some problems with medication I go after it myself [P09]."*

Half of the participants mentioned that already being experienced or skilled with digital devices helped them to self-manage their COPD and HF via the digital portal. *“And so if you are experienced with using computers it might be a bit easier, than for people who are less experienced in that area. My wife would definitely not be able to handle the portal, because she cannot work with computers at all. So, if she had to do such a program it would indeed become more complicated [P09]."*

The second least frequently mentioned positive aspect was that participants already were physically active which was indicated as helpful. *“I just know for myself that I exercise a lot. Because I do*

everything in and around the house, and I go to the physiotherapist twice a week. And I also do exercises there [P04]. "

Perceived effectiveness – facilitating conditions and social influence – negative aspects

The second least frequently mentioned negative aspect was that self-management via the digital portal hampers if patients are not open to use digital devices. Three participants said that they were not willing to follow or listen to the advice of a digital device. *"Then you let yourself be guided by such a device and I do not do that. [...] I do not listen to a device [P06]."*

3.2.4. Support

Participants received support from family or friends, or participants were supported by technical professionals and case managers when using the MATCH self-management intervention for COPD and HF.

3.2.4.1. Support by family or friends

A comprehensive description of the positive aspects and negative aspects from users' experiences with the support by family or friends is provided in Table 9. Four patients received support from family or friends when using the MATCH self-management intervention for COPD and HF. Two types of positive aspects were identified: 1) a spouse who helped with self-management of COPD and HF; and 2) helps with using digital devices. One type of negative aspects was identified: 1) a spouse had a negative influence on patient's learning. No points for improvement were identified.

Table 9. *Positive aspects, negative aspects and points for improvement from users' experiences with the support by family or friends[a] (n=4).*

Structure	Positive aspects	Negative aspects	Points for improvement
Usage – facilitating conditions and social influence	*A spouse who helped with the self-management of COPD and HF (n=3)* • Spouse helps and stimulates patient to self-treat symptoms and to go to the doctor (P06,P08) • Spouse receives advice and asks questions on behalf of patient (P06) • Spouse gives feedback to patient (P06) • Clearly explains information from portal to patient (P03) • Reminded patient to take inhalation medication (P03) *Helps with using digital devices (n=2)* • Spouse helps with and uses digital devices (P06) • Friend helpede when participant had problems with digital devices (P05)	*Spouse had negative influence on patient's learning (n=1)* • Doing tasks meant for patient (P06)	• Were not identified

Abbreviations: *COPD,* Chronic obstructive pulmonary disease; *HF,* Heart failure
[a]That participants received from informal caregivers.

Usage – facilitating conditions and social influence – positive aspects

The most frequently mentioned positive aspect was that participants received help with the self-management of COPD and HF from their spouses. For example, two participants mentioned that their spouses helped and stimulated patients to self-treat symptoms and to go to the doctor. *"Then she (the spouse) says, you have to start taking the pills [P08]." "But I just did not go to the doctor until my wife told me to go to the doctor. Well, and then my wife said, examine everything in his blood [P06]."*

The least frequently mentioned positive aspect was that participants received help from family and friends with using the digital devices. One participant had a friend who helped if the participant encountered problems with digital devices. *"I had a friend who was still living in Enschede at that time and she came to see me three times a week and she helped me sometimes. If I did not understand things, she would come over and then she said "you should do that". It turned out that I was in the wrong place inside the portal [P05]."*

Usage – facilitating conditions and social influence – negative aspects

One participant referred to a negative influence that the spouse had on the patient's learning. For example, the spouse did tasks that were actually meant for the patient. *"I did not do anything with the tablet, nothing at all. [...] I do not use a tablet, but my wife does and she can handle it well, and she asked questions to that club of people (researchers from the MATCH project). [...] So, it may have helped that I complained about the MATCH project. However, it might be possible that my wife said it instead of me [P06]."*

3.2.4.2. Support by technical professionals and case managers

A comprehensive description of the positive aspects, negative aspects and points for improvement from users' experiences with the support by technical professionals and case managers is provided in Table 10. All patients (n=9) were supported by technical professionals and case managers when using the MATCH self-management intervention for COPD and HF. Four types of positive aspects were identified: 1) initiative of the patient; 2) already experienced in contacting medical professionals; 3) sufficient professionals' qualities; and 4) supportive tasks and maintain contact. Four types of negative aspects were identified: 1) organisational flaws; 2) insufficient amount of personal contact and postponing contact by participant; 3) insufficient follow-up of problems; and 4) insufficient professional qualities. Four types of points for improvement were identified: 1) give case managers other tasks; 2) case managers must have more personal contact with patients; 3) improve organisation of current support; and 4) react faster upon patient's call.

Table 10. *Positive aspects, negative aspects and points for improvement from users' experiences with the support by technical professionals and case managers[a] (n=9).*

Structure	Positive aspects	Negative aspects	Points for improvement
Usage – facilitating conditions and social influence	*Already experienced in contacting medical professionals[b] (n=6)* • Patients have experience with contacting medical professionals (P09,P06,P07,P03,P01,P04) *Supportive tasks and maintain contact (n=4)* • Monitor patients' data (P04,P07) • Gave quick and personalized advise (P04) • Opened possibility to ask questions directly to the technical and medical professional (P04,P09) • Well informed (P04) • Face-to-face meetings (P09) • Called or mailed back if patient called or reported that he did not feel well (P09,P07) • Asked about usage of avatar (P09) • Solving problems with portal and sensor on inhaler (P07,P03) • Supported patient (P03)	• Were not identified	• Were not identified
Usage – perceived usefulness	• Were not identified	*Insufficient follow-up of problems (n=2)* • *N 61:* No or little response on patient's call about technical and medical problems (P09) • *N62:* Response on notification of problem came too late, the problem was already solved (P09) • *N63:* No communication about solution (P09) • *N64:* No response when abnormalities were reported or when comments about abnormalities were made via telephone or tablet (P09,P01)	• Were not identified
Appreciation – facilitating conditions and social influence	*Sufficient professionals' qualities (n=5)* • Is experienced, has much expertise and much knowledge (P04,P01) • Has problem-solving capabilities (P04) • Being kind and nice (P09) • Listens and understands problem (P03)	*Organisational flaws (n=5)* • Medical professionals[b] that were not involved in the project were poorly informed about the MATCH self-management intervention (P04,P08) • There was no support of pulmonologist and cardiologist (P09)	*Improve organisation of current support (n=3)* • Appoint more professionals to support participants and give professionals more time to support patients (P09,P07) – *Linked to N65* • Create a good collaboration between the cardiac and pulmonary specialized case managers (P01)

	• Always serious (P07) • Always willing to help (P03)	• Insufficient communication between professionals (P09) • Medical professional[b] judged Fitbit as not important (P09) • Patient seeks support at medical professional[b] outside project (P09) • *N65:* To little professionals to support patient (P09) • *N66:* Not sending data to hospital (P03) • *N67:* Medical professional[b] was pulmonary nurse, while heart problems were more severe (P01) • *N68:* Participant wants advice from a medical professional[b] instead of digital devices in case of deteriorating symptoms (P09,P01) • Unpersonal having to explain situation and complaints every time to professionals outside project (P07) • *N69:* Was not clear that case managers did not read notes made by patients (P01)	
Appreciation – perceived usefulness	• Were not identified	*<u>Insufficient amount of personal contact and postponing contact by participant (n=4)</u>* • *N72:* Not regular personal contact with patient (P09) • *N73:* Poorly reachable technical professionals and case managers (P04,P09,P07,P01) • *N74:* Misses being asked how is doing (P09) • *N75:* Never talked about self-management (P09) • Unclear who was contact person (P01) • *N76:* Did not know medical professional[b] before start of the project (P01) • *N77:* Not enough input from medical professional[b], because a computer gives advice (P01) • Patient postpones seeking contact (P07,P01) *<u>Insufficient professional qualities (n=1)</u>* • Gradually the professionals' interests weakened (P09)	*<u>Give case managers other tasks (n=5)</u>* • Case managers must help to differentiate between lung- & heart problems (P04) – *Linked to N3 (see Table 7)* • Provide one direct (cell)phone number or email address that is 24 hours a day reachable which can be used to ask questions or to ask for help, that is coordinated by a medical professional[b] who is on duty (P04,P08,P09,P01) – *Linked to N73* • Case managers should be the link between patient and medical specialist (P08) • Medical professional[b] should delegate technical support (P09) • Data about patient's health status should be sent to the hospital so that data can be monitored (P03) – *Linked to N66* *<u>Case managers must have more personal contact with patients (n=4)</u>* • Give advice or support immediately, in case patients notified professionals about abnormalities in health

			status or if abnormalities in health status are registered (P09,P07,P01) – *Linked to N62 and N64* • Provide more personal support by technical professionals and case managers to answer questions, to solve problems, to ask how patient is doing and to interpret data for the patient (P09,P03) – *Linked to N35 (see Table 8), N61, N63, N72, N74 N75 and N77* • Leave a telephone message if the patient was not reached and make phone number visible (P03) • Medical professional[b] should know patient upfront, that makes contact easier (P01) – *Linked to N67 and N76* • Guide people who experience difficulties using a PC (P09) – *Linked to N31, N32 and N33 (see Table 8)* *<u>React faster upon patient's call (n=1)</u>* • React faster upon patient's call (P09) – *Linked to N70*
Perceived effectiveness – facilitating conditions and social influence	*<u>Initiative of the patient (n=6)</u>* • Assertive attitude (P06,P04,P09,P07,P03) • Kept notifying medical and technical professionals about non-functioning components, symptoms and abnormalities (P06,P09,P07,P03,P01,P04) • Patient keeps contacting professionals for advice what to do (P06,P04,P09) • Participant kept contacting professional to solve problem (P09)	• Were not identified	• Were not identified

Abbreviations: *N60-N77,* Negative aspect 60 till 77 is linked by its number to specific points for improvement
[a]That participants received from the case managers from the hospital and technical professional from Roessingh Research and Development (RRD);
[b]The medical professionals that informed patients during the training and supported patients when using the MATCH self-management intervention.

Usage – facilitating conditions and social influence – positive aspects

The least frequently mentioned positive aspect was that the supportive tasks and maintaining contact with the technical professionals and case managers was helpful. Two participants said that it opened the possibility to ask questions directly to the technical and medical professional. *"It's nice that someone can watch what I do. [...] Then you can ask questions instantly when they arise [P04]."*

Usage – perceived usefulness – negative aspects

The second least frequently mentioned negative aspect was an insufficient follow-up of problems. Two participants said that the medical professional did not respond when participants had reported abnormalities or when comments about abnormalities via telephone or tablet. *"So, I told someone at the phone that the Fitbit did no longer work. "Oh then I will pass that on!" Yes, well and then nothing happened. I even called Enschede a few times. Called with someone there too. "Oh, well then we go after it." Until I called twice or three times and I said, "Listen carefully, that thing does not work, that Fitbit does not work!" But, nothing happened. [...] After that call, I called one more time and then I said well I am done with it. Then they should figure it out themselves. If there is so little response to my complaint, to my comments. Whose interest is it then? The people who set up the MATCH project or my interest [P09]?"*

Appreciation – facilitating conditions and social influence – positive aspects

Half of the participants pointed out that sufficient qualities of professionals was important. As mentioned by two participants, it was considered helpful if professionals are experienced, have much expertise and have much knowledge. *"That one case manager was an expert in the field of heart failure and the other case manager in the field of COPD. [...] Because they (case managers) were able to clearly explain what COPD is and the other case manager explained what heart failure is. I was also pleased that it was their specialty. [...] Someone who is specialized talks with more ease and love about his profession. That's nice. [...] This person will communicate that differently. But that is not only the case with these case managers, that is with everyone in fact [P04]."*

Appreciation – facilitating conditions and social influence – negative aspects

The other most frequently mentioned negative aspect were organisational flaws. Two participants said that medical professionals that were not involved in the project were poorly informed about the MATCH self-management intervention. *"What I did experience was that I tried to call people from the MATCH project a few times and that goes via this medical department. [...] Then they did not know the people from the MATCH project or they did not know about the MATCH project at all and the desk was therefore poorly informed about the study [P04]." "Sylvia said to call my case manager. So, I called. "Who is on the phone (asked the secretary)?" "Yes, P08 (said P08)." "That does not mean anything to me, what do you want (asked secretary)?" "I am calling because of the MATCH project (said P08)." "What is that (asked the secretary)?" "That is a project I said (said P08)." "Oh I do not know anything about that (said the secretary)." So, I said that I whished to speak to the case manager. "Who is that (asked the secretary)?" "Well, I don't know that either (said P08)." She did not know anything about it, that secretary [P08]."*

Appreciation – facilitating conditions and social influence – points for improvement

The second least frequently mentioned point for improvement was that the organisation of the current support could be improved. Two participants wanted more professionals to support participants and would like it if professionals had more time to support patients. *"When they start working on the MATCH project again, they should appoint an assistant who can help. Or make more free time for those people (case managers). Those people from the hospital are so overloaded nowadays. That is hard to ask them to invest their time. [..] So, I do not know how it can be furtherly improved. More staff perhaps. That must be it [P09]."*

Appreciation – perceived usefulness – negative aspects

The second most frequently mentioned negative aspect was the insufficient amount of personal contact and that participants postponed contact. The most given example is that the technical professionals and case managers were poorly reachable, according to four participants. *"I have called once. And then promptly when 198 (a case manager) was not there. Yes, that is possible. I mean everybody can not there whole the time. But, then I actually just waited [P01]."*

The least frequently mentioned negative aspect was that insufficient professional qualities hampered the self-management of COPD and HF. One participant thought that the professionals' interests weakened gradually. *"I had the impression that the interest was huge in the beginning, but that gradually faded away [P09]."*

Appreciation – perceived usefulness – points for improvement

The most frequently mentioned point for improvement was that case managers should be given other tasks as well. Four participants wanted a direct (cell)phone number or email address that is 24 hours a day reachable which can be used by patients to ask questions or to ask for help. This should be coordinated by a medical professional who is on duty to support patients in this way. *"You have to have a central person that is in charge. This person must have a general understanding of all kinds of things. The heart, lungs, maybe blood vessels or whatever. And that person has to divide the calls. There must be someone on duty around the clock, day and night. So, that person will divide that and should know which heart failure specialist or lung specialist is present in the hospital at that moment. This person has to arrange that the specialist calls me. This person should hand-over the patient's problem. The specialist should call me then. And this coordinator should call me back and say, "Take diuretics and then it will be okay and then wait until the next day. Well, those advices are useful. That means you have someone on duty all the time. And otherwise it is worthless [P08]."*

The second most frequently mentioned point for improvement was that it might be an improvement if case managers had more personal contact with patients. Two participants wanted more personal support by technical professionals and case managers to answer questions, to solve problems, to ask how the patient is doing and to interpret data for the patient. *"I would have liked it if you had personal contact for example, once a month. Having a short conversation with the person who checks your data. And this person should say, well at this moment, this happened. And that this person can give the medical explanation for it. [...] Then you can ask questions. [...] Well, or call once a month to ask how you are doing? […] So, people will receive more attention [P03]." "When people have problems, or questions, or do not use the programme as it is intended. The case managers must respond more vigorously to that, I think [P09]."*

The least frequently mentioned point for improvement was that it is desirable to react faster upon patient's call. *"The intervals between my first submission of the complaint and the response to it is terribly long. [...] If the patient reports that the equipment is not working, they must respond immediately. Because in that way action can be taken. Either by telephone or by someone who comes along. Or that they say "Take it with you to us". Anyway, respond. And if they do not. Yes, what do you do then? So, a point for improvement is that they have to be much more assertive on that point, they have to respond faster [P09]. "*

Perceived effectiveness – facilitating conditions and social influence – positive aspects

The other most frequently mentioned positive aspect was if patients took initiative by themselves. To give an example, six participants kept notifying the medical and technical professionals about non-functioning components of the MATCH self-management intervention, symptoms and abnormalities.

"If the sensor (on the inhaler) did not work at all and you called and then you receive the answer that it is temporary, it does not work at the moment. But you have to take the initiative for that [P03]."

3.3. Evaluation of the MATCH self-management intervention by informal caregiver

In the following paragraphs, only the most important categories and codes that are derived from the one-to-one in-depth semi-structured interview with the informal caregiver (spouse of P06) are described and highlighted with the informal caregiver's quotes. A comprehensive description of the categories and codes that are derived regarding the three components of the MATCH self-management intervention: 1) training; 2) the digital portal; and 3) support are presented in Table 11.

