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Abstract

This document describes the initial user requirements elicitation activities in the Council of Coaches project, consisting of (I) a long-term qualitative diary study on health information behaviour, targeting the main target audience of older adults, people with chronic pain or diabetes mellitus type 2, (II) additional studies that aim to test core hypothesis related to multi-party coaching interaction, and (III) a summary and expert-based prioritization of requirements originating from those studies.

Corrections

v1.0.1 Correctly applied EU logo on header page.

v2.0.0 This version of the deliverable was updated as a response to the project's first periodic review in April of 2019. The following changes were made:

- In the introduction of this deliverable (section 1), a table is inserted which provides an overview of each study that is described in this document. The table shows for each study the following aspects: study name, method, setting, sample size, the number of participants per age group (< 55 vs > 55 years) and the number of participants that have a chronic health condition.
- Subdivided the document in three parts: (A) longitudinal diary study for user requirements elicitation (HIB), (B) overview of additional studies for eliciting user requirements, and (C) a description of the outcomes, in which the process of prioritizing the user requirements is explained and the complete overview of all user requirements is given.
- A structured abstract has been written for each study, using the following sections: Background, Method, Results, Discussion.
- We restructured the descriptions of each study, using the following sections: Abstract, Introduction, Methods, Results, Discussion.
- Version 1.0.1 contained preliminary results of the Health Information Behaviour (HIB) study. Deliverable D2.5 included the full results. We have removed the results of the HIB study from D2.5 and added the results in this updated version of D2.3 to improve readability.
- Added Abstract for the HIB study (section 3.1)
- Terminology: patient journey → health journey
- Terminology: patients → people
- This document now uses the new, updated deliverable template format.

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Symbols, abbreviations and acronyms

ARI	Age Related Impairments
CMC	Centre for Monitoring and Coaching
CP	Chronic Pain
COUCH	Council of Coaches
D	Deliverable
DBT	Danish Board of Technology Foundation
DM2	Diabetes Mellitus Type-2
EC	European Commission
HIB	Health Information Behaviour
ISPRINT	Innovation Sprint
M	Month
MS	Milestone
RRD	Roessingh Research and Development
SU	Sorbonne University
UDun	University of Dundee
UPV	Universitat Politècnica de València
UT	University of Twente
WP	Work Package

1 Introduction

This document describes the coming about of the initial user requirements for the Council of Coaches, and includes the list of these requirements. This document describes a longitudinal study in which potential end-users of the Council of Coaches system were followed in their daily lives. Additionally, two studies were performed to gain necessary insights in specific to-be developed features of the system.

Multiple group sessions with the project team were held to determine the focus of the system development during the design process and to prioritize the requirements originating from these studies.

This document is subdivided in three main parts:

Part A: End-user requirements – describes the main end-user involvement study for the elicitation of user requirements. This is the Health Information Behaviour (HIB) study, in which 24 participants with chronic health conditions (older adults, people with chronic pain, people with diabetes type 2) were followed for four weeks.

Part B: Additional studies – describes two studies that were conducted for additional user requirement elicitation: (1) an online experiment of the persuasiveness of virtual agents, conducted by Sorbonne University, and (2) a role-playing video study on health-related conversations with multiple health professionals, conducted by the University of Dundee.

Part C: Outcomes – describes an internal process of prioritizing the focus of the system development by group discussions with representatives of each project partner. The outcomes of this process are higher-level requirements to generate the necessary technology push.

An overview of all the studies that are described in this document is provided in Table 1 below.

Table 1: Overview of studies described in D2.3: Name, method, setting, N, number of participants younger and older than 55 years, number of participants that have a chronic health condition.