Table 11. *Positive aspects, negative aspects and points for improvement from informal caregiver's experiences with using the three components of the MATCH self-management intervention[a] (n=1).*

Components	Structure	Positive aspects	Negative aspects	Points for improvement
Training[b]	*Appreciation – perceived ease of use*	<u>*Clear explanation of exercises (n=1)*</u> • Clear explanation of exercises (CG01)	• Were not identified	• Were not identified
Digital portal[c]	*Usage – perceived ease of use*	• Were not identified	<u>*Takes time to being used to having the project integrated in their daily life as an automated daily routine (n=1)*</u> • It takes some time to being used to having the project integrated in their daily life as an automated daily routine (CG01)	• Were not identified
	Appreciation – perceived ease of use	<u>*Easy to fill in data with digital devices (n=1)*</u> • Easy to fill in data (CG01) • System was easy to use (CG01) • Handy to place comments (CG01)	<u>*Weighing the patient[d] took too much time and effort (n=1)*</u> • *N59:* Weighing the patient[d] took too much effort and time (CG01)	<u>*Data about weights should be automatically registered in the digital portal (n=1)*</u> • Data about weights should be automatically registered in the digital portal (CG01) – *Linked to N39 and N59*
	Appreciation – facilitating conditions and social influence	<u>*Female avatar instead of male avatar (n=1)*</u> • Female avatar instead of male avatar (CG01)	<u>*Impeding personality of informal caregiver and patient[d] (n=1)*</u> • Patient[d] dislikes exercising (CG01) • The project has to full-fill informal caregiver's expectations (CG01) • Informal caregiver only used components if they suited the informal caregiver and and patient[d] (CG01)	<u>*Should give a notification if the digital system cannot be used and include the reason for it (n=1)*</u> • Should give a notification if the digital system cannot be used and include the reason for it (CG01)
	Appreciation – perceived usefulness	• Were not identified	<u>*Technical problems regarding functionality of digital devices (n=1)*</u> • Empty battery (CG01) • *N38:* It was a slow responding system (CG01) • *N39:* Malfunctioning weighing scale: not automatically registered weights (CG01) • *N40:* Unclear overview of data about weight monitoring (CG01) • Malfunctioning system (CG01) <u>*Negative appearance of the avatar (n=1)*</u>	<u>*Create a fast digital portal (n=1)*</u> • Create a fast digital portal (CG01) – *Linked to N38* <u>*Avatar should be used to call for help (n=1)*</u> • The avatar should be used to call for help (CG01) <u>*Give a more clear overview of data (n=1)*</u> • Give a more clear overview of data about weight monitoring (CG01) – *Linked to N40* • Do not present NT-proBNP measurements (CG01) – *Linked to N17*

		• *N50:* Unpleasant and annoying to work with (CG01) • *N51:* An unnecessary function (CG01) • *N52:* The avatar felt as unwanted interference and gave irrelevant and standardised information or advice (CG01) • The avatar popped up too early in the morning with reminders to complete tasks (CG01)	*Give immediate advice and notifications in case of changes in health status (n=1)* • Give notifications and advice immediately in case of changes in health status (CG01) – *Linked to N52* *Manually monitor weight on paper (n=1)* • Clearer to manually monitor weight on paper (CG01)
Perceived effectiveness – perceived usefulness	*Gives useful advice and insight about the patient's[d] current health status, also in case of weight gain or weight loss by displaying patient's[d] data (n=1)* • Gives useful advice and insight about the patient's[d] current health status, also in case of weight gain or weight loss by displaying patient's[d] data (CG01)	*Contained unnecessary information (n=1)* • *N17:* The digital portal contained unnecessary information (CG01)	• Were not identified
Perceived effectiveness – facilitating conditions and social influence	*Being responsible and motivated (n=1)* • Informal caregiver is willing to save visits to the medical professionals[g] (CG01) • Informal caregiver was consciously and engaged with the project (CG01 • Informal caregiver was afraid that something might happen to patient[d] (CG01) • Informal caregiver wanted to do things correctly (CG01) *Already experienced in self-monitoring and self-treatment (n=1)* • Informal caregiver already self-monitored with sputum samples, and self-treated symptoms of the patient[d] by giving medication (CG01) • Assertive attitude (CG01) *Solving technical problems by informal caregiver (n=1)*	*Patient[d] would not be willing to take advice or information from avatar (n=1)* • *N30:* Patient[d] would not be willing to take advice or information from avatar (CG01)	• Were not identified

		• Informal caregiver solved technical problems by herself (CG01) *<u>Informal caregiver knows that the patient[d] is already physically active (n=1)</u>* • Informal caregiver knows that the patient[d] is already physically active (with extra help of a physiotherapist that is visited once a week) (CG01)		
Support by the informal caregiver[e]	*Usage – facilitating conditions and social influence*	*<u>The informal caregiver keeps track of the patient's[d] medication use (n=1)</u>* • Keeps track of the patient's[d] medication use (CG01)	*<u>The informal caregiver decided for the patient[d] (n=1)</u>* • Informal caregiver decided for patient[d] (CG01)	• Were not identified
	Perceived effectiveness – facilitating conditions and social influence	• Were not identified	*<u>The informal caregiver could cause negative feelings at the patient[d] (n=1)</u>* • Could irritate patient[d] (CG01) • Patient[d] would not listen to advice (CG01)	• Were not identified
Support by technical professionals and case managers[f]	*Usage – facilitating conditions and social influence*	*<u>Informal caregiver was already experienced in contacting medical professionals[g] (n=1)</u>* • Informal caregiver has experience with contacting medical professionals[g] (CG01)	• Were not identified	• Were not identified
	Appreciation – perceived usefulness	*<u>Reassuring thought to have case manager's telephone number to ask questions directly to the case manager (n=1)</u>* • Having the case manager's telephone number was a reassuring thought, questions could be asked directly to the case manager (CG01)	*<u>Technical professionals were poorly reachable (n=1)</u>* • *N73:* Technical professionals were poorly reachable in case of technical problems (CG01) *<u>Insufficient qualities of technical professionals (n=1)</u>* • *N70:* Technical professionals were not able to solve technical problems or to give information (CG01) • *N71:* Technical professional was unpolite when handling a question of the informal caregiver (CG01)	*<u>Intensify the supportive tasks of the case managers (n=1)</u>* • Somebody should be reachable to ask for help (CG01) – *Linked to N73* • Case managers should be the link between patient[d]/informal caregiver and medical specialist (CG01) *<u>Have competent technical professionals (n=1)</u>* • Technical professionals should be available to solve technical problems (CG01) – *Linked to N70* • Informal caregiver need to be taken seriously and problem should be handled appropriately (CG01) – *Linked to N71*

Perceived effectiveness – facilitating conditions and social influence	<u>*Initiative of the informal caregiver (n=1)*</u> • Notified technical professionals about non-functioning components and problems (CG01) • Informal caregiver kept contacting technical professional to solve technical problems (CG01)	• Were not identified	• Were not identified

Abbreviations: *MATCH,* The Self-Management And Telemedicine in patients with COPD and chronic heart failure; *NT-proBNP*, the fysiological inactive adjunct product of Brain Natriuretic Peptide; *N17-N73,* Negative aspect seventeen till 73 is linked by its number to specific points for improvement

[a]The MATCH self-management intervention for COPD and HF consists of three components: 1) training; 2) a digital portal; and 3) support by technical professionals, case managers, by an avatar that was included in the digital portal and informal caregivers were not intended to be involved in the MATCH self-management intervention as a source of support, however, it became apparent during the interviews that a number of participants had received support from informal caregivers;

[b]With two self-management sessions in groups that were given in the hospital by one nurse practitioner Chronic obstructive pulmonary disease (COPD) and one nurse practitioner heart failure (HF) and one individual self-management session in the hospital with one nurse practitioner COPD or one nurse practitioner HF;

[c]MATCH programme that participants used on the tablet and included the support that participants received from the avatar;

[d]Spouse of the informal caregiver;

[e]That patients received from informal caregivers;

[f]That participants received from the case managers from the hospital and technical professional from Roessingh Research and Development (RRD)

[g]The medical professionals that informed patients during the training and supported patients when using the MATCH self-management intervention.

3.3.1. Training

A description of the positive aspect from the informal caregiver's experiences with the training is provided in Table 11. The informal caregiver was present during the self-management sessions with a patient with COPD and HF (P06). The patient was trained during the self-management sessions. One type of positive aspect was identified: 1) a clear explanation of exercises was given. No types of negative aspects were identified and no points for improvement were identified.

Appreciation – perceived ease of use – positive aspects

The only positive aspect that was referred to was that during the training a clear explanation of exercises was given. *"Like the exercises and exercises about movement. That was actually very well explained at those self-management meetings. [...] It was clearly explained by them [CG01]. "*

3.3.2. Digital portal

A comprehensive description of the positive aspects, negative aspects and points for improvement from the informal caregiver's experiences with the digital portal is provided in Table 11. The informal caregiver used the digital portal of the MATCH self-management intervention for COPD and HF instead of the patient (P06). Seven types of positive aspects were identified: 1) easy to fill in data with digital devices; 2) female avatar instead of male avatar; 3) gives useful advice and insight about the patient's current health status, also in case of weight gain or weight loss by displaying patient's data; 4) being responsible and motivated; 5) already experienced in self-monitoring and self-treatment; 6) solving technical problems by informal caregiver; and 7) the informal caregiver knows that the patient is already physically active. Seven types of negative aspects were identified: 1) takes time to being used to having the project integrated in their daily life as an automated daily routine; 2) weighing the patient took too much time and effort; 3) impeding personality of informal caregiver and patient; 4) technical problems regarding the functionality of digital devices; 5) negative appearance of the avatar; 6) contained unnecessary information; and 7) patient would not be willing to take advice or information from the avatar. Seven types of points for improvement were identified: 1) data about weights should be automatically registered in the digital portal; 2) the digital portal should give a notification if the digital system cannot be used and include the reason for it; 3) create a fast digital portal; 4) the avatar should be used to call for help; 5) give a more clear overview of data; 6) give immediate advice and notifications in case of changes in health status; and 7) manually monitor weight on paper.

Usage – perceived ease of use – negative aspects

One of the negative aspects that was least frequently referred to was that it takes time to being used to having the MATCH self-management intervention integrated in their daily life as an automated daily routine. *"In the beginning you have to get used to it. That he (P06) has to stand on the weighing scale every morning [CG01]. "*

Appreciation – perceived ease of use – positive aspects

The positive aspect that was second most frequently referred to was that it was easy to fill in data with the digital devices. An important example was that the digital portal was easy to use.
"Filling in the data was fairly easy. [...] The usage was simple. [...] It is a simple system that everyone can use. [CG01]."

Appreciation – perceived ease of use – negative aspects

Also, one of the negative aspects that was least frequently referred to was that weighing the patient took too much time and effort. *"I had to pick up too many bells and whistles. Placing the weighing*

scale in the middle of the room, I had to kneel down and enter the data. [...] And I am very honest with you. We do not have time for that in the morning [CG01]."

Appreciation – perceived ease of use – points for improvement

One of the points for improvement that was least frequently referred to was that data about weights should be automatically registered in the digital portal. *"I am going to stand on the weighing scale and the weights are not automatically entered in the tablet. When I am working on automatization, I would connect everything. [...] Then I think that it should indeed just be a simple tick. And then it must be entered in the tablet. You have weighed yourself and you should be done [CG01]."*

Appreciation – facilitating conditions and social influence – positive aspects

One of the positive aspects that was least frequently referred to was that the avatar was female instead of male. *"I was happy, because I said let it just be a woman, because I hate listening to guys [CG01]."*

Appreciation – facilitating conditions and social influence – negative aspects

The negative aspect that was referred to several times was that the personality of the informal caregiver and the patient were hampering the self-management of COPD and HF. For example, the patient (P06) dislikes exercising. *"He (P06) terribly hates to walk. [...] He (P06) is not such a fun of cycling either [CG01]."*

Appreciation – facilitating conditions and social influence – points for improvement

Another point for improvement that was least frequently referred to was that the digital portal should give a notification if the digital system cannot be used and include the reason for it. *"You should tell, we will take it out of the air for an hour and we will bring it back on again. And send a notification if the portal works again. Not to be used for one hour due to maintenance. All users receive that message. That is very easy. [...] So, that it is very simple, you can say for a moment the digital portal cannot be used, because it is malfunction between this and this hour. I even get that on my telephone from the Koninklijke PTT Nederland N.V. (KPN), because of maintenance work between that time and that time not available. Well, and that is also possible with the portal on the tablet [CG01]."*

Appreciation – perceived usefulness – negative aspects

The negative aspect that was most frequently referred to were the technical problems regarding the functionality of digital devices. For example, the weighing scale malfunctioned, because weights were not automatically registered. *"The program does not register the weights. And I literally had to lie on my knees to weigh him (P06) and see okay this is what he (P06) weighs. I thought that was a disadvantage. Look, if I weigh someone and I have a system like that. And I also have a special weighing scale with it, then I expect that everything is filled in and that I immediately see it. [...] When I entered the weights I found it very bad that it was not directly registered in the tablet from the weighing scale [CG01].* Another example is that the overview of data about weight monitoring was unclear. *"I find the overview of the weight very bad. Monitoring, let's see. That does not inform you right? I could not see at all whether I had gained weight or whether I had lost weight. How can you think this is clear? Do you think this is clear, to see how much weight he (P06) gained or how much weight he (P06) lost? I really did not think that was clear. [...] The graph of the weight, well I find it worthless [CG01].* One last example is that it was a slow responding system. *"The system is very slow. [...] You noticed that at the moment when you enter something how long it takes for something to happen. Look, you see how long that takes. It simply takes time for the tablet to execute an action [CG01]. "*

Also, the negative aspect that was second most frequently referred to was that the avatar had some downsides. One problem was that the avatar was unpleasant and annoying to work with. *“I find Sylvia extremely annoying. I did not like it, I did not do anything with it. It did not help me, it could not help me either. I actually did not want to do anything with it. Nine out of ten times it reminded me if I completed my exercises. Have you done your exercises? Did you do your exercises? Please, I have no time for that. Another time perhaps [CG01]. "*

Appreciation – perceived usefulness – points for improvement

One of the points for improvement that was least frequently referred to was to create a fast digital portal. *"In my opinion, the system can be much faster [CG01]."*

Another point for improvement that was least frequently referred to was that the avatar should be used to call for help. *“That if you indeed feel bad, you can call for help via the tablet. [...] If he (P06) feels bad that I can say “Hey, I have a question.” "What should I do? He is short of breath stuffy and he had prednisone. What am I supposed to do?” That I can asked for help. Like, "Hey, it is not going well." That would suit me and him (P06) better, instead of getting advice every time you have not weight yourself yet [CG01]."*

The point for improvement that was most frequently referred to was that a more clear overview of data should be given. *“I think you should present it much clearer, in a different way. [...] That you can clearly see the weight differences. [...] The whole presentation of the weights should become clearer. That you can clearly see okay, I weigh eighty kilograms today and tomorrow I weigh eighty five kilograms and the day after tomorrow I weigh ninety kilograms and then all of a sudden I weigh eighty kilograms. That is much clearer. […] That you can clearly see, wait a minute, here I weight eighty kilograms and there I weight eighty-five kilograms. But in the way as it is now, if you look at his graph (P06’ graph), you are not able to make sense of it, really not [CG01].”*

Furthermore, another point for improvement that was least frequently referred to was that immediate advice and notifications in case of changes in health status should be given. *“If there are changes in the portal on the tablet, I would expect hey, that I would get a message like, hey, be aware. I needed that in the portal. That I had received an advice [CG01]. "*

The other point for improvement that was least frequently referred to was that weight could also be manually monitored on paper. This would be clearer according to the informal caregiver. *“So, that about his (P06) weight, that graph is not clear. It was clearer what he (P06) did, keeping track of the weights by hand for care provider X (nurse) [CG01]. ”*

Perceived effectiveness – perceived usefulness – positive aspects

One of the positive aspects that was least frequently referred to was that the digital portal gives useful advice and insight about the patient’s current health status, also in case of weight gain or weight loss by displaying patient’s data. *“I also found those advice (from the module self-management) valuable and I used it. So, from that point of view the advice was good. […] The diary gave me good tools. [...] I filled it in and if there was anything. Look, like here, there is an advice given regarding the symptoms. And if it was green, there are no complaints. Well, I absolutely loved that [CG01]."*

Perceived effectiveness – perceived usefulness – negative aspects

Another negative aspect that was least frequently referred to was that the digital portal contained unnecessary information. *“There was a lot of information that I would not use. And that was the information of the exercises and such. Yes, it was nice that they were included, but we did not do anything with it [CG01]."*

Perceived effectiveness – facilitating conditions and social influence – positive aspects

Furthermore, the positive aspect that was most frequently referred to was that it was an advantage to be responsible and motivated. For example, the informal caregiver wanted to do things correctly, which facilitates the self-management of COPD and HF. *"So, we were consciously engaged with it and we wanted to do it right, because otherwise you do not have to participate. If I think, well, we will see how it goes, I will not participate [CG01]."*

The positive aspect that was second least frequently referred to was to be already experienced in self-monitoring and self-treatment, because the informal caregiver already self-monitored symptoms of COPD with sputum samples, and self-treated symptoms of the patient by giving medication. *"What I really like is that I can apply self-management with those medicines. We have been doing self-management for some time already. [...] So, we have collected the sputum samples for a long time. Already with doctor X (lung specialist). And if he had symptoms, he (P06) also took prednisone. [..] So, we apply self-management with medication. We have prednisone in stock so that we do not have to go to the specialist. Well, that is why we collect those sputum samples [CG01]."*

One of the positive aspects that was least frequently referred to was that the informal caregiver solved technical problems by herself. *"The Fitbit ran out of battery. And could come over to the hospital to pick up a new battery. I said, no I will go to the Lidl. I will get one myself [CG01]."*

The other positive aspect that was least frequently referred to was that the informal caregiver knows that the patient is already physically active. *"He (P06) goes to physiotherapy once a week to do exercises. And that goes well [CG01]."*

Perceived effectiveness – facilitating conditions and social influence – negative aspects

The other negative aspect that was least frequently referred to was that the patient would not be willing to take advice or information from the avatar. *"The avatar with all those advice. He (P06) does not use that. He would not participate, he would not (P06). He would find it very annoying like, do not come meddling in my life [CG01]. "*

3.3.3. Support

The informal caregiver provided support to a patient (P06) with COPD and HF, being the spouse of that patient. The informal caregiver had used the digital portal of the MATCH self-management intervention for COPD and HF and received support from technical professionals and case managers when using the MATCH self-management intervention for COPD and HF.