Study	Method	Setting	N	Participants <54	Participants >55	Participants with health conditions (DM-II, CP)
Health Information Behaviour (HIB) Study	Qualitative online diary study (four weeks)	Daily Life	24	9	15	24
Patient Consultation Corpus	Corpus Creation & Annotation	Lab Setting	N/A	N/A	N/A	N/A
Virtual Agent Persuasion Study	Quantitative, Online Experiment	Online	209	178	31	-
Totals			233	187	46	24

Together, these studies have resulted in a list of initial requirements (provided in Section 7). These requirements follow the formatting as discussed in (Van Velsen, Wentzel, & Van Gemert-Pijnen, 2013). They are classified according to the FICS classification (Benyon & Macaulay, 2002), which stands for Functions & Events, Interactions & Usability, Content & Structure, and Style & Aesthetics. Requirements are prioritized using the MoSCoW method, whereby requirements are classified as must-haves, should-haves, could-haves, and won't-haves.

The results and requirements that are derived from these studies serves as the basis for the technological development, done in WP3, WP4, WP5 and WP6, and integrated in WP7. As the title of this deliverable implies, this set of requirements is merely the *initial* set. These requirements will be refined in three rounds of prototyping and end-user evaluations to be reported in D2.4, D2.5 and D2.6 respectively. The list of requirements should therefore not be seen as the result of a one-time exercise. Rather, it is a living document that can be expanded, shortened or modified. In close collaboration with the technological partners, it should be decided which requirements will be dealt with first, and which ones later on. Then, continuous evaluation cycles will have to focus on these requirements: were they implemented well? Do end-users understand and appreciate them? This feedback should then cycle back in the requirements document.

2 Objectives

The objectives of this deliverable are as follows:

- To create an inventory of end-users' needs, wishes and context, so that we can formulate a service model, functional requirements, and non-functional requirements;
- To establish a shared repository of requirements for the Council of Coaches project;
- To create an inventory of the technological challenges and goals for the Council of Coaches project.



Part A: End-user requirements

1. Health Information Behaviour (HIB) study: a longitudinal diary study (four weeks) among people with chronic pain, diabetes mellitus type 2 and (pre-)frail older adults

3 Health Information Behaviour (HIB) study

3.1 Abstract

Background: The Council of Coaches system is intended to support older adults in living a healthy lifestyle. To improve the fit between the user and the system, it is essential that we understand how the health of older adults progresses over time and where and when in their daily lives health-related questions and situations occur. In addition, we should not solely focus on active health information behaviour (HIB), but also passive encounter and active avoidance of health information. These two forms of HIB have so far received little attention in literature, but are essential in understanding the channels through which people find health information and consequently base their health decisions upon as well as gaining an understanding in the barriers that people have in relation to their health.

Methods: We conducted a longitudinal diary study for four weeks in three countries among three end-user groups. In the Netherlands people with chronic pain (CP) were recruited, in Denmark older adults with age-related impairments (ARI) were recruited and in Scotland people with diabetes mellitus type 2 (DM2) were recruited. Every day, participants filled out an online diary form. Before the diary study commenced, a workshop was done to map their individual health journey. After the four weeks ended, a second workshop was held to discuss their experiences and to validate a general health journey per end-user group, which was based on the individual ones.

Results: A total of 24 people participated (7 ARI, 5 CP, 12 DM2), with a combined total of 314 diary forms (92 active HIB, 151 passive HIB, and 71 avoidant HIB). The internet and conversations with other people were the most used sources. ARI participants mostly talked to health professionals for health-related questions, while CP and DM2 people talked more to family members or friends. Experiencing a health issue or symptoms was the most common cause for people to engage in active HIB. All participants mentioned they would like a mental coach. People with DM2 and ARI also expressed the need for a physical activity and diet coach. People with CP mentioned they preferred a pain expert coach.

Discussion: This study shows the different ways in which people with chronic health conditions search for, encounter or avoid health information in various facets of their daily lives. These results were used to elicit user requirements for development of the system. In addition, health journeys were designed and validated that can provide a basis for Council of Coaches on how to support people over a longer period of time.

3.2 Introduction

To make the Council of Coaches technology applicable in the daily life of patients and older adults, insights are needed on what health information needs these target audiences have, and how they currently behave regarding their health outside of treatment programmes. An important aspect of the requirements engineering stage for the Council of Coaches project will therefore be devoted to identifying health information needs and behaviour in the daily lives of chronic illness patients and patients with age-related health conditions. These insights will be translated into functional and non-functional requirements for the technology.