3.3.3.1. Support by the informal caregiver

A description of the positive aspect and negative aspects from the informal caregiver's experiences with the support provided to a patient with COPD and HF (P06) can be found in Table 11. One type of positive aspect was identified: 1) the informal caregiver keeps track of the patient's medication use. Two types of negative aspects were identified: 1) the informal caregiver decided for the patient; and 2) the informal caregiver could cause negative feelings at the patient. No points for improvement were identified.

Usage – facilitating conditions and social influence – positive aspects

The only positive aspect that was referred to was that the informal caregiver keeps track of the patient's medication use. *"You have started taking prednisone again on April 25th. Well, and before*

that you had those antibiotics for a week and before that you had prednisone again for a week [CG01]."

Usage – facilitating conditions and social influence – negative aspects

The negative aspect that was least frequently referred to was that the informal caregiver decided for the patient. *"I think those exercises and exercises about movement, he (P06) does not use that. And I can tell him (P06) ten times, well a hundred times to do his (P06) exercises. But that would irritate him (P06) [CG01]."*

Perceived effectiveness – facilitating conditions and social influence – negative aspects

The negative aspect that was most frequently referred to was that the informal caregiver could cause negative feelings at the patient. *"I can tell him (P06) every morning that he has to do his exercises. "Have you thought about doing your movements?" Then he (P06) would say "You really have to stop pushing me". He would find that very annoying and we would get discussions about it. [...] So, at a certain point, he would tell me to stop pushing him by bringing up those exercises, because he would say "I do not want that" [CG01]."*

3.3.3.2. Support by technical professionals and case managers

A comprehensive description of the positive aspects, negative aspects and points for improvement from the informal caregiver's experiences with the support by technical professionals and case managers is provided in Table 11.The informal caregiver received support from technical professionals and case managers when using the MATCH self-management intervention for COPD and HF. Three types of positive aspects were identified: 1) the informal caregiver was already experienced in contacting medical professionals; 2) it was a reassuring thought to have case manager's telephone number to ask questions directly to the case manager; and 3) the initiative of the informal caregiver. Two types of negative aspects were identified: 1) technical professionals were poorly reachable; and 2) insufficient qualities of technical professionals. Two types of points for improvement were identified: 1) intensify the supportive tasks of the case managers; and 2) have competent technical professionals.

Usage – facilitating conditions and social influence – positive aspects

One of the positive aspects that was least frequently referred to was that the informal caregiver was already experienced in contacting medical professionals. *"I liked it to have the phone number of the case manager. To use when something happened, because that is what I also do with healthcare provider X (nurse). If there is something, I call healthcare provider X (nurse) [CG01]. "*

Appreciation – perceived usefulness – positive aspects

The other positive aspect that was least frequently referred to was that it reassured the informal caregiver to have the case manager's telephone number, because questions could be asked directly to the case manager. *"It reassured me, because he (P06) was weighted. It was reassuring to know who to call when I need help. I have their telephone numbers that I can call. Yes, it certainly reassured me [CG01]. "*

Appreciation – perceived usefulness – negative aspects

The negative aspect that was least frequently referred to was that technical professionals were poorly reachable. *"What I found annoying was that from Friday afternoon to Monday morning nine o'clock, half past nine nobody could be reached. I thought that was a downside. [...] And that nobody can be reached if there is a problem. [...] Because it is of course insane to do something like that. If*

you are really sick and you participate in such a study and on Friday at noon the plug is pulled until Monday morning half past nine [CG01]. ”

The other negative aspect, which was most frequently referred to, were insufficient qualities of technical professionals. For instance, one technical professional was unpolite when handling a question of the informal caregiver. *“I received a telephone number, in the event of a malfunction, I should call that telephone number. So, I called that phone number. Nobody answered, not until Monday morning half past nine. "Madam, who is calling on Friday afternoon? (asked a technical professional)" I said well, I did. The portal does not work. "Yes, you could have note down your data manually." Boink (telephone was put down). We did that too, but really easy right? I am from IT and I say "Yes, you could have note down your data manually". That is demotivating. I think that is careless. There are technical problems and this happens to you in a big program. You have your patients using a program and they are in a life-threatening situation. Yes, you just have note down your data manually. Boink (telephone is put down) [CG01]. "*

Appreciation – perceived usefulness – points for improvement

One of the points for improvement that was most frequently referred to was to intensify the supportive tasks of the case managers. The informal caregiver wanted for example somebody to be reachable to ask for help. *“And in the event of malfunctioning, that there really is someone on the background who can help you. [...] That there is a background to dot that [CG01]. "*

The other point for improvement that was most frequently referred to was that it is desirable to have competent technical professionals. One important example was that technical professionals should be available to solve technical problems. *“That in any case there are multiple professionals who know things, who can solve things. And that there is an IT person who actually says "Okay, wait a minute, right there is a problem." We put the portal out of the air for an hour. And we bring it back again. ”[…] So, by turning it into a real IT work. [...] And someone who ensures that a IT person is on the background in case of problems or small adverse events. That someone is available [CG01]. "*

Perceived effectiveness – facilitating conditions and social influence – positive aspects

The positive aspect that was most frequently referred to was the initiative taken by the informal caregiver. To give an example, the informal caregiver kept contacting technical professionals to solve technical problems. *“I tried a lot, because I started calling on Friday afternoon. First, with the case manager. “No, sorry she is not present.” Then I recalled, I had received a phone number for technical support earlier on. I called that number and left the message "Call me back, the portal does not work." Then at some point I called again, because the problem was still not solved. Then I got the phone number in case of problems, call that phone number. So, then I called that phone number. But nobody answered my call [CG01].”*

4. Discussion

The main aim of this study was to identify positive aspects, negative aspects and points for improvement from users' experiences with the different components of the MATCH self-management intervention for COPD and HF that was used in the MATCH study. Various positive aspects, negative aspects and points for improvement of the different components of the MATCH self-management intervention for COPD and HF were mentioned by the participants. The identified positive aspects, negative aspects and points for improvement that are considered most important are described in paragraphs. These paragraphs are structured using the three components of the MATCH self-management intervention: 1) training, 2) digital portal; and 3) support. Furthermore, usage, appreciation and perceived effectiveness and the relevant determinants of UTAUT [34] are used to structure the paragraphs. Every paragraph ends with implications for future research. These recommendations can be used together with the identified points for improvement that are mentioned by the participants to furtherly develop future digital self-management interventions that are more useful for patients, for example by adjusting digital self-management interventions to the different needs of patients.

4.1. General conclusion

To give a general idea of participants' satisfaction about the usage of the whole MATCH self-management intervention and about the digital portal, the corresponding scores with which participants expressed their satisfaction can be considered. The scores for the whole MATCH self-management intervention (i.e. training, digital portal, and support together) strongly varied. In general, some participants were very satisfied with the whole MATCH self-management intervention, however some others were extremely dissatisfied with it. Some participants were not very satisfied with the whole MATCH self-management intervention, but were also not very dissatisfied with it. The scores for the digital portal varied less, but still varied. Some participants were extremely satisfied with the digital portal, however some participants were not very satisfied with it, but the majority was very satisfied with the digital portal. The median score of a seven (IQR 4.5-8.0) for the whole MATCH self-management intervention and the median score of a seven (IQR 6.0-8.6) for the digital portal indicates that the MATCH self-management intervention and digital portal equally satisfied participants in general. However, that the scores for the digital portal less varied and had higher scores, based on the IQR than the scores for the whole MATCH self-management intervention, also based on the IQR, indicates that more participants were sufficiently satisfied with the digital portal than with the whole MATCH self-management intervention. Moreover, the scores for the digital portal are more concentrated around the median score of seven, only including sufficient scores. However, the scores for the whole MATCH self-management intervention are more spread out around the median score of seven and also include insufficient scores. This also implies that more participants were sufficiently satisfied with the digital portal than with the whole MATCH self-management intervention. Both the scores for the whole MATCH self-management intervention and for the digital portal seem to be inline with the identified positive aspects, negative aspects and points for improvement. Because the MATCH self-management intervention in general had some advantages, but had also some disadvantages that could be improved, which is also implied by the median score and IQR of the whole MATCH self-management intervention. The digital portal had also some positive aspects, but also had some negative aspects that could also be improved, which is implied by the median score and IQR too. Therefore, it seems that participants were consistent in expressing their satisfaction with the MATCH self-management intervention. Overall, more participants seemed to be more satisfied with the digital portal, based on the scores, when compared with the scores of the whole MATCH self-management intervention, because the scores

for the whole MATCH self-management intervention varied more and includes more insufficient scores than the scores for the digital portal, that include more sufficient scores. However, based on the median score of the whole MATCH self-management intervention and of the digital portal, both equally satisfied participants, but there is still room for improvement. Hence, a general conclusion is that the whole MATCH self-management intervention truly satisfied participants, especially the digital portal, but improvements are necessary to achieve more patient satisfaction with the MATCH self-management intervention.

4.2. Reasons for patients to participate

Appreciation – perceived usefulness

The majority of participants had used the MATCH self-management intervention for COPD and HF to help other patients and to provide researchers with data. The minority of participants mentioned a more self-centred reason to use the MATCH self-management intervention for COPD and HF, namely they wanted to learn new things regarding the self-management of COPD and HF. That most participants used the MATCH self-management intervention to help others is surprising, because the previous qualitative study of Korpershoek et al. (2018) [27] who examined perceptions of patients with COPD towards using mobile health (mHealth) for the self-management of exacerbations, reported for instance that patients had difficulties with exacerbation detection and taking prompt action upon it [27]. Since the population of Korpershoek et al. (2018) [27] is similar to the study population of the current study, it seems likely that participants from the current study also experienced the same difficulties. The MATCH self-management intervention for COPD and HF was likely to help participants counteracting these difficulties. However, for unknown reasons participants seemed not to be aware of this possible benefit to them. One explanation might be that participants did not know upfront what the goals were of the MATCH self-management intervention and that it was unknown to participants how they could benefit from using the MATCH self-management intervention for COPD and HF. This seems plausible, because half of the participants pointed out that they saw no added value for using the digital portal of the MATCH self-management intervention. Another explanation might be that participant experienced some pressure to participate in the MATCH study. The latter was also indicated by some participants as well. For these reasons, implications for future research are: to explain what the goals are of a digital self-management intervention during a first training session, before patients start to use the self-management intervention; to explain during a first training session, before patients start to use the self-management intervention how patients might benefit from using a digital self-management intervention; and to strongly emphasize that patients participate voluntarily, when they are recruited.

4.3. Training

Appreciation and perceived effectiveness – facilitating conditions and social influence

Participants found it an important positive aspect that they had personal contact during the training. For example, the connection between patients had helped them to learn from other patients' experiences. That most participants considered personal contact to be important is supported by a previous qualitative study of Sigurgeirsdottir et al. (2019) [42]. This study investigated COPD patients' experiences, self-reported needs and needs-driven strategies to cope with self-management and reported that patients had a need to talk openly about COPD with other patients which helped them to maintain hope and courage when coping with self-management [42]. Considering the similarities between the population of Sigurgeirsdottir et al. (2019) [42] and the study population of the current study, the described need by Sigurgeirsdottir et al. (2019) [42] might explain why most participants in the current study found personal contact with other patients important. Because personal contact

with other patients' might have helped patients to maintain hope and courage when self-managing their diseases and it might be possible that participants of the current study had an unidentified need for that too. This personal contact might be hampered if there are no heterogenous groups of participants, as was mentioned by some participants during the current study. Unfortunately, during the current study no heterogeneous groups of participants were created, resulting in patients who felt to be in the wrong group and having a limited connection with other patients. Therefore, an implication for future research would be to help to create personal contact between patients by grouping them into heterogenous subgroups, based on commonalities. A subgroup of patients could for example be, patients that are recently diagnosed with COPD or HF and patients that have been diagnosed with COPD or HF for a longer time (e.g. several years). This is supported by a finding of Korpershoek et al. (2018) [27] who described that patients thought that recently diagnosed patients would benefit most from an self-management intervention, since these patients had a lack of information at the early stage of their disease [27]. Therefore, it seems reasonable that patients with a recent diagnosis would learn other things about self-management than patients that are diagnosed for a longer time. Hence, creating a subgroup based on how long a patient has been diagnosed seems to make sense. Another subgroup of patients might be patients that are not experienced with the self-management of COPD and HF and patients that are experienced with the self-management of COPD and HF. In this way patients that are already experienced with the self-management of COPD and HF can work on other goals than patients who are not experienced with the self-management of COPD and HF. Having these universal subgroups would help to create personal contact between patients.

4.4. Digital portal

Appreciation and perceived effectiveness – perceived ease of use and perceived usefulness

Many participants felt empowered by the MATCH self-management intervention for COPD and HF. For example, participants said that the provided information during the training was easy to understand and that this information had helped them to self-recognize, self-monitor and self-treat symptoms of COPD and HF. Participants also mentioned that the digital portal provided them with a better insight into physical activity, weight gain or loss, current health status, inhalation technique and cause of symptoms, because the patients' data was presented in a clear way. These findings are in line with two previous conducted qualitative studies. The first one is of Vaart et al. (2010) [19] among a different study population than the current study and the second one is of Slevin et al. (2019) [43] among a similar study population [19, 43]. The study of Vaart et al. (2010) [19] examined experiences and preferences of patients with rheumatic diseases regarding an online interactive health communication application [19]. The similarity with the current study is that patients' experiences with the usage of the MATCH self-management intervention have been examined too. The MATCH self-management intervention is also an digital health application. Vaart et al. (2010) [19] described that patients were interested in disease information, for example clinical picture and symptoms [19]. The MATCH self-management intervention satisfied this need. Therefore it is not surprising that participants had experienced benefits from the provided information. Because presenting each participant with data about health status in a clear way, is likely to be useful for participants concerning the self-management of COPD and HF, since their need is satisfied. The study of Slevin et al. (2019) [43] explored the potential benefits of digital health technology for the self-management of COPD from patients' perceptions and found that patients perceived an improvement of their capacity for self-management by capturing data from digital health technology [43]. Since, the MATCH self-management intervention is also a digital health technology and because the study population of Slevin et al. (2019) [43] is similar to the population of the current study, it would not be surprising if participants in the current study would also have an improved capacity for self-

management by giving participants insight into physical activity, weight gain or loss, current health status, inhalation technique and cause of symptoms by presenting their data. On the other hand, several participants pointed out that the MATCH self-management intervention also contained information that did not met their needs and that this was a negative aspect of the MATCH self-management intervention. For example, multiple participants mentioned that the provided information during the training, but also on the digital portal was insufficient and unnecessary. For these reasons, it can be concluded that the MATCH self-management intervention already provided participants with information that met their needs, which was useful. But participants could benefit more from the MATCH self-management intervention if the information that is provided is furtherly tailored to the needs of patients, thus becomes more useful to patients. This recommendation is in line with Korpershoek et al. (2018) [27], because they reported that a mobile health self-management intervention (mHealth), which has commonalities with the MATCH self-management intervention, should be tailored to the patients needs to optimize engagement. To tailor the provided information to the needs of patients, each training sessions could start with identifying what patients already know and asking what patients' needs are regarding information about the self-management of COPD and HF. By organizing multiple training sessions of one hour each (e.g. five or six or seven till nine sessions in total), to discuss information in a group discussion on a regular basis, patients also repeat the information, which helps participants to better recall information about self-managing their COPD and HF. Training sessions of one hour are considered not to take too much time and effort from participants and provide patients with not a too large amount of information during each training session. These things were important according to participants. In addition, during each training session the information could be discussed in a group discussion in such a way that the patients' needs are met. Patients could study in advance various topics related to self-management (e.g. what are symptoms of COPD and HF and how to self-treat those symptoms), and these topics can be discussed during the training sessions (e.g. talk about which symptoms each participant experiences and how they self-treat those symptoms). The information that patients can use to study can become available on the digital portal so that patients can always look back to it, but must certainly should be discussed during the training sessions. Therefore it is recommended to keep only the information on the digital portal that patients will certainly use, for example by discussing this information during training sessions. When patients do not use certain information, it is recommended to remove that information. This is a benefit of a digital self-management intervention, because removing information in for example a digital portal is easy to do. By removing information, the digital self-management intervention becomes also more tailored to the patients needs. Discussing information in a group discussion on a regular basis also stimulates interaction between patients and satisfies patients who want to have regular face-to-face contact.

Appreciation – perceived usefulness

Most of the participants had used the avatar that was included in the digital portal, especially at the beginning. However, participants had perceived serious downsides of the avatar. Participants mentioned for example that the avatar was unpleasant and annoying to work with. The reason why the avatar was perceived as annoying was because participants wanted the avatar to be more personal instead of providing standardised and irrelevant information. This finding is not in line with a previous description of virtual agents (i.e. avatars) like the one from the MATCH self-management intervention by Vardoulakis et al. (2012) [44] who described two field studies that were about the development of avatars designed to provide long-term, continuous social support to isolated older adults [44]. Despite that Vardoulakis et al. (2012) [44] described these two complete different studies, the essence of what an avatar should do according to Vardoulakis et al. (2012) [44] can be discussed upon. Vardoulakis et al. (2012) [44] described that avatars like the one from the MATCH self-management intervention, are designed for companionship and long-term continual use [44].

However, the avatar that was used in the MATCH self-management intervention is not able to establish companionship and long-term continual use, because of the downsides that participants mentioned. For example, that the avatar was unpleasant and annoying to work with. An explanation for this difference is that Vardoulakis et al. (2012) [44] described two complete different studies that did not take into account the experiences of patients with COPD and HF regarding an avatar as the one that was included in the MATCH self-management intervention. Looking at the needs of participants, they wanted the avatar to be more personal by including a question and answer function to be able to reach the case manager instead of the avatar. However, this would result in a lower degree of self-management, because it might be possible that participants will ask case managers how to self-manage their diseases instead of following the advice from the digital self-management intervention, which would not be self-management anymore. To still satisfy the need to be able to get questions answered and to satisfy patients' need for more personal contact (see support, usage, appreciation and perceived effectiveness – facilitating conditions and social influence and perceived usefulness), a recommendation would be to organize multiple training sessions of one hour each (e.g. five or six or seven till nine sessions in total) with at least one case manager that is present, to discuss questions in a group of patients on a regular basis so that patients still have a chance to getting their questions answered by the case manager. In this way multiple patients will receive the answers to questions, takes not too much time and effort from participants and provides patients with not a too large amount of information during each training session. These things were important to participants. Multiple training sessions are also useful for a better recall for information about the self-management of COPD and HF, because participants repeat information in another context. During the first training session, it should be clearly explained during a first training session how an avatar might help participants to self-manage their diseases, so that participants see the possible benefit from such an avatar. Next to that, case managers should be reachable for urgent problems (see support, usage and appreciation - facilitating conditions and social influence and perceived usefulness). Besides that, an avatar should not remind patients to complete tasks too often, because participants of the current study found that the avatar popped-up too often. It is also important that the avatar pops-up at the appropriate time, because a participant said that the avatar popped-up too early in the morning with a reminder to complete tasks. In this way the patient did not had a chance to complete the tasks. This is an example why multiple participants said that the avatar felt as unwanted interference. It is recommended to let the avatar remind patients just once or twice a day, preferably at the end of the day so that participants had enough time to complete their tasks. In addition, an avatar should be more specific instead of formulating vague answers and tasks, as was currently perceived by participants. An avatar should show which specific tasks are not completed yet or refer to relevant information, instead of providing small talk. Because the result was that participants found the avatar childish and was not taken serious. In case a future avatar would be developed using these recommendations and patients would still find that avatar not useful, it should be possible to switch off the avatar. That should be easy to do in a digital self-management intervention. Taking everything together, the avatar was considered not very useful and a general recommendation would be to remove the current avatar. In addition, the current avatar should be adjusted using the former recommendations.

Appreciation – perceived ease of use, perceived usefulness, and facilitating conditions and social influence

Participants perceived that the digital portal was easy to use, except that most participants had encountered technical problems regarding the design of digital devices and functionality of digital devices. For example, the design of the sensor was unpleasant and hindered participants' inhalation of medication. Initially, it was assumed that all the digital devices had worked flawless, but that had not been the case as it turned out. One explanation for these differentiating results from the initial expectations is that possibly, digital devices were not extensively tested before participants started to use them. As a result the technical problems remained undiscovered and were encountered by

participants, which made the digital devices harder to use. For future research it is recommended to extensively test digital devices upfront, so that the devices function well before participants start to use them. Another explanation might be that it was initially expected that technical problems would be solved in a short period of time. However, it turned out that it took a long time before technical problems were solved and this also made the digital devices harder to use. Therefore, it is advised to solve technical problems in a short period of time or at least, that participants are told when technical problems are expected to be solved (see support, usage and appreciation - facilitating conditions and social influence and perceived usefulness). Another finding that stood out was that a couple of participants said that they believed that their body should be given time to be able to heal itself, thus they did not take action too quickly. This finding is quite interesting, because it raises the question if at least these participants understood when it was okay to postpone or delay self-treatment, because the body will heal itself and when participants had to take action, but also if they are sufficiently trained or experienced to be able to make that distinction. It was assumed that participants were well trained to self-manage their COPD and HF, but it is doubtful if three self-management sessions, in which the participants were trained, were an sufficient amount of training sessions to be able to make a distinction between when it is okay to postpone or delay self-treatment and when participants have to take action. Moreover, it can be doubted if participants were capable of making such distinctions after using the MATCH self-management intervention for just about two months. It is questionable if that period of time in which the MATCH self-management intervention was used, was a sufficient amount of time to expect such long-term effects. Therefore, it is recommended to let participants of future studies use a digital self-management intervention for a longer period of time, for example three or four months, or maybe even five or six months, so that participants can become more experienced with the self-management of their diseases. Some of this period of time could be used to organize more training sessions, for example five or six self-management sessions or maybe even seven till nine self-management sessions of one hour each. This does not take too much time and effort from participants, and provides them with not a too large amount of information during each training session. Those things were important for participants. These self-management sessions could also include practice sessions about how participants would self-manage their diseases in certain situations. Ideas on how to do that could be discussed during a group session, which also stimulates interaction between patients and satisfies patients who want to have regular face-to-face contact.

4.5. Support

Usage – facilitating conditions and social influence

Most participants found the support of an informal caregiver useful. It is noteworthy that all of these participants were male and were experienced with at least one digital device (e.g. smartphone, tablet, PC). Spouses and friends had helped these participants with the self-management of COPD and HF, for example when having problems with digital devices. That most males were supported by an informal caregiver is in line with a previous finding of Sigurgeirsdottir et al. (2019) [42] who examined COPD patients' experiences, self-reported needs and needs-driven strategies to cope with self-management and reported that patients had a need to talk openly about COPD with other patients which helped them to maintain hope and courage when coping with self-management [42]. Sigurgeirsdottir et al. (2019) [42] also found that male participants referred to their wives as being enormous sources of support and said that their wives were responsible for managing patients' COPD medications [42]. One explanation for these similar findings might lay in the similarities between the study population of Sigurgeirsdottir et al. (2019) [42] and the population of the current study. Because these study populations have commonalities, it Is not unexpected that both studies found that male participants are supported by their wives in the self-management of the patients' diseases. This help made self-management of COPD and HF easier for patients and might therefore

found to be useful. One participant in particular (P06) extremely benefited from the help of the spouse, because this participant had not used the digital devices from the MATCH self-management intervention, instead the spouse used the digital devices. This participant (P06) had also a negative opinion about the digital devices from the MATCH self-management intervention, but had not used them at all. The reason for the participant (P06) not to use the digital devices from the MATCH self-management intervention was that the participant was not open to use the digital devices, because this patient had no interest in digital devices and was not willing to follow or listen to the advice of digital devices. Based on these findings some recommendations can be given. A recommendation for future research would be to involve the informal caregiver in self-management to a greater extent, especially for male participants, because most male participants found the support of an informal caregiver useful. However, if male participants benefit more from the support of an informal caregiver than women should be furtherly investigated during future research, because only a few participants, which were all male, had received support from an informal caregiver during the current study. If informal caregivers are going to be more involved in future research, it is recommended to evaluate informal caregivers' experiences with a digital self-management intervention as well. Because during the current study one informal caregiver was interviewed and the informal caregiver's experience with the digital devices brought-up valuable information that actually summarized the information as provided by patients in a clear way. This important information is useful in the further development of digital self-management intervention and therefore informal caregivers' experiences with a digital self-management intervention should be evaluated in future studies. The extent to which patients are helped by their informal caregiver could be monitored when organizing multiple training sessions of one hour each (e.g. five or six or seven till nine sessions in total). This makes it possible to take appropriate actions whenever necessary, to slow down the informal caregiver and give responsibilities of self-managing their diseases back to the patient. In addition, the training sessions do not take too much time and effort and provides patients with not a too large amount of information during each training session. These things are important for participants. From the finding that participant (P06) was not open to use the digital devices of the MATCH self-management intervention and therefore did not use them, it can be concluded that not everyone is necessarily ready to start using a digital self-management intervention. Hence, digital self-management interventions require a kind of readiness to start using it. This seems to be in line with the study of Prochaska et al. (1993) [45] who developed a model that helps to understand self-initiated and professionally assisted changes [45]. Prochaska et al. (1993) [45] reported five different stages of change [45]. In the first stage, precontemplation, there is no intention to change behaviour in the foreseeable future, while at the second stage, contemplation, patients are aware that a problem exists and are seriously thinking about overcoming it, but have not yet made a commitment to take action. At the contemplation stage the MATCH self-management intervention can be helpful for participants, because participants then see the need to self-manage their COPD and HF, but have not taken action yet. The MATCH self-management intervention helps by being that necessary action. The participant (P06) that was not open to use the digital devices was most likely in the precontemplation stage, while it was necessary to be in the contemplation stage. Considering this, it is recommended to only include patients that are at least at the contemplation stage, therefore are willing to change their behaviour. In this way patients are willing to use a digital self-management intervention and it should be avoided to offer a digital self-management intervention to patients that are not yet willing to use it. To help patients who are not yet willing to use a digital self-management intervention to move from the precontemplation phase to the contemplation phase and thus becoming willing to use a digital self-management intervention, it should be explained to these patients what kind of health issues they are facing and also stressing the importance to overcome them. In addition, it should be explained how a digital self-management intervention might help

patients to overcome their health issues, so that they see the possible benefits of a digital self-management intervention. Next to the patients that will certainly use a digital self-management intervention, this should also be done on a regular basis (e.g. during a visit to a doctor or nurse) with patients that are not willing yet to use a digital self-management intervention. It might be possible that these patients move to the contemplation phase, because they start to see the need to change. Hopefully, patients are then willing to change their behaviour. As a result these patient may become willing to use a digital self-management intervention.

Usage, appreciation and perceived effectiveness – facilitating conditions and social influence and perceived usefulness

In general, participants were positive about the support by technical professionals and case managers, however there were some serious negative aspects as well. To start with some positive aspects, technical professionals and case managers were experienced, had much expertise, much knowledge and opened the possibility for participants to ask questions. Some negative aspects were for example, the amount of personal contact was insufficient and technical professionals and case managers were poorly reachable. This made participants' experience with contacting medical professionals and participants' initiative important when contacting technical professionals or case managers. For instance, participants kept notifying technical professionals and case managers about non-functioning components of the MATCH self-management intervention, symptoms and abnormalities, even if technical professionals or case managers did not always respond on these notifications. The study of Korpershoek et al. (2018) [27] that examined perceptions of patients with COPD towards using mobile health (mHealth) for self-management of exacerbations, reported that a pro-active role from medical professionals (i.e. case managers) is needed to achieve positive patient outcomes [27]. Because of the commonalities between the study of Korpershoek et al. (2018) [27] and the current study, barring that the current study population were patients with COPD and HF and that the MATCH self-management intervention was not a mobile health intervention, it can be concluded that it is intolerable that technical professionals and case managers were poorly reachable during the MATCH study and that they did not always respond upon patients' notifications about non-functioning components of the MATCH self-management intervention, symptoms and abnormalities is also undesirable. Some reasons for the poor reachability and non-response on the patients' notifications by at least the case managers were found in a previously conducted qualitative study of Westland et al. (2018) [28]. That study explored the perceptions of primary care nurses towards delivering an intervention to enhance physical activity in patients at risk for cardiovascular diseases in primary care [28]. Despite that Westland et al. (2018) [28] explored perceptions of primary care nurses, instead of nurse practitioners, which were the case managers during the current study and a different intervention with a different goal was used in primary care during that study, some findings of that study may explain why case managers were poorly reachable and why they did not always respond upon patients' notifications about non-functioning components of the MATCH self-management intervention, symptoms and abnormalities. Westland et al. (2018) [28] reported multiple findings: the lack of patients' motivation to participate in the intervention to enhance physical activity negatively affected nurses' engagement; it was difficult for nurses to acquire new skills in order to be supportive and facilitative when helping patients to become more physically activity, because nurses were used to their daily role of being the expert; and other clinical demands which nurses encountered hampered the use of the intervention for physical activity in clinical practice [28]. A possible lack of patients' motivation is not likely to have intervened case managers' engagement in the current study, because participants showed quite some initiative in seeking contact with the case managers. Therefore, it is assumed that this did not negatively affect case managers' engagement in the current study. A more plausible explanation for the case managers' poor reachability and sometimes ill response upon patients' notifications in the MATCH study is that case managers found it difficult to have a more supportive role when helping patients to self-manage their COPD and HF. Because the case managers are also used to the role of expert in daily practice

and it might therefore be possible that this negatively affected case managers' ability to acquire more supportive skills that were necessary for their supportive role during the MATCH study. But, the most plausible explanation seems to be that the case managers encountered clinical demands when also having being in the supportive role during the MATCH study. This could have hampered them to always carry out their supportive role towards patients. This was also speculated by one participant during an interview. On the other hand, participants mentioned also positive aspects about the support of technical professionals and case managers and since participants were also positive, it can be concluded that the support of the technical professionals and case managers is an important component of a self-management intervention. This all being said, a recommendation to improve upon the support by technical professionals and case managers for future studies is to keep training case managers upfront so they are used to their supportive role. This could for example be done by providing a clear description on what is expected from case managers and what is expected from other medical professionals. A first step to do that would be to inform the whole medical department that is involved in the study and to explain what the role is of the case managers and other medical professionals. Even medical professionals that are not directly involved in the study should be adequately informed. Once the whole medical department is adequately informed and if all roles and expectations from case managers and other medical personal are clear for them, case managers can for example practice their roles with each other with different cases during one or two practice sessions. The most important recommendation is to ensure that a medical professional is available throughout the day to appropriately respond upon patients' calls when they called with urgent problems. That may be the case manager, but since case managers can be disturbed when they encounter clinical demands, it may be better to have a small group of medical professionals available who are always reachable that appropriately respond upon patients' calls when they called with urgent problems, preferably on the same day. But like described earlier, to being able to do that these medical professionals should be informed about the study upfront. In addition, it is important that this group of medical professionals must be qualified enough to be able to appropriately respond upon patients' calls about urgent problems. The same applies to technical professionals. There too, a small group of technical professionals should be well informed about the study, should be reachable, preferably throughout the day, and should tell patients at least when their urgent problems are expected to be solved or appropriately respond upon patients' calls in another way. Again, well qualified personal to do that is important. The former recommendations suggest that technical professionals and case managers treat patients' questions as separate supportive entities, namely one entity for medical problems and one entity for technical problems. Only patients with urgent problems should be supported via telephone. This is not expected to drastically lower the degree of self-management, because this support is for urgent problems only and is important, because patients had a need for more personal contact with particularly, the case managers, but also with the technical professionals (see digital portal, appreciation – perceived usefulness). To furtherly satisfy patients' need for more personal contact, it is recommended to organize multiple training sessions of one hour each (e.g. five or six or seven till nine sessions in total) (see digital portal, appreciation – perceived usefulness). Because in this way patients will have more personal contact during a group discussion between patients and the case manager that is present.

4.6. Strengths and limitations

The positive aspects, negative aspects and points for improvement that were identified during the current study can be used to furtherly develop future digital self-management interventions that are more useful for patients, for example by adjusting digital self-management interventions to the different needs of patients. Future research can use the results of the current explorative study as guidance on which positive aspects should be included in a digital self-management intervention and which negative aspects should not be included. Furthermore, other studies should identify predictors to find out which patients are better self-managing their diseases versus which patients are worse at

it. These predictors can be used to furtherly tailor the different components of digital self-management interventions to the patients' individual needs. In addition, further research is necessary to determine if a digital self-management intervention such as the MATCH self-management intervention is cost-effective when compared to regular healthcare. This would confirm if digital self-management interventions have an actual added value to regular healthcare in terms of patients' health outcomes versus the induced costs of digital self-management interventions.

Trustworthiness of the current study was enhanced since the data analysis was conducted by two researchers, because the change of bias diminished [27, 41]. The second coder independently coded a sample of three randomly selected interviews, which comprises 30% of all the interviews. The previous study of Lilgendahl and McAdams (2011) [46] double coded around 15% of the data to establish reliability [46] and the previous study of McLean and Pratt (2006) [47] reported that they double coded around 14% of the entire data [47]. Hence, the amount of double coded interviews during the current study was considered sufficient to establish reliable codes. Future studies are advices to also have at least 14% of the entire data coded by a second coder so that their codes are reliable too.