3.2.1 Health information needs

Much of the research on health information needs focus on *which* health-related topics people search for and *where* they search for this information. There are many studies that provide elaborate lists of the different themes people want to know more about. The internet is both a well appreciated tool and a source to fulfil such needs. For example, research on health information needs among patients with breast cancer includes needs such as self-management, treatment information, drug information, receiving emotional support, and the ability to discuss experiences (Holmes, Bishop, & Calman, 2017). A literature review of (Zhao & Zhang, 2017) on online information seeking studies listed the topics that patients search for on the web. This illustrates how different patient groups employ information search strategies on different topics. Whereas diabetes patients search for information on causes, signs and symptoms, educational resources, diet and lifestyle, obesity patients are more interested in products, weight loss programs and self-support.

Many of these studies only focus on information gaps by listing the topics people search for, while neglecting the actual needs that underlie them. Information needs arise when people notice their current knowledge is not sufficient to answer a question or achieve a goal. This goal is not always a knowledge gap, question or problem they want to solve, but could simply be the desire to make more sense of a situation, such as anxiety reduction, assurance or more stimulation (Case, 2012).

The work in (Xie, 2009) aims to explain different health information needs by proposing a continuum of health participation that ranges between wanting basic information to being involved in decision making and treatment plans. This study identifies four types of health needs:

1. Basic information, knowing what to expect;
2. Detailed information, comprehending and monitoring health progress;
3. Complementary information, for example on lifestyle;
4. Provide information, for making decisions and selecting treatment options.

This framework tries to explain the differences in health needs between patients, but does not consider situational aspects. It could be that in some situations people prefer basic information, but in other situations they want to be more involved. More insights on this matter is necessary so eHealth technology can be more attuned to the personal *and* situation-specific needs of individuals.

3.2.2 Health information behaviour

After identifying the information needs, an individual decides on his/her information behaviour strategy:

- 1) to actively seek information;
- 2) to passively seek information; or
- 3) to purposively decide not to seek information, e.g. avoidance (Case, 2012).

The first type of information behaviour strategy is straightforward; an individual will start searching to fulfil a certain goal (active search), or he has some basic knowledge on that topic and wants to know more about it (ongoing search). Actions include visiting websites, reading a book or talking with authorities. The second strategy means the individual does not start searching, but s/he hears or sees information unintentionally (passive attention) or is searching for another goal and in that process encounters the necessary information s/he earlier wanted (passive search) (Wilson, 1997). Finally, an individual can decide not to search for information, for example because of certain barriers and therefore avoids this topic (Sairanen & Savolainen, 2010). These barriers could be personal (i.e. cost-reward, level of trust in technology), social (i.e. presence of others), or environmental (i.e. geography, culture) (Wilson, 1997).

As previously seen in the research on health information needs and behaviour, most studies look at the active search processes people launch. The authors in (Price, Pak, Müller, Stronge, & Breedlove, 2009) sought insight on health information seeking behaviours by conducting a two-week diary study. Participants made entries in their diaries when they had a question or concern regarding their health. Passive search strategies, such as accidentally discovering information, were not included. A diary study that did address both active and passive information searches, was the research of Van Velsen et al. (2012). This study assessed citizens use of mass media during the EHEC outbreak in 2011. Interestingly, participants made a total of 239 passive information search diary entries compared to 24 active information seeking diary entries. Further, the topics between passive and active diary entries were sometimes quite different. Where passive information searches covered themes such as prevention, presence of the bacteria and number of deaths and infections, active information searches consisted of questions like *'What is the current situation on EHEC like?'*, *'How can one be infected with EHEC?'*, *'Is [vegetable] infected with EHEC?'*, and *'Is the EHEC outbreak a result of a terrorist strike?'* (Van Velsen et al., 2012, p9). These differences in frequencies and topics emphasize the importance of studying all types of information behaviour within the situational context. This would hopefully also uncover interaction effects, for example when an individual hears a news item on the radio (passive) and individual searches for more information on this topic (active).