The one-to-one in-depth semi-structured interviews with COPD and HF patients provided a safe environment during the interviews, because the semi-structured interviews were conducted individually. In this way situations in which other participants could influence the answers of the participants were avoided [35] and conducting one-to-one in-depth semi-structured interviews is therefore considered a strength of the current study. Furthermore, the researcher's intention to learn from participants and the open, non-judgmental attitude of the researcher during the interviews and of the researchers during the data-analysis added credibility to the current study. It is assumed that this attitude of the researchers had helped participants to freely talk about their opinion, thoughts, experiences and feelings and had helped the researchers to answer the research questions truthfully. It is recommended to also create a safe environment for patients who participate in future studies. One-to-one interviews are easy to do that. In addition, researchers of future studies should also have an open, non-judgmental attitude during data collection and data-analysis, since this adds more credibility to studies.

Healthcare professionals had used the MATCH self-management intervention. They were trained to: provide participants with training; support participants in their self-management of COPD and HF; use the digital portal of the MATCH self-management intervention. That is in line with the findings of Korpershoek et al. (2018) [27] who examined perceptions of patients with COPD towards using mobile health (mHealth) for self-management of exacerbations and reported that patients find it crucial that healthcare professionals are familiar with the self-management intervention that patients use [27]. An explanation for why this was also the case in the MATCH study, is that for safety reasons case managers had to check on participants' symptoms once a week to see whether patients with significantly increased symptoms did improve. It is assumed most likely that the easiest way to do that was to create a portal for case managers too. Hence, case managers had to use the MATCH self-management intervention. It can be concluded that also during the current study it is considered a strength that healthcare professionals were also familiar with the MATCH self-management intervention. Taking everything together, a recommendation for future studies would be to oblige case managers or other medical professionals with a supportive role to use the digital self-management intervention.

A limitation of the current study is that the results may have a limited generalisability to other patient populations, due to a relatively small sample size. On the other hand, to enhance generalisability of the results, it was strived to have maximum variation in the baseline characteristics of the participants that were included. However, as a result of the criteria on which participants were included, not all baseline characteristics of the MATCH participants that were interviewed comprised

variation. For instance, all participants had experience using one or more digital devices. Including more patients with no experience in the usage of digital devices could have resulted in different patient perspectives towards positive aspects, negative aspects and points for improvement, because participants without experience might encounter other (technical) problems compared to participants that are experienced users of digital devices. It might also be interesting to know the perspectives of patients that experience a high amount of exacerbations each year (e.g. more than six exacerbations each year) towards positive aspects, negative aspects and points for improvement of a self-management intervention like the MATCH self-management intervention for COPD and HF. Because patients that experience a high amount of exacerbations each year (e.g. more than six exacerbations each year) might also experience the self-management of COPD and HF differently when compared to patients that experience no exacerbations each year. This might bring forth other positive aspects, negative aspects and points for improvement when compared to the perceived positive aspects, negative aspects and points for improvement of patients that have no exacerbations each year. Taking everything together, a first recommendation for future research would be to include about twenty participants, because the previously conducted study of Korpershoek et al. (2018) [27] who examined perceptions of patients with COPD towards using mobile health (mHealth) for the self-management of exacerbations, included thirteen COPD patients and six healthcare providers. The previously conducted study of Sigurgeirsdottir et al. (2019) [42] who investigated COPD patients' experiences, self-reported needs and needs-driven strategies to cope with self-management, reported that fifteen in-depth interviews were conducted [42]. However, the study of Slevin et al. (2019) [43] explored the potential benefits of digital health technology for the self-management of COPD from patients' perceptions and conducted thirty in-depth interviews with COPD patients. It can be concluded that a study population of twenty participants is considered to be sufficient, hence future research should include that amount of patients. This enhances the generalisability to other patient populations. It is also recommended for future research to also include participants without experience in the usage of digital devices in the study population and to include patients that have a high amount of exacerbations each year (e.g. more than six exacerbations each year) in the study population. In general, future studies should strive for more variation in baseline characteristics of the participants.

Apart from the first researcher, two other researchers that were involved in code development and data analysis were also involved in the development of the MATCH self-management intervention for COPD and HF. It might be argued that this may have introduced some confirmation bias into this study, since these researchers might have had expectations about the MATCH self-management intervention and may unintentionally have used their expectations when developing codes and when analysing the data. However, this seems not likely, because the first researcher and interviewer was not involved in the development of the MATCH self-management intervention or other MATCH projects and is therefore considered independent. Moreover, the interviewer independently developed methods to execute the interviews. In addition, the first researcher developed the majority of the codes and analysed the majority of the data. Taking everything together, it can be concluded that it is not likely that the interviews themselves and the analysis of the interviews were biased by the other two researchers. This strengthens the reliability of the results of the current study.

Due to time constrains, the two case managers' experiences with the different components of the MATCH self-management intervention for COPD and HF were not evaluated in the current study. The previously conducted qualitative study of Korpershoek et al. (2018) [27] examined perceptions of patients with COPD towards using mobile health (mHealth) for the self-management of exacerbations [27]. Korpershoek et al. (2018) [27] reported healthcare providers' perspectives, for example health are providers said that "it is the patient's responsibility to do something with the information he or she gets out of the app, instead of a nurse or somebody else receiving notifications and having to call all the patients [27]." Considering this finding, it was unfortunate that the two case

managers' experiences with the different components of the MATCH self-management intervention for COPD and HF were not evaluated in the current study, because as it seems the two case managers could have provided valuable information about positive aspects, negative aspects and points for improvement. Their experiences could have been useful for the further development of digital self-management interventions in the future. For these reasons, future research should evaluate healthcare providers' perspectives on digital self-management interventions.

The timespan of about four to five months between using the MATCH self-management intervention and participating in the interviews might be a limitation in this study. Many participants acknowledged that they failed to remember parts of the MATCH self-management intervention. Furthermore, some participants gave information about features of the MATCH self-management interventions that did not match with the actual capabilities of the MATCH self-management intervention. However, all participants also revealed very specific knowledge attained during the use of the MATCH self-management intervention. To prevent that participants failed to remember parts of the MATCH self-management intervention during the interviews, information about the different components of the MATCH self-management intervention was provided. If participants still had questions or things that were unclear to them, the interviewer gave additional information until participants recalled the part of the MATCH self-management intervention again.
In conclusion, it is assumed that participants brought-up all the information that they had knowledge of. Since, participants brought-up much information and revealed very specific knowledge attained during the use of the MATCH self-management intervention. However, because of the contradiction that participants acknowledged that they failed to remember parts of the MATCH self-management intervention and the very specific knowledge attained during the use of the MATCH self-management intervention that was revealed, it remains unclear if the timespan of about four to five months between using the MATCH self-management intervention and participating in the interviews indeed limited participants to provide all relevant information during the interviews. To prevent this unclarity in future research, a recommendation would be to keep the timespan between the usage of digital self-management interventions by participants and the interviews as small as possible, preferably one or two months at the most. In that way participants may recall their experiences with the digital self-management intervention better.

Because of time constraints, all of the codes from only seven interviews were structurally brought together into categories. But, it might have strengthen the results of the current study if all the codes that were developed, were brought together into categories. In that way, it might have been possible that some categories might have been supported by more participants than currently is described. On the other hand, from the three remaining interviews the most important codes, codes that added extra information to the codes and categories obtained from the seven interviews, were brought together into categories or were added to the already obtained categories. That only the most important codes from the three remaining interviews were brought together into categories or were added to the already obtained categories, was discussed with an researcher who had experience with analysing interviews. As a result of this discussion it did not seem likely that not bringing all the developed codes into categories affected the results and conclusions of the current study. In addition, that the most important codes from the three remaining interviews were brought together into categories or were added to the already obtained categories, strengthens the results of the current study. Because in this way, the most important codes are still included in the current study by bringing these codes together into categories or by adding these codes to the already obtained categories. In addition, the codes from the three interviews that were not structurally brought together into categories were developed by the first researcher only. Hence, the codes of the three interviews that the two researchers reached consensus about were brought together into categories. Therefore, the strength about the coding of the sample of three randomly selected interviews which comprises 30% of all the interviews which was done by a second coder for reliability holds. For that reasons the established codes are still considered to be reliable. A recommendation for future

research would be to structurally bring together all the developed codes into categories. In that way the results are strengthened.

Finally, the average duration of the ten interviews that were coded was about 100 minutes. Because of that participants might have experienced a high burden, because of the effort to participate (e.g. duration of the interviews). This seems of special importance since participants already pointed out that the MATCH self-management intervention for COPD and HF took too much effort and time from participants. The duration of the interviews may have added to the burden participants already experienced and may have hampered participants to give all relevant information. Next to that, the interviews could have been stressful for participants, since participants were asked to talk about their personal opinion, thoughts, experiences and feelings. The reason why the interviews took about 100 minutes on average is that participants could extensively tell about their opinion, thoughts, experiences and feelings. It might also be possible that participants became tiered during the interviews, making formulating their opinion, thoughts, experiences and feelings harder, thus it took longer. To overcome a high burden for participants were told that they had the opportunity during the interviews to take a break whenever necessary and participants had the possibility to stop their participation at any moment. In addition, participants did not need to answer questions if they did not want to. Another precaution to limit the burden of patients was to conduct the interviews in a place that was suitable for them, namely at the patients' home or at the MST hospital in Enschede or at the ZGT hospital in Almelo. Taking everything together, it is assumed that the burden of participants was not too high and that this did not affect the participants during the interviews. For future research it is recommended to also take precautions like was done in the current study when a high burden for participants is expected.

5. Conclusion

The aim of this study was to identify positive aspects, negative aspects and points for improvement from users' experiences with the different components of the MATCH self-management intervention for COPD and HF that was used in the MATCH study. Based on the identified positive aspects, negative aspects and points for improvement, it can be concluded that the whole MATCH self-management intervention truly satisfied patients with COPD and HF, especially the digital portal. However, the avatar was considered not very useful and it turned out that not everyone is necessarily ready to start using a digital self-management intervention. In addition, it was intolerable that technical professionals and case managers were poorly reachable during the MATCH study and that they did not always respond upon patients' problems. Taking everything together, it is advised to use a digital self-management intervention, especially a digital portal, because it satisfied patients with COPD and HF. However, improvements are necessary to achieve more patient satisfaction with a digital self-management intervention. Hence, the most important recommendations for future research are: to explain during a first training session how patients might benefit from using a digital self-management intervention, how it might help them to overcome their health issues, what the goals are of a digital self-management intervention, and how an avatar might help participants to self-manage their diseases, but to remove the current avatar; to create personal contact between patients by grouping them into heterogenous subgroups; to tailor the provided information to the needs of patients (e.g. each training sessions could start with identifying what patients already know and asking what patients' needs are regarding information about the self-management of COPD and HF); by organizing multiple training sessions of one hour each (e.g. five or six or seven till nine sessions in total) with at least one case manager that is present, to discuss information in a group of patients on a regular basis; to keep only the information on the digital portal that patients will certainly use (e.g. discuss information during training sessions); to extensively test digital devices upfront, so that the devices function well before participants start to use them; to only include patients that are willing to change their behaviour and it should be avoided to offer a digital self-management intervention to patients that are not yet willing to use it; to inform the whole medical department and technical department that is involved in the study and to explain what the role is of the case managers, other medical professionals, and technical professionals; to ensure that a small group of medical professionals and technical professionals is available throughout the day to appropriately respond upon patients' calls about only urgent problems; technical professionals and case managers should treat patients' questions as separate supportive entities, namely one entity for medical problems and one entity for technical problems; to evaluate informal caregivers' experiences with a digital self-management intervention; to identify predictors to find out which patients are better self-managing their diseases versus which patients are worse at it; to determine if a digital self-management intervention such as the MATCH self-management intervention is cost-effective when compared to regular healthcare; to strive for more variation in baseline characteristics of the participants (e.g. include participants without experience in the usage of digital devices and include patients that have a high amount of exacerbations each year); and to evaluate healthcare providers' perspectives on digital self-management interventions. These recommendations can be used together with the identified points for improvement that are mentioned by the participants to furtherly develop future digital self-management interventions that are more useful for patients.

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Additional files

Appendix 1: Informed consent form for patients

Informatie die u kreeg via de telefoon en nu per post of e-mail.

A. Ramlal, mei 2019

Geachte Heer/Mevrouw (naam),

Mijn naam is Aniel Ramlal. Ik ben een student gezondheidswetenschappen die bezig is met afstuderen aan de Universiteit Twente in Enschede. In mijn onderzoek wil ik uw ervaringen (sterke punten en verbeterpunten) over het MATCH project graag met u bespreken in een interview.

U heeft in de periode van oktober 2018 tot en met januari 2019 deelgenomen aan het MATCH project voor COPD en hartfalen. Daarom benader ik u om deel te nemen aan een interview. Met dit interview hopen we meer kennis en inzicht te krijgen over hoe het MATCH project voor patiënten met COPD en hartfalen kan worden gebruikt. Met deze informatie hopen we het MATCH project voor COPD en hartfalen te verbeteren en aan te passen naar de behoeften van patiënten.

We zijn benieuwd naar uw ervaringen met het MATCH project voor COPD en hartfalen. Tijdens het interview zal ik eerst vragen stellen over het project in het algemeen en daarna zal ik de afzonderlijke onderdelen van het MATCH project met u nalopen.

Het interview zal ongeveer 90 minuten duren. De interviews zullen worden afgenomen op een voor u geschikte plaats. Dat kan bij u thuis zijn, in het Medisch Spectrum Twente of in de Ziekenhuis Groep Twente in Almelo of Hengelo. Van het interview zal een geluidsopname worden gemaakt zodat het gesprek later woord voor woord kan worden uitgewerkt door de onderzoeker.

We vragen u om tijdens het interview te praten over uw mening, gedachten, ervaringen en gevoelens. De tijd die het interview u kost en de inspanning die u tijdens het gesprek moet leveren zouden belastend voor u kunnen zijn. U mag tijdens het interview altijd aangeven een pauze te willen als u dat nodig heeft en u hoeft geen vragen te beantwoorden die u niet wilt beantwoorden. Uw deelname aan dit interview is geheel vrijwillig en u kunt uw deelname op elk gewenst moment stoppen, zonder dat u een reden moet opgeven.

Wanneer het interview in het ziekenhuis wordt afgenomen, kunt u na uw deelname aan dit onderzoek de reiskosten (van 0,19 cent per kilometer) en parkeerkosten vergoed krijgen. U krijgt na het interview een formulier waarop u kunt aangeven of u een vergoeding van de reiskosten wil ontvangen.

Uw privacy wordt maximaal beschermd. Er wordt op geen enkele wijze vertrouwelijke informatie van of over u met anderen gedeeld. Uw gegevens zullen anoniem worden gemaakt.

Door uw naam anoniem te maken, kan wel worden onderzocht wat u in het gesprek aangeeft, maar weten de onderzoekers niet dat u het bent.

In wetenschappelijke artikelen of rapporten zullen anonieme onderzoeksgegevens worden gebruikt. Geluidsopnamen, formulieren en andere documenten gerelateerd aan dit onderzoek worden opgeslagen op het beveiligde netwerk bij het Medisch Spectrum Twente, Universiteit Twente en op de beveiligde computers van de onderzoekers.

Als u voorafgaand aan het interview besluit af te zien van deelname, heeft dit op geen enkele wijze gevolgen voor u of uw behandeling.

Als u besluit om uw medewerking te staken, dan zal dat ook op geen enkele wijze gevolgen voor u of voor uw behandeling hebben. In dat geval zullen de gegevens tot aan het moment waarop uw deelname stopt in het onderzoek gebruikt worden.

Als u vragen of opmerkingen heeft of als u meer wil weten over het interview, neemt u dan alstublieft contact op met de onderzoeker: Aniel Ramlal. Van maandag tot en met vrijdag tussen 9:00 en 16:00, direct per telefoon te bereiken via [redacted] Of direct per e-mail te bereiken via [redacted]

Met vriendelijke groet, mede namens de onderzoekers van het MATCH project,

Aniel Ramlal,
Student gezondheidswetenschappen en onderzoeker MATCH project.

Joanne Sloots,
Onderzoeker MATCH project.

Toestemmingsformulier.

Interview over ervaringen MATCH project.

A. Ramlal, mei 2019

Geachte Heer/Mevrouw (naam),

Het doel van dit document is om de voorwaarden van uw deelname aan het interview vast te leggen.

Van het interview zal een geluidsopname worden gemaakt zodat het gesprek later woord voor woord kan worden uitgewerkt. Deze uitwerking wordt gebruikt in het verdere onderzoek.

U hoeft geen vragen te beantwoorden die u niet wilt beantwoorden. U kunt uw deelname op elk gewenst moment stoppen, of weigeren dat uw gegevens voor het onderzoek mogen worden gebruikt, zonder dat u een reden moet opgeven.

Het praten over uw mening, gedachten, ervaringen en gevoelens, de tijd die het interview u kost en de inspanning die u tijdens het gesprek moet leveren, kan belastend voor u zijn. U mag aangeven een pauze te willen als u dat nodig heeft.

Eventuele reis- en parkeerkosten worden vergoedt. De interviewer zal aan het einde van het interview een formulier samen met u invullen.

Met uw ondertekening van dit document geeft u aan dat u aan het interview wil deelnemen en dat na het interview nog contact met u kan worden opgenomen via de telefoon of via e-mail als dat nodig is. Daarnaast geeft u aan dat u goed bent geïnformeerd over het onderzoek. De manier waarop de onderzoeksgegevens worden verzameld en gebruikt, zijn met u besproken.

Indien u vragen had, geeft u bij ondertekening aan dat u deze vragen heeft kunnen stellen en dat deze vragen helder en duidelijk zijn beantwoord. U krijgt een toestemmingsformulier van de onderzoeker mee aan het einde van het interview dat ook ondertekend is door de interviewer Aniel Ramlal.

Heeft u nog vragen?

U verklaart dat u akkoord gaat met deelname aan het onderzoek.

1. U kreeg voldoende informatie over dit onderzoek. Het doel van uw deelname als een geïnterviewde in dit onderzoek is helder aan u uitgelegd en u weet wat dit voor u betekent.
2. U geeft de onderzoeker toestemming om tijdens het interview geluidsopnames en schriftelijke notities te maken.
3. U heeft dit formulier voorgelezen gekregen en u heeft al eerder informatie over het onderzoek via de telefoon gekregen en per post of e-mail. U heeft al de informatie die u kreeg, begrepen. Al uw vragen zijn naar uw tevredenheid beantwoord.
4. U neemt vrijwillig deel aan dit onderzoek.

Naam Deelnemer	**Naam Onderzoeksleider** Aniel Ramlal
Handtekening	**Handtekening**
Datum	**Datum**

Met vriendelijke groet, mede namens de onderzoekers van het MATCH project,

Aniel Ramlal,
Student gezondheidswetenschappen en onderzoeker MATCH project.

Joanne Sloots,
Onderzoeker MATCH project.

Appendix 2: Interview guide for semi-structured interviews with patients

Locatie: MST, ZGT of bij patiënten thuis.
Verwachte tijdsduur: 90 minuten.
Aanwezig: 1 patiënt en 1 onderzoeker, interviewer.

Checklist	1. 1 Formulier reiskostenvergoeding 2. 1 Overzicht MATCH zelfmanagementbijeenkomsten 3. 1 Interview schema, 1 blad voor notities, 1 pen en 1 potlood meenemen 4. 2x informed consent 5. Brief niet storen op de deur in verband met interview 6. Reservebatterijen mee 7. Werktelefoon mee, op stil 8. Telefoon in vliegtuigstand en wekkers uit 9. MATCH portaal voor patiënten in tablet opgestart, op dag van vandaag zetten, horizontaal houden, alle tips van de dag foto op tablet openzetten via de app galerij 10. Sensor inhalator op de stoel naast je leggen 11. Timer bij de hand 12. Audiorecorder & telefoonopname gereed, gecontroleerd en aan 13. Opstelling klaar 14. Zitten in 90° ten opzichte van elkaar, participant rechts van mij 15. Drinken voor participant en interviewer
Introductie	- <u>*Welkom & mezelf voorstellen*</u> *Mijn naam is Aniel Ramlal. Ik ben een student gezondheidswetenschappen die bezig is met dit onderzoek voor mijn afstuderen aan de Universiteit Twente in Enschede.* *- Wij als onderzoekers vragen ons af wat het MATCH project voor COPD en HF u heeft opgeleverd voor uw klachten van COPD en HF. Daar wil ik graag vragen over stellen tijdens dit interview. Eerst gaan we in op het project in het algemeen en daarna zullen we de afzonderlijke onderdelen met u nalopen.* *- U heeft deelgenomen aan het MATCH project voor COPD en HF. Daarbij heeft u gewerkt met de verschillende onderdelen van het project. Dat bestond uit training in het ziekenhuis, een digitaal portaal dat u op de tablet voor een paar maanden heeft gebruikt en uit ondersteuning. In het project was zelfmanagement belangrijk en dat is de manier waarop u met de gevolgen van uw COPD en HF omgaat.* - <u>Doornemen en ondertekenen informed consent (toestemmingsformulier)</u> *- Ik wil alvast aangeven dat ik veel door moet blijven vragen. U kunt het aangeven als u een onderwerp genoeg heeft besproken.* - *<u>Ik ga nu de timer en geluidsopname starten met de audiorecorder en telefoon zodat we kunnen beginnen met het interview. Bent u er klaar voor?</u>*
Kern	<u>Gebruik van het MATCH project voor COPD en HF in het algemeen (dus de training, het portaal en de ondersteuning, alles bij elkaar)</u> *- Wat vond u van het MATCH project voor COPD en HF in het algemeen (dus de training, het portaal en de ondersteuning, alles bij elkaar)?* *-> Wat vond u meevallen? Wat vond u tegenvallen?* *-> Wat vond u goed/nuttig? Wat vond u minder goed/minder nuttig?* *-> Waarom? Kunt u een voorbeeld geven waaruit dat blijkt?* *-> Heeft u het MATCH project elke dag gebruikt? Zo ja, wat heeft u dagelijks gedaan?* *-> Waarom heeft u het elke dag gebruikt? Waarom heeft u wel eens overgeslagen? Kunt u een voorbeeld geven waaruit dat blijkt?* *- We hebben denk ik het MATCH project voor COPD en HF in het algemeen zo voldoende besproken.* *-> Heeft u hier nog iets aan toe te voegen?*
	<u>Waardering van de verschillende onderdelen van het MATCH project voor COPD en HF</u> • *Training met zelfmanagementbijeenkomsten: tijdens 3 sessies die werden gegeven in het ziekenhuis door 2 verpleegkundig specialisten COPD en HF. Er waren 2 groepsbijeenkomsten in Hengelo en 1 individuele*

bijeenkomst met Clara van Ommeren (verpleegkundig specialist COPD in het MST) of Alexandra Kleberger (verpleegkundig specialist HF in het ZGT).

- Wat vond u van de zelfmanagementbijeenkomsten?
-> Wat vond u meevallen? Wat vond u tegenvallen?
-> Wat vond u goed/nuttig? Wat vond u minder goed/minder nuttig?
-> Waarom? Kunt u een voorbeeld geven waaruit dat blijkt?
-> Wat vond u van de informatie die de verpleegkundig specialisten hebben gegeven over COPD en HF?
-> Wat vond u van de informatie die de verpleegkundig specialisten hebben gegeven over hoe u uw klachten van COPD en HF kon herkennen?
-> Wat vond u van de uitleg over de ademhalingsoefeningen?
-> Wat vond u van de uitleg over de ontspanningsoefeningen?
-> Wat vond u van de uitleg over het gebruik van het portaal?
-> Wat vond u van de uitleg over het gebruik van de apparaten, zoals de Fitbit, weegschaal en sensor als u die had?

- Was u bij alle zelfmanagementbijeenkomsten aanwezig?
-> Waarom wel? Waarom niet? Hoe is dat gekomen? Kunt u een voorbeeld geven waaruit dat blijkt?
-> Wanneer was dat? Wanneer was dat niet?
-> Waarom wel? Waarom niet? Kunt u een voorbeeld geven waaruit dat blijkt?

- U kreeg informatie over COPD en HF, hoe u uw klachten van COPD en HF kon herkennen, u kreeg uitleg over het gebruik van het portaal en u kreeg uitleg over het gebruik van de apparaten, zoals de Fitbit, sensor en weegschaal (bijeenkomst 1: groep). U kreeg uitleg over uw actieplan en de "wat is normaal voor mij"-kaart werd met u besproken (bijeenkomst 2: individueel). U kreeg informatie over voeding, beweging, stoppen met roken en u kreeg uitleg over de ademhalingsoefeningen en over de ontspanningsoefeningen (bijeenkomst 3: groep).

- Hebben de zelfmanagementbijeenkomsten u iets opgeleverd? Zo ja, wat dan?
-> Waarom wel? Waarom niet? Wanneer wel? Wanneer niet? Kunt u een voorbeeld geven waaruit dat blijkt?
-> Wat kan voor u als COPD en HF patiënt een voordeel zijn?
-> Waarom dan? Waarom niet? Wanneer wel? Wanneer niet? Kunt u een voorbeeld geven waaruit dat blijkt?
-> Welke informatie of onderdelen uit de zelfmanagementbijeenkomsten vond u nuttig? Welke informatie of onderdelen uit de zelfmanagementbijeenkomsten zouden we in het vervolg kunnen overslaan?
-> Waarom wel? Waarom niet? Kunt u een voorbeeld geven waaruit dat blijkt?

- Heeft u iets gemist in de zelfmanagementbijeenkomsten? Zo ja, wat dan?

- We hebben denk ik de zelfmanagementbijeenkomsten zo voldoende besproken.
-> Heeft u hier nog iets aan toe te voegen?

- *Portaal:* <u>Alleen tablet laten zien.</u> *Het MATCH programma op uw tablet dat u gebruikte bestond uit verschillende onderdelen.*

- Wat vond u van het MATCH portaal op uw tablet in het algemeen (dus alle onderdelen bij elkaar)?
-> Wat vond u meevallen? Wat vond u tegenvallen?
-> Wat vond u goed/nuttig? Wat vond u minder goed/minder nuttig?
-> Waarom? Kunt u een voorbeeld geven waaruit dat blijkt?

- Wat vond u van het gebruik van het portaal op een tablet?
-> Vond u het makkelijk of moeilijk om met het portaal op uw tablet te werken?
-> Hoe komt dat dan?
-> Bij welke onderdelen wel? Bij welke onderdelen niet?
-> Waarom wel? Waarom niet? Kunt u een voorbeeld geven waaruit dat blijkt?

- Wat deed u zoal op uw tablet? Hoe heeft u het MATCH portaal op uw tablet in het algemeen gebruikt?
-> Wanneer heeft u het MATCH portaal op uw tablet gebruikt? Wanneer heeft u het portaal op uw tablet niet gebruikt?
-> Waarom wel? Waarom niet? Kunt u een voorbeeld geven waaruit dat blijkt?

- Heeft het MATCH portaal op uw tablet u in het algemeen iets opgeleverd? Zo ja, wat dan?
-> Welke onderdelen wel? Welke onderdelen niet? Waarom wel? Waarom niet? Wanneer wel? Wanneer niet? Kunt u een voorbeeld geven waaruit dat blijkt?
-> Wat kan voor u als COPD en HF patiënt een voordeel zijn?

	-> Bij welke onderdelen wel? Bij welke onderdelen niet? Waarom dan? Waarom niet? Wanneer wel? Wanneer niet? Kunt u een voorbeeld geven waaruit dat blijkt? *- We hebben denk ik het portaal op uw tablet in het algemeen zo voldoende besproken.* *-> Heeft u hier nog iets aan toe te voegen?* --- ➔ *Zelfmanagement:* Tabblad laten zien op tablet. (Zetten op 1 dag vooruit) *- Wat vond u van het onderdeel zelfmanagement?* *-> Wat vond u meevallen? Wat vond u tegenvallen?* *-> Wat vond u goed/nuttig? Wat vond u minder goed/minder nuttig?* *-> Waarom? Kunt u een voorbeeld geven waaruit dat blijkt?* *- Wat deed u zoal bij het onderdeel zelfmanagement? Hoe heeft u het onderdeel zelfmanagement gebruikt?* *-> Wanneer heeft u het onderdeel zelfmanagement gebruikt? Wanneer heeft u het onderdeel zelfmanagement niet gebruikt?* *-> Waarom wel? Waarom niet? Kunt u een voorbeeld geven waaruit dat blijkt?* *-> Heeft u naar de takenlijst gekeken? Heeft u uw taken dagelijks opgevolgd?* *-> Waarom wel? Waarom niet? Kunt u een voorbeeld geven waaruit dat blijkt?* *- Dit tabblad zag u bij het opstarten.* *- Heeft het onderdeel zelfmanagement u iets opgeleverd? Zo ja, wat dan?* *-> Waarom wel? Waarom niet? Wanneer wel? Wanneer niet? Kunt u een voorbeeld geven waaruit dat blijkt?* *-> Wat kan voor u als COPD en HF patiënt een voordeel zijn?* *-> Waarom dan? Waarom niet? Wanneer wel? Wanneer niet? Kunt u een voorbeeld geven waaruit dat blijkt?* *-> Welke delen van het onderdeel zelfmanagement vond u nuttig? Welke delen van het onderdeel zelfmanagement mogen er volgens u uitgelaten worden?* *-> Hoe zat dat voor het klachtendagboek?* *-> Waarom wel? Waarom niet? Kunt u een voorbeeld geven waaruit dat blijkt?* *- Heeft u iets gemist in het tabblad zelfmanagement? Zo ja, wat dan?* *- U vulde dagelijks zelf een klachtendagboek in, uw lichaamsgewicht werd gemeten en waarvoor u adviezen kreeg om uw klachten van COPD en HF te verminderen.* *- We hebben denk ik het onderdeel zelfmanagement zo voldoende besproken.* *-> Heeft u hier nog iets aan toe te voegen?* --- ➔ *Monitoring:* Tabblad laten zien op tablet. (Zetten op 14 november 2018) *- Wat vond u van het onderdeel monitoring?* *-> Wat vond u meevallen? Wat vond u tegenvallen?* *-> Wat vond u goed/nuttig? Wat vond u minder goed/minder nuttig?* *-> Waarom? Kunt u een voorbeeld geven waaruit dat blijkt?* *- Wat deed u zoal bij het onderdeel monitoring? Hoe heeft u het onderdeel monitoring gebruikt?* *-> Wanneer heeft u het onderdeel monitoring gebruikt? Wanneer heeft u het onderdeel monitoring niet gebruikt?* *-> Waarom wel? Waarom niet? Kunt u een voorbeeld geven waaruit dat blijkt?* *- Heeft het onderdeel monitoring u iets opgeleverd? Zo ja, wat dan?* *-> Waarom wel? Waarom niet? Wanneer wel? Wanneer niet? Kunt u een voorbeeld geven waaruit dat blijkt?* *-> Wat kan voor u als COPD en HF patiënt een voordeel zijn?* *-> Waarom dan? Waarom niet? Wanneer wel? Wanneer niet? Kunt u een voorbeeld geven waaruit dat blijkt?* *-> Welke delen van het onderdeel monitoring vond u nuttig? Welke delen van het onderdeel monitoring zouden we in het vervolg kunnen overslaan?* *-> Waarom wel? Waarom niet? Kunt u een voorbeeld geven waaruit dat blijkt?* *- Heeft u iets gemist in het tabblad monitoring? Zo ja, wat dan?* *- Dit tabblad gaf een overzicht van uw lichaamsgewicht, klachten, adviezen en wat u daarmee heeft gedaan.*

	- We hebben denk ik het onderdeel monitoring zo voldoende besproken. *-> Heeft u hier nog iets aan toe te voegen?* --- ➔ *Sensor:* <u>Sensor laten zien.</u> *-> Gebruikte u sensoren op de inhalatiemedicatie? Antwoord nee: Stelt u zich eens voor dat u zo een sensor zou gebruiken.* *- Denkt u dan dat zo een sensor u zal helpen?* *Waarom wel? Waarom niet? Kunt u een voorbeeld geven waaruit dat blijkt?* *- Wat vond u van de sensor?* *-> Wat vond u meevallen? Wat vond u tegenvallen?* *-> Wat vond u goed/nuttig? Wat vond u minder goed/minder nuttig?* *-> Waarom? Kunt u een voorbeeld geven waaruit dat blijkt?* *- Wat deed u zoal met de sensor? Hoe heeft u de sensor gebruikt?* *-> Wanneer heeft u de sensor gebruikt? Wanneer heeft u de sensor niet gebruikt?* *-> Waarom wel? Waarom niet? Kunt u een voorbeeld geven waaruit dat blijkt?* *- Heeft de sensor u iets opgeleverd? Zo ja, wat dan?* *-> Waarom wel? Waarom niet? Wanneer wel? Wanneer niet? Kunt u een voorbeeld geven waaruit dat blijkt?* *-> Wat kan voor u als COPD en HF patiënt een voordeel zijn?* *-> Waarom dan? Waarom niet? Wanneer wel? Wanneer niet? Kunt u een voorbeeld geven waaruit dat blijkt?* *-> Welke informatie van de sensor vond u nuttig? Welke informatie van de sensor vond u niet zinvol?* *-> Waarom wel? Waarom niet? Kunt u een voorbeeld geven waaruit dat blijkt?* *-> Wat was het effect van de sensor op uw klachten van COPD?* *-> Heeft de sensor u geholpen om uw medicatie beter te inhaleren?* *-> Waarom wel? Waarom niet? Kunt u een voorbeeld geven waaruit dat blijkt?* *-> Heeft de sensor u geholpen om meer controle te krijgen over uw klachten van COPD?* *-> Waarom wel? Waarom niet? Kunt u een voorbeeld geven waaruit dat blijkt?* *- Heeft u iets gemist bij de sensor? Zo ja, wat dan?* *- De sensor registreerde of de inhalator op tijd werd gebruikt en of de inhalatiemedicatie met de juiste techniek werd geïnhaleerd.* --- ➔ *Inhalator:* <u>Tabblad laten zien op tablet.</u> *- Wat vond u van het onderdeel inhalator?* *-> Wat vond u meevallen? Wat vond u tegenvallen?* *-> Wat vond u goed/nuttig? Wat vond u minder goed/minder nuttig?* *-> Waarom? Kunt u een voorbeeld geven waaruit dat blijkt?* *- Wat deed u zoal bij het onderdeel inhalator? Hoe heeft u het onderdeel inhalator gebruikt?* *-> Wanneer heeft u het onderdeel inhalator gebruikt? Wanneer heeft u het onderdeel inhalator niet gebruikt?* *-> Waarom wel? Waarom niet? Kunt u een voorbeeld geven waaruit dat blijkt?* *- Heeft het onderdeel inhalator u iets opgeleverd? Zo ja, wat dan?* *-> Waarom wel? Waarom niet? Wanneer wel? Wanneer niet? Kunt u een voorbeeld geven waaruit dat blijkt?* *-> Wat kan voor u als COPD en HF patiënt een voordeel zijn?* *-> Waarom dan? Waarom niet? Wanneer wel? Wanneer niet? Kunt u een voorbeeld geven waaruit dat blijkt?* *-> Welke informatie van het onderdeel inhalator vond u nuttig? Welke informatie van het onderdeel inhalator mag er volgens u uitgelaten worden?* *-> Waarom wel? Waarom niet? Kunt u een voorbeeld geven waaruit dat blijkt?* *-> Wat was het effect van het onderdeel inhalator op uw klachten van COPD?* *-> Heeft het onderdeel inhalator u geholpen om uw medicatie beter te inhaleren?* *-> Waarom wel? Waarom niet? Kunt u een voorbeeld geven waaruit dat blijkt?* *-> Heeft het onderdeel inhalator u geholpen om meer controle te krijgen over uw klachten van COPD?* *-> Waarom wel? Waarom niet? Kunt u een voorbeeld geven waaruit dat blijkt?* *- Heeft u iets gemist in het onderdeel inhalator? Zo ja, wat dan?*