3.2.3 Models of information behaviour

There are many models that explain information behaviour. Among these models, the most well-known are the Information Behaviour Model of Wilson (1997) and the Information Search Process model of Kuhltau (1993). The former is a more functional model of the different steps taken by an individual towards the behaviour, whereas the latter is a more holistic approach on how thoughts, feelings and actions can initiate search processes that start from vague ideas toward concrete focal points. This model also explains the stages after a certain information behaviour, such as satisfaction and the effect

on their feelings, thoughts and actions. Below, in Figure 1 below, the Information Behaviour Model of Wilson (1997) can be seen.

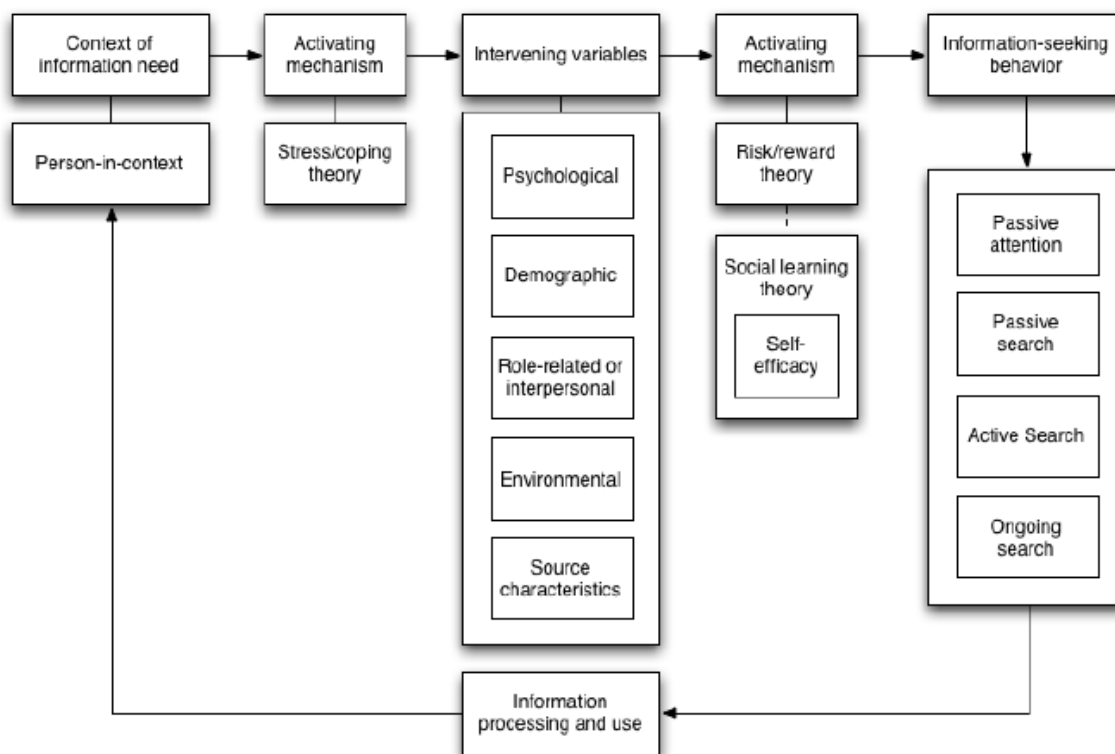


Figure 1: Information Behaviour Model of Wilson (1997).

The model considers the context in which a need arises and it incorporates different types of behaviour (both active and passive). The Information Processing Model (Kuhltau, 1993) (see Figure 2) differs from Wilson's model since it is more focussed on the cognitive and emotional aspects of information behaviour. It argues that most information queries start from a state of uncertainty, which we want to resolve. To do this, we go through several phases in which the information we search becomes more specific with each step.

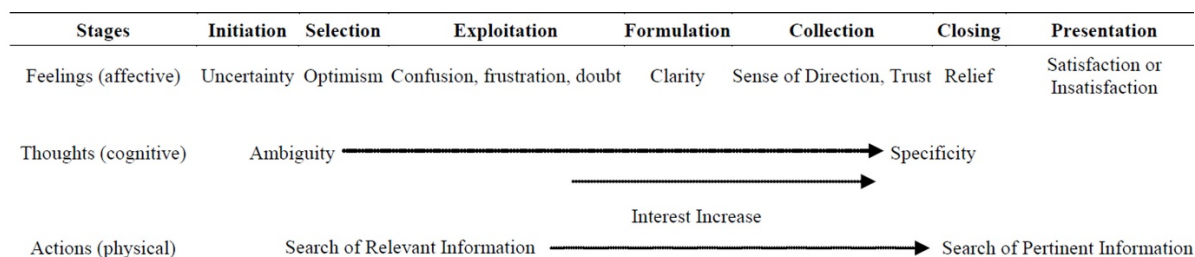


Figure 2: Information Processing Model of Kuhltau (1993).

Another stream within the field of information behaviour commenced with the sense-making theory of Dervin (1992). The basic assumption of this established theory is that individuals experience a 'gap' in their lives and they want to make sense of this situation. This is the starting point to finding information in order to bridge the gap between the unknown situation and the outcome. Sairanen and Savolainen (2010) elaborate on this theory by introducing their Everyday Life Information Seeking (ELIS) model. The idea behind this model is that people have their own 'order of things', i.e. their way of life. This could be, for example, culturally dependent or influenced by the generation to which they belong. Information seeking is perceived as a form of 'mastery of life', namely activities, such as problem solving, to keep everything in order. Although this model tries to be more concrete than the sense-making theory, by addressing values, life phases, material and everyday activities, it does not specify the situations, factors, motivations or triggers for people to engage in information behaviour.

Health information behaviour models are scarce. Although there are well-known models such as the Health Belief model in (Glanz, 2002) and the Protection Motivation Theory of Rogers (1975) (1983) these models focus more on how individuals handle and perceive their own health instead of how they acquire and search for health information. Also, there are some ecological models that try to describe how health behaviour depends on different factors (intrapersonal, interpersonal, community, etc.) and contexts, such as physical, social, and personal environments, such as the Model of Health Behaviour (McLeroy, Bibeau, Steckler, & Glanz, 1988). The Ecological model of Four Domains of Active Living (Sallis, et al., 2006) is also interesting because it states that multiple interventions should be implemented on different levels in a community to create positive health changes among population.

One model that does try to explain some of the factors that influence health information behaviour is the patient engagement model of (Graffigna, Barelo, Bonanomi, & Riva, 2017). Patient engagement is an important precursor for frequency of online health information-seeking behaviour. Although this model only looks at the medical side of health information behaviour and does not consider the situational influences in daily life, it is interesting since it illustrates how different factors such as interpersonal relationships (between patient and doctor) and feelings of empowerment interact and influence health information behaviour.

The main limitations of these models is that they do not include *why* people engage in active, passive or avoidant health behaviour, more specifically what triggers or influences them to search or consume health information. We need to understand the questions chronic patients have about their health in daily life and why they do, or do not, consume health information. Furthermore, it is relevant to know more about the situations in which they make the choice between searching and avoiding, to create eHealth applications that can support chronic patients in the everyday situations they encounter. A new model is therefore needed to study health information behaviour in daily life.

3.2.4 The Council of Coaches health information behaviour model

Based on the observed gaps and problems in health information behaviour literature, we propose a new, explorative model in this study to get insights on (1) the types of health information situations that chronic patients encounter in daily life, (2) how this affects their health information behaviour, and (3) what are the outcomes of such situations and behaviours. This model can be viewed in Figure 3.

This model has six elements, namely (1) health information situation, (2) trigger, (3) health information behaviour, (4) type of information, (5) barriers, and (6) health information behaviour outcome. These elements will be discussed further.