	- Dit tabblad gaf een overzicht van wanneer de inhalator werd gebruikt in de afgelopen maand, of dat op tijd was en of de inhalatiemedicatie met de juiste techniek werd geïnhaleerd. *- We hebben denk ik de sensor en het onderdeel inhalator zo voldoende besproken.* *-> Heeft u hier nog iets aan toe te voegen?* --- ➔ <u>De andere tabbladen (informatie, oefenen, beweging) op de tablet laten zien.</u> *- Wat vond u van de andere onderdelen?* *-> Wat vond u meevallen? Wat vond u tegenvallen?* *-> Wat vond u goed/nuttig? Wat vond u minder goed/minder nuttig?* *-> Waarom? Kunt u een voorbeeld geven waaruit dat blijkt?* *- Wat deed u zoal bij de andere onderdelen? Hoe heeft u de andere onderdelen gebruikt?* *-> Wanneer heeft u de andere onderdelen gebruikt? Wanneer heeft u de andere onderdelen niet gebruikt?* *-> Waarom wel? Waarom niet? Kunt u een voorbeeld geven waaruit dat blijkt?* *- Welke onderdelen heeft u het meest gebruikt?* *-> Waarom? Kunt u een voorbeeld geven waaruit dat blijkt?* *- Welke onderdelen heeft u het minst gebruikt?* *-> Waarom? Kunt u een voorbeeld geven waaruit dat blijkt?* *- Zijn er onderdelen die u niet heeft gebruikt?* *-> Waarom wel? Waarom niet? Kunt u een voorbeeld geven waaruit dat blijkt?* *- Heeft u wel eens informatie teruggezocht op het tabblad informatie?* *-> Welke informatie was dat?* *-> Waarom die informatie? Waarom niet? Kunt u een voorbeeld geven waaruit dat blijkt?* *-> Heeft u wel eens teruggekeken naar de 'Wat is voor mij normaal' kaart?* *-> Waarom wel? Waarom niet? Kunt u een voorbeeld geven waaruit dat blijkt?* *-> Waar had u meer informatie over willen hebben?* *- Welke informatie of delen van het portaal op uw tablet in het algemeen (dus alle onderdelen bij elkaar) vond u nuttig? Welke informatie of delen van het portaal op uw tablet in het algemeen mogen er volgens u uitgelaten worden?* *-> Waarom wel? Waarom niet? Wanneer wel? Wanneer niet? Kunt u een voorbeeld geven waaruit dat blijkt?* *- Heeft u iets gemist in het portaal op uw tablet? Zo ja, wat dan?* *- We hebben denk ik de andere onderdelen en het portaal op uw tablet in het algemeen zo voldoende besproken.* *-> Heeft u hier nog iets aan toe te voegen?* --- • *Ondersteuning van de digitale persoon (Sylvia), zorgverleners en mantelzorgers.* ➔ *Sylvia:* <u>Sylvia laten zien op tablet.</u> *- Wat vond u van Sylvia?* *-> Wat vond u meevallen? Wat vond u tegenvallen?* *-> Wat vond u goed/nuttig? Wat vond u minder goed/minder nuttig?* *-> Waarom? Kunt u een voorbeeld geven waaruit dat blijkt?* *-> Wat vond u van de persoonlijkheid van Sylvia? Hoe kwam Sylvia op u over?* *-> Vond u dat Sylvia het portaal persoonlijker maakte? Bijvoorbeeld, vond u dat het portaal meer op u gericht werd doordat Sylvia er was?* *-> Waarom wel? Waarom niet? Kunt u een voorbeeld geven waaruit dat blijkt?* *- Wat vond u ervan om adviezen van een digitaal persoon te ontvangen?* *-> Heeft u de adviezen van Sylvia opgevolgd? Zo ja, welke dan?* *-> Waarom wel? Waarom niet? Kunt u een voorbeeld geven waaruit dat blijkt?* *-> Wat vond u van de herinneringen aan taken? Heeft u daar iets mee gedaan? Hoe vaak per dag kwam er een herinnering aan taken? Wat vond u daarvan? Was dat teveel? Was dat te weinig? Wanneer heeft u de adviezen over uw herinnering aan taken opgevolgd? Wanneer heeft u de adviezen over uw herinnering aan taken niet opgevolgd?*

-> Wat vond u van de adviezen over uw inhalatie van medicatie? Heeft u daar iets mee gedaan? Hoe vaak per dag kwam een advies over uw inhalatie van medicatie op? Wat vond u daarvan? Was dat te veel? Was dat te weinig? Wanneer heeft u de adviezen over uw inhalatie van medicatie opgevolgd? Wanneer heeft u de adviezen over uw inhalatie van medicatie niet opgevolgd?
-> Wat vond u van de tip van de dag? Voorbeeld geven met tablet (zie alle tips van de dag in galerij)
Heeft u daar iets mee gedaan? Wat vond u ervan hoe vaak de tip van de dag opkwam? Was dat te veel? Was dat te weinig? Wanneer heeft u de tip van de dag opgevolgd? Wanneer heeft u de tip van de dag niet opgevolgd?

- Op welke manier heeft u gebruik gemaakt van Sylvia?
-> Heeft u met Sylvia gepraat over haar leven?
-> Waarom wel? Waarom niet? Kunt u een voorbeeld geven waaruit dat blijkt?
-> Wat vond u van het praten met Sylvia over haar leven? Hoe vaak per dag kwam dat op? Wat vond u daarvan? Was dat teveel? Was dat te weinig?
-> Wanneer heeft u met Sylvia gepraat over haar leven? Wanneer heeft u niet met Sylvia gepraat over haar leven?
-> Waarom wel? Waarom niet? Kunt u een voorbeeld geven waaruit dat blijkt?

- Heeft Sylvia u iets opgeleverd? Zo ja, wat dan?
-> Waarom wel? Waarom niet? Wanneer wel? Wanneer niet? Kunt u een voorbeeld geven waaruit dat blijkt?
-> Wat kan voor u als COPD en HF patiënt een voordeel zijn?
-> Waarom dan? Waarom niet? Wanneer wel? Wanneer niet? Kunt u een voorbeeld geven waaruit dat blijkt?
-> Welke informatie van Sylvia vond u nuttig? Welke informatie van Sylvia mag er volgens u uitgelaten worden?
-> Waarom wel? Waarom niet? Kunt u een voorbeeld geven waaruit dat blijkt?
-> Hebben de adviezen over uw inhalatie van medicatie u iets opgeleverd? Zo ja, wat dan? Vind u de herinneringen aan taken nuttig? Hebben de tips van de dag u iets opgeleverd? Zo ja, wat dan? Vind u het praten met Sylvia over haar leven nuttig?
-> Waarom wel? Waarom niet? Kunt u een voorbeeld geven waaruit dat blijkt?

- Heeft u iets gemist bij Sylvia? Zo ja, wat dan?

- Sylvia is de digitale persoon in het digitale portaal die u adviezen gaf over uw inhalatie van medicatie, die herinneringen aan taken gaf, die een tip van de dag gaf en met wie u kon praten over Sylvia haar leven.

- We hebben denk ik Sylvia zo voldoende besproken.
-> Heeft u hier nog iets aan toe te voegen?

➔ *Zorgverleners (ofwel case managers): 2 verpleegkundig specialisten COPD en HF gaven de zelfmanagementbijeenkomsten en hielpen u wanneer nodig om meer controle te krijgen over uw klachten van COPD en HF.*

- Wat vond u van de ondersteuning door de zorgverleners?
-> Wat vond u meevallen? Wat vond u tegenvallen?
-> Wat vond u goed/nuttig? Wat vond u minder goed/minder nuttig?
-> Waarom? Kunt u een voorbeeld geven waaruit dat blijkt?

- Hoe hebben de zorgverleners u ondersteunt?
-> Wanneer kreeg u ondersteuning van de zorgverleners? Wanneer kreeg u geen ondersteuning van de zorgverleners?
-> Waarom wel? Waarom niet? Kunt u een voorbeeld geven waaruit dat blijkt?
-> Hoe vaak had u contact met de zorgverleners tijdens het MATCH project? Wat vond u daarvan? Was dat teveel? Was dat te weinig?
-> Wat deden de zorgverleners voor u? Hadden ze nog meer voor u kunnen doen? Zo ja, wat dan?
-> Waarom wel? Waarom niet? Wanneer wel? Wanneer niet? Kunt u een voorbeeld geven waaruit dat blijkt?

- Heeft de ondersteuning van de zorgverleners u iets opgeleverd? Zo ja, wat dan?
-> Waarom wel? Waarom niet? Wanneer wel? Wanneer niet? Kunt u een voorbeeld geven waaruit dat blijkt?
-> Wat kan voor u als COPD en HF patiënt een voordeel zijn?
-> Waarom dan? Waarom niet? Wanneer wel? Wanneer niet? Kunt u een voorbeeld geven waaruit dat blijkt?
-> Wanneer heeft de ondersteuning van de zorgverleners u wat opgeleverd? Wanneer heeft de ondersteuning van de zorgverleners u niets opgeleverd?
-> Waarom wel? Waarom niet? Kunt u een voorbeeld geven waaruit dat blijkt?

	- Heeft u iets gemist bij de ondersteuning van de zorgverleners? Zo ja, wat dan? *- We hebben denk ik de ondersteuning van de zorgverleners zo voldoende besproken.* *-> Heeft u hier nog iets aan toe te voegen?* --- ➔ *Mantelzorgers: uw naasten (partner, familielid, vriend) die u mogelijk geholpen hebben tijdens het MATCH project voor COPD en HF. Een mantelzorger helpt u niet voor zijn of haar beroep.* *- Heeft u hulp gekregen van uw naasten tijdens het MATCH project voor COPD en HF?* *Zo nee,* *- Denkt u dat hulp van naasten nodig is tijdens het MATCH project voor COPD en HF?* *-> Waarom wel? Waarom niet? Kunt u een voorbeeld geven waaruit dat blijkt?* *- Wat zou u van de ondersteuning door uw naasten vinden denkt u?* *-> Wat zou u vinden meevallen? Wat zou u vinden tegenvallen?* *-> Wat zou u goed/nuttig vinden? Wat zou u minder goed/minder nuttig vinden?* *-> Waarom? Kunt u een voorbeeld geven waaruit dat blijkt?* *- Hoe zou u dan ondersteunt willen worden door uw naasten?* *-> Wanneer zou u ondersteuning van uw naasten nodig hebben? Wanneer zou u geen ondersteuning van uw naasten nodig hebben?* *-> Waarom wel? Waarom niet? Kunt u een voorbeeld geven waaruit dat blijkt?* *-> Hoe vaak zouden uw naasten u tijdens het MATCH project ondersteunen denkt u?* *-> Zou u veel zelf doen? Of zou u juist veel hulp nodig hebben? Wat denkt u dat uw naasten voor u zouden kunnen doen?* *-> Waarom? Kunt u een voorbeeld geven waaruit dat blijkt?* *- Zou de ondersteuning van uw naasten u iets opleveren denkt u? Zo ja, wat dan?* *-> Waarom wel? Waarom niet? Wanneer wel? Wanneer niet? Kunt u een voorbeeld geven waaruit dat blijkt?* *-> Wat zou voor u als COPD en HF patiënt een voordeel zijn denkt u?* *-> Waarom dan? Waarom niet? Wanneer wel? Wanneer niet? Kunt u een voorbeeld geven waaruit dat blijkt?* *-> Wanneer zou u de ondersteuning door uw naasten nuttig vinden? Wanneer zou de ondersteuning van uw naasten u niets opleveren?* *-> Waarom wel? Waarom niet? Kunt u een voorbeeld geven waaruit dat blijkt?* *- Uw naasten zouden u misschien kunnen helpen om meer controle te krijgen over uw klachten van COPD en HF.* --- *Zo ja,* *- Wat vond u van de ondersteuning door uw naasten?* *-> Wat vond u meevallen? Wat vond u tegenvallen?* *-> Wat vond u goed/nuttig? Wat vond u minder goed/minder nuttig?* *-> Waarom? Kunt u een voorbeeld geven waaruit dat blijkt?* *- Hoe hebben uw naasten u ondersteunt?* *-> Wanneer kreeg u ondersteuning van uw naasten? Wanneer kreeg u geen ondersteuning van uw naasten?* *-> Waarom wel? Waarom niet? Kunt u een voorbeeld geven waaruit dat blijkt?* *-> Hoe vaak ondersteunde uw naasten u tijdens het MATCH project?* *-> Wat vond u daarvan? Was dat teveel? Was dat te weinig?* *-> Deed u veel zelf? Of kreeg u juist veel hulp? Wat deden uw naasten voor u? Hadden uw naasten nog meer voor u kunnen doen? Zo ja, wat dan?* *-> Waarom wel? Waarom niet? Wanneer wel? Wanneer niet? Kunt u een voorbeeld geven waaruit dat blijkt?* *- Heeft de ondersteuning van uw naasten u iets opgeleverd? Zo ja, wat dan?* *-> Waarom wel? Waarom niet? Wanneer wel? Wanneer niet? Kunt u een voorbeeld geven waaruit dat blijkt?* *-> Wat kan voor u als COPD en HF patiënt een voordeel zijn?* *-> Waarom dan? Waarom niet? Wanneer wel? Wanneer niet? Kunt u een voorbeeld geven waaruit dat blijkt?* *-> Wanneer vond u de ondersteuning van uw naasten nuttig? Wanneer heeft de ondersteuning van uw naasten u niets opgeleverd?* *-> Waarom wel? Waarom niet? Kunt u een voorbeeld geven waaruit dat blijkt?*