Health information situation: Most information behaviour models incorporate the aspect of 'context' as an influencing variable on information behaviour, or certain elements, such as personal, social and group-level factors in ecological models. For health information, detailed specification is necessary since different patients have different experiences with their illness, have different variables that affect their health (e.g. extremely high temperatures can be cumbersome for COPD patients) and employ different methods to deal with health-related issues. Therefore, in this model the health information situation consists of four factors, namely personal, social, environmental, and medical. Personal factors could be health literacy, motivation for living healthy, and emotions. Social factors can be described as the influence of the social network of the patient, such as a spouse or close friends and family members. Environmental factors are the characteristics of the location, activity or day in which patients have a health information situation. Medical factors are factors that are directly related to health issues or situations. These could be a consultation with a healthcare provider, or receiving new medicines from the pharmacist.

Trigger: Although many information models and theories describe the process of identifying a need and based on that need engage in information behaviour (in which the realization of the need serves as a starting point in finding information), this would only be the case for active information behaviour. Further, by only focusing on the need, situational factors (as mentioned above) are not considered. This model therefore chooses instead of a need to incorporate a trigger, which can be described as the moment patients become aware of health information or

a need for more health information. This instigates them to engage in health information behaviour, active, passive or avoidant.

Type of information: The study of van Velsen et al. (2012) indicates that active and passive information behaviours sometimes have different information topics. Therefore, it is relevant to explore if the type of information affects the health information behaviour.

Barriers: In (Wilson, 1997), the author suggests that there are three types of barriers that people experience in information behaviour: personal, social, and environmental. In addition to these three barriers, we propose a fourth barrier, namely technological. Nowadays, where 85% of the households in Europe have internet access, and of the individuals between 16 and 74 years, 87% use internet daily, and 59% have a mobile connection to the internet (e.g. smartphone, tablet, laptop) (Eurostat, 2017), it is important to also take into account technological barriers, such as technology adoption attitude, usability issues, and technical defaults (e.g. WiFi problems, errors, connectivity issues).

Health information behaviour outcome: This last one is derived from the sense making theory (Dervin, 1992), namely that to every situation you want to overcome (i.e. closing the gap) there is a certain outcome. In the case of health information behaviour, you can fail or succeed in finding the right type of information for your health information situation, or, if we look at the model of Kuhltau (1993), you can have a sense of accomplishment or increased self-awareness. In the case of the latter, this could possibly influence your health motivation to make healthy life choices.

This study explores the health information situations that chronic patients encounter in their daily life and tries to understand the factors or interplay of factors that affects them. The main research question is: *Which factors influence the health information behaviour (active, passive, avoidant) of chronic illness patients in daily life?*

There are several sub-questions formulated:

1. *Which situational factors or interplay of factors create a 'trigger' for health information behaviour?*
2. *To what extent are there differences in factors (or interplay of factors) that triggers patients to engage in active, passive or avoidant health information behaviour?*
3. *To what extent influences the type of information active, passive or avoidant health information behaviour?*
4. *Which barriers prevent patients from engaging in health information behaviour?*
5. *What are the outcomes of such a health information situation?*

Leading up to the development of the virtual coaches, we need to understand how these could be implemented by the different user groups. Therefore, both different stakeholders such as medical professionals (see deliverable 2.2), and potential patient groups are studied. By examining these different perspectives, we can get a better grasp on how Council of Coaches would be truly a useful and supportive technology for the different end-users it aims to target. In the stakeholder interviews, the respondents are asked about their perceptions on how technology could be enabled in treatment programs and cure paths of chronic patients. In the health information study, chronic patients will be followed for a month to get insights on the different situations and questions they experience in their life. The outcomes of this study can be used to gain more knowledge of the needs and questions chronic patients have about their health and the situations in which these arise. By attaining insights on (1) what they want to know about their health, (2) when they want to know something about their health, (3) what motivates them to search information about their health, and (4) what they do with this information, we can create valuable input for the development of the virtual coaches in this project. For example, differences in the type of questions between the three patient groups could mean that depending on the patient group, the virtual coaches should address different topics.

The next paragraphs will explain in detail the general design of the health information behaviour study (also named as the '*Diary Study*'). Then the several elements of this study will be separately discussed. Lastly, the data analysis will be explained.