	- Heeft u iets gemist in de ondersteuning van uw naasten? Zo ja, wat dan? *- Uw naasten hebben u misschien geholpen om meer controle te krijgen over uw klachten van COPD en HF.* *- We hebben denk ik de ondersteuning door uw naasten zo voldoende besproken.* *-> Heeft u hier nog iets aan toe te voegen?*
	<u>Effect van het MATCH project voor COPD en HF in het algemeen (dus de training, het portaal en de ondersteuning, alles bij elkaar) op de doelen</u> *- Wij als onderzoekers vragen ons af wat het MATCH project voor COPD en HF u heeft opgeleverd voor uw klachten van COPD en HF. Daar gaan we nu dieper op in.* *- Ik wil het apart hebben over uw COPD en HF.* ➔ *Over uw COPD* *- Heeft het MATCH project voor COPD en HF in het algemeen (dus de training, het portaal en de ondersteuning, alles bij elkaar) u iets opgeleverd voor uw klachten van COPD? Zo ja, wat dan?* *-> Waarom wel? Waarom niet? Wanneer wel? Wanneer niet? Kunt u een voorbeeld geven waaruit dat blijkt?* *-> Wanneer vond u het MATCH project voor COPD en HF nuttig voor uw klachten van COPD? Wanneer heeft het MATCH project voor COPD en HF u niets opgeleverd voor uw klachten van COPD?* *-> Waarom wel? Waarom niet? Wanneer wel? Wanneer niet? Kunt u een voorbeeld geven waaruit dat blijkt?* *-> Welke tips heeft u om dit te verbeteren?* *- Heeft uw deelname aan het MATCH project u iets opgeleverd voor uw COPD? Zo ja, wat dan?* *-> Waarom wel? Waarom niet? Wanneer wel? Wanneer niet? Kunt u een voorbeeld geven waaruit dat blijkt?* *-> Wat kan voor u als COPD patiënt een voordeel zijn?* *-> Waarom dan? Waarom niet? Wanneer wel? Wanneer niet? Kunt u een voorbeeld geven waaruit dat blijkt?* *-> Welke tips heeft u om dit te verbeteren?* *- Bent u nu beter in staat om uw klachten van COPD te herkennen? Herkent u uw klachten van COPD eerder?* *-> Waarom wel? Waarom niet? Kunt u een voorbeeld geven waaruit dat blijkt?* *- Bent u nu beter in staat om uw klachten van COPD zelf te behandelen?* *-> Waarom wel? Waarom niet? Kunt u een voorbeeld geven waaruit dat blijkt? Kunt u vertellen waarom u wel of niet zelfbehandeling kon uitvoeren?* *-> Bent u ook ooit zelf een behandeling gestart thuis voor uw klachten van COPD? (Want je mocht zelf starten met bijvoorbeeld een kuur prednisolon)* *-> Waarom wel? Waarom niet? Kunt u een voorbeeld geven waaruit dat blijkt?* *-> Heeft u dat zelf gedaan of zorgverleners?* *-> Waarom is dat zo gegaan? Kunt u een voorbeeld geven waaruit dat blijkt?* *-> Hoe hadden we dat anders voor u kunnen doen?* --- ➔ *Over uw HF* *- Heeft het MATCH project voor COPD en HF in het algemeen (dus de training, het portaal en de ondersteuning, alles bij elkaar) u iets opgeleverd voor uw klachten van HF? Zo ja, wat dan?* *-> Waarom wel? Waarom niet? Wanneer wel? Wanneer niet? Kunt u een voorbeeld geven waaruit dat blijkt?* *-> Wanneer vond u het MATCH project voor COPD en HF nuttig voor uw klachten van HF? Wanneer heeft het MATCH project voor COPD en HF u niets opgeleverd voor uw klachten van HF?* *-> Waarom wel? Waarom niet? Wanneer wel? Wanneer niet? Kunt u een voorbeeld geven waaruit dat blijkt?* *-> Welke tips heeft u om dit te verbeteren?* *- Heeft uw deelname aan het MATCH project u iets opgeleverd voor uw HF? Zo ja, wat dan?* *-> Waarom wel? Waarom niet? Wanneer wel? Wanneer niet? Kunt u een voorbeeld geven waaruit dat blijkt?* *-> Wat kan voor u als HF patiënt een voordeel zijn?* *-> Waarom dan? Waarom niet? Wanneer wel? Wanneer niet? Kunt u een voorbeeld geven waaruit dat blijkt?* *-> Welke tips heeft u om dit te verbeteren?* *- Bent u nu beter in staat om uw klachten van HF te herkennen? Herkent u uw klachten van HF eerder?* *-> Waarom wel? Waarom niet? Kunt u een voorbeeld geven waaruit dat blijkt?* *- Bent u nu beter in staat om uw klachten van HF zelf te behandelen?*

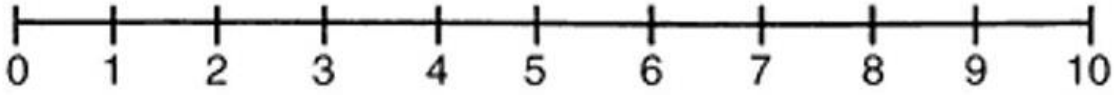
-> Waarom wel? Waarom niet? Kunt u een voorbeeld geven waaruit dat blijkt? Kunt u vertellen waarom u wel of niet zelfbehandeling kon uitvoeren?
-> Bent u ook ooit zelf een behandeling gestart thuis voor uw klachten van HF? (Want je mocht zelf starten met bijvoorbeeld plastabletten)
-> Waarom wel? Waarom niet? Kunt u een voorbeeld geven waaruit dat blijkt?
-> Heeft u dat zelf gedaan of zorgverleners?
-> Waarom is dat zo gegaan? Kunt u een voorbeeld geven waaruit dat blijkt?
-> Hoe hadden we dat anders voor u kunnen doen?

- We hebben denk ik het effect van het MATCH project voor uw COPD en HF zo voldoende besproken.
-> Heeft u hier nog iets aan toe te voegen?

➔ *Algemene verbeterpunten*

- Wat zou u als rapportcijfer geven voor het MATCH project voor COPD en HF op een schaal van 0 tot 10? Waarbij 0 betekent 'Het heeft helemaal niets opgeleverd voor u' en 10 betekent 'Het heeft extreem veel opgeleverd voor u'.

<u>Cijfer noteren</u>



Helemaal niets opgeleverd voor u — **Neutraal** — **Extreem veel opgeleverd voor u**

-> Waarom dit cijfer? Kunt u een voorbeeld geven waaruit dat blijkt?
-> Hoe zou het voor u een hoger cijfer, bijvoorbeeld een.. kunnen worden? Hoe zou het MATCH project voor COPD en HF zoals u het <u>nu</u> heeft gebruikt beter kunnen worden voor u?
-> Wat had u anders willen zien?

- Heeft u iets gemist in het MATCH project voor COPD en HF? Zo ja, wat dan?

- Zou u anderen met COPD en HF het MATCH project voor COPD en HF aanraden?
-> Waarom wel? Waarom niet? Kunt u een voorbeeld geven waaruit dat blijkt?

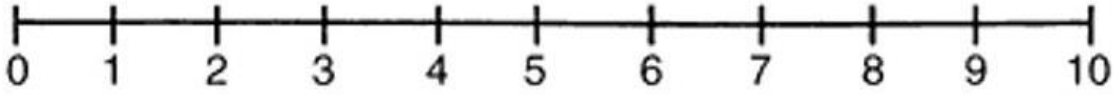
- Zou u voor een langere tijd deelnemen aan het MATCH project voor COPD en HF?
-> Waarom wel? Waarom niet? Kunt u een voorbeeld geven waaruit dat blijkt?

- Als u nog een keer zou deelnemen aan het MATCH project voor COPD en HF.
-> Welke onderdelen wilt u dan opnieuw gebruiken? Welke onderdelen wilt u niet opnieuw gebruiken?
-> Waarom wel? Waarom niet? Kunt u een voorbeeld geven waaruit dat blijkt?
-> Welke onderdelen van het MATCH project zijn goed? Welke onderdelen ontbreken aan het MATCH project?

- Welke verbeterpunten heeft u voor het MATCH project voor COPD en HF in het algemeen?

- Wat zou u als rapportcijfer geven voor het portaal op de tablet op een schaal van 0 tot 10? Waarbij 0 betekent 'Het heeft helemaal niets opgeleverd voor u' en 10 betekent 'Het heeft extreem veel opgeleverd voor u'.

<u>Cijfer noteren</u>

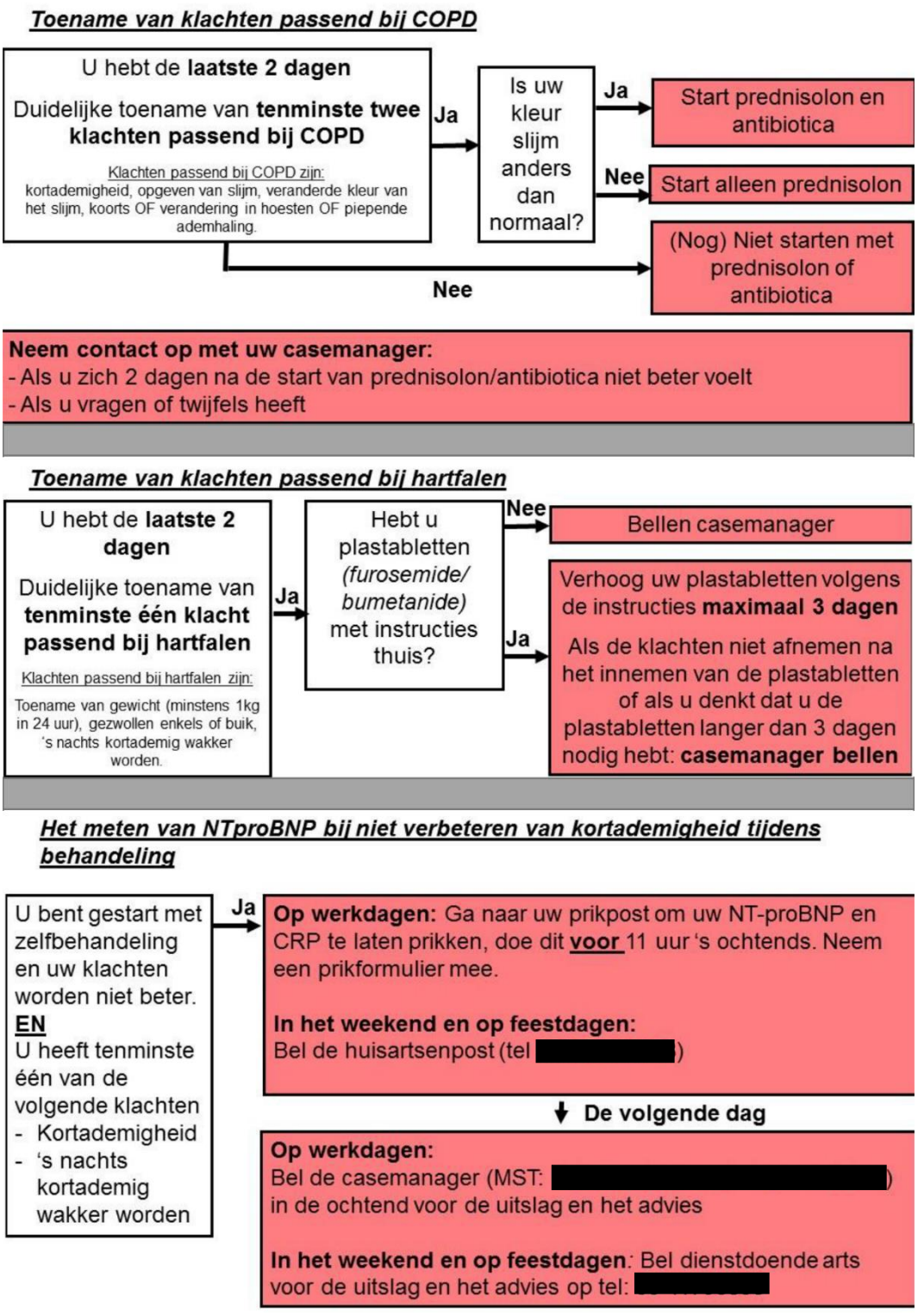


Helemaal niets opgeleverd voor u — **Neutraal** — **Extreem veel opgeleverd voor u**

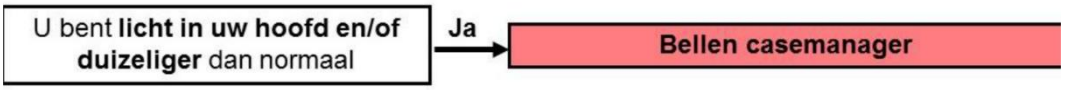
-> Waarom dit cijfer? Kunt u een voorbeeld geven waaruit dat blijkt?
-> Hoe zou het voor u een hoger cijfer, bijvoorbeeld een.. kunnen worden? Hoe zou het portaal op de tablet zoals u het <u>nu</u> heeft gebruikt beter kunnen worden voor u?

	-> Wat had u anders willen zien? *- Heeft u iets gemist in het MATCH project voor COPD en HF? Zo ja, wat dan?* *- Zou u anderen met COPD en HF het MATCH portaal op de tablet aanraden?* *-> Waarom wel? Waarom niet? Kunt u een voorbeeld geven waaruit dat blijkt?* *- Zou u voor een langere tijd het MATCH portaal op de tablet gebruiken?* *-> Waarom wel? Waarom niet? Kunt u een voorbeeld geven waaruit dat blijkt?* *- Als u nog een keer het portaal op de tablet zou gebruiken.* *-> Welke onderdelen wilt u dan opnieuw gebruiken? Welke onderdelen wilt u dan niet opnieuw gebruiken?* *-> Waarom wel? Waarom niet? Kunt u een voorbeeld geven waaruit dat blijkt?* *-> Welke onderdelen van het portaal op de tablet zijn goed? Welke onderdelen ontbreken aan het portaal op de tablet?* *- Welke verbeterpunten heeft u voor het portaal op de tablet in het algemeen?* *- We hebben denk ik de verbeterpunten voor het MATCH project voor COPD en HF en voor het portaal op de tablet zo voldoende besproken.* *-> Heeft u hier nog iets aan toe te voegen?*
Slot	*- Ik zou nu het interview willen afronden.* *- Heeft u verder nog iets op te merken of te vragen?* *- Bedankt voor uw tijd.* <u>Uitschakelen opnameapparatuur</u> *- Heeft u nog tips wat ik de volgende keer beter kan doen?* *- Waren de vragen helder voor u?* *- Als de resultaten van het onderzoek bekend zijn, brengen we u op de hoogte.* <u>Formulier parkeer- en reiskostenvergoeding samen invullen & ondertekenen (als interview in ziekenhuis)</u> <u>Geven 2e ondertekend exemplaar van informed consent aan participant</u> <u>Patiënt uitritkaart krijgen van secretaresse als interview in ZGT</u> <u>Geluidsopname en verdere gegevens anoniem maken & opslaan op eigen laptop</u>

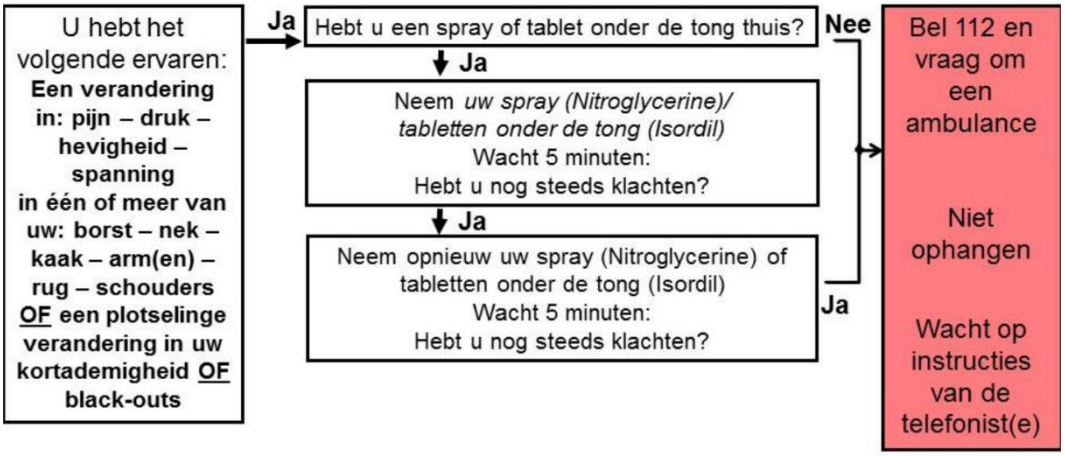
Appendix 3: Action plan included in the MATCH study



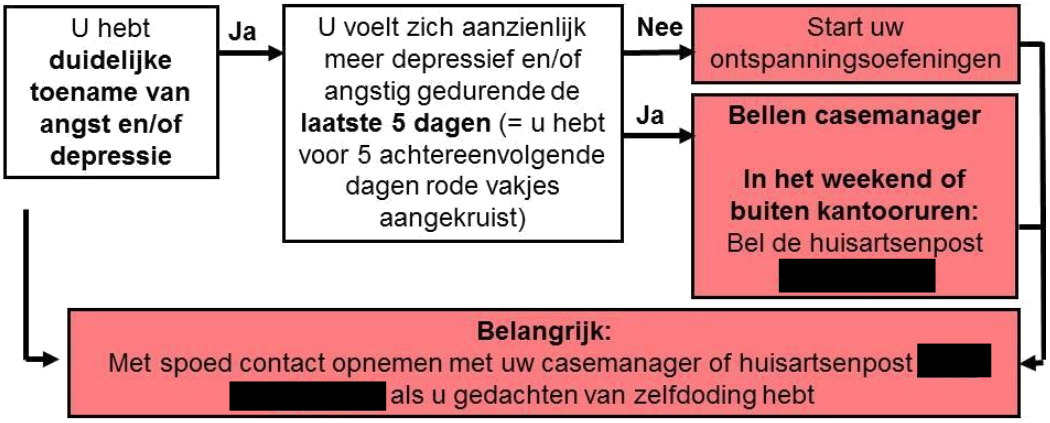
Licht in het hoofd en/of duizeliger dan normaal



Acute hartklachten



Toename van angst en/of depressie



En tot slot:

Onthoud: u kunt altijd contact opnemen met uw casemanager als u twijfels of vragen heeft én wanneer u:

- 2 dagen achter elkaar **duidelijk kortademiger bent dan normaal,** zonder dat u andere klachten hebt
- zich 2 dagen na de start van prednisolon/antibiotica niet beter voelt
- minstens **2 dagen op een rij koorts** (meer dan 38,5°C) hebt gehad, maar **géén** rode vakjes voor andere klachten hebt aangekruist

In het weekend of buiten kantooruren:

- bel de huisartsenpost [redacted]
- geef aan dat u deelneemt aan de MATCH studie

Acknowledgements

Via this way I thank all patients and healthcare providers who participated in the one-to-one in-depth individual semi-structured interviews for investing their time, effort and sharing their perceptions towards positive aspects, negative aspects and points for improvement of the MATCH self-management intervention. I also acknowledge all healthcare centres for recruiting patients. Furthermore, I thank Anke Lenferink, PhD, Stans Drossaert, PhD and Joanne Sloots, MSc who supervised me during my research process and my development as professional. Finally, I thank the researchers from the Pulmonary department of the Medisch Spectrum Twente (MST) in Enschede for the way they supported me.