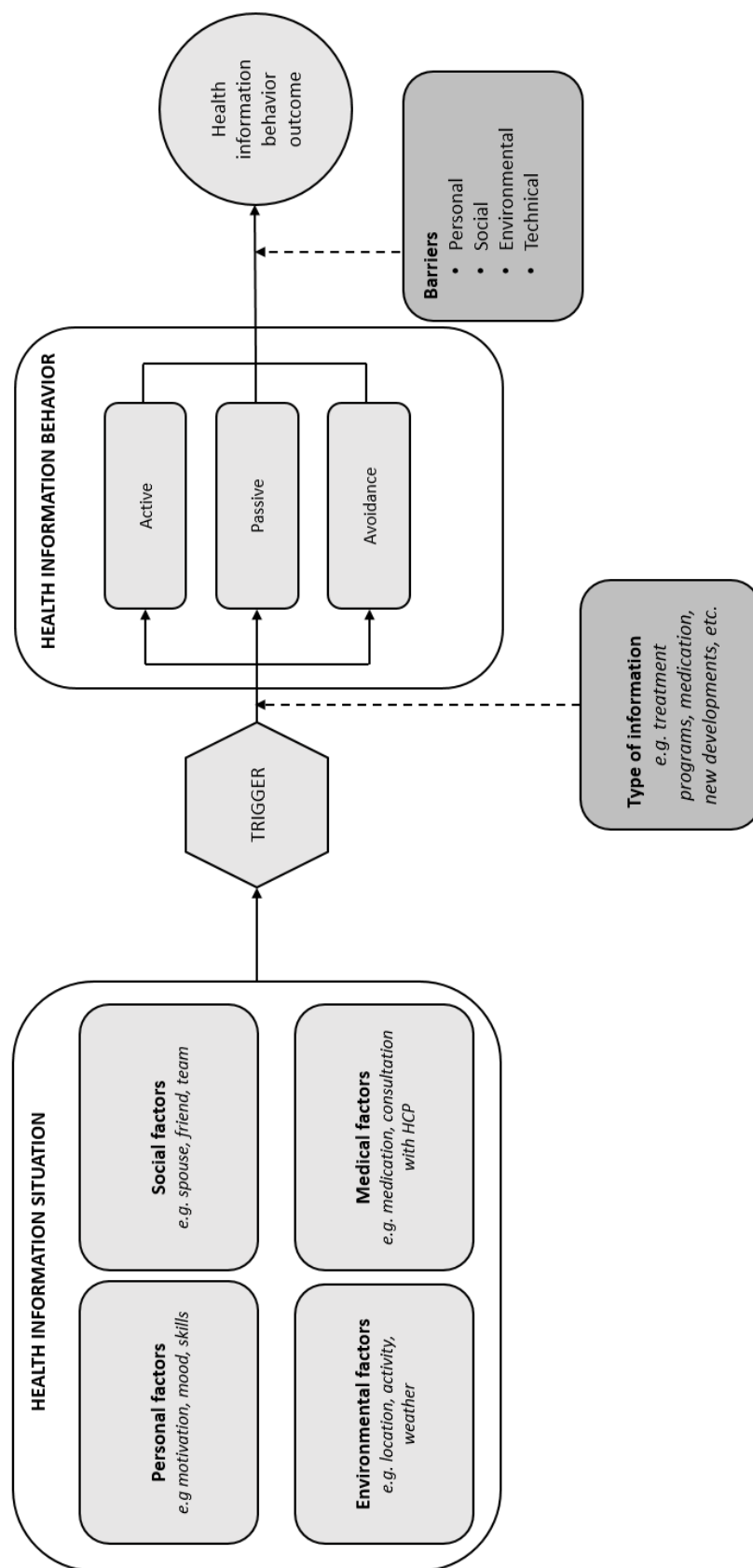


Figure 3: The Council of Coaches Health Information Behaviour (HIB) model.

3.3 Methods

3.3.1 Participants and Inclusion/Exclusion Criteria

In this study, three end-user groups are followed over a course of four weeks. These groups are: people with chronic pain (CP), people with diabetes mellitus type 2 (DM2) and people of 55 years and older with age-related impairments (ARI). Between five to ten participants will be recruited for each end-user group. Table 2 shows the division of these end-user groups per country and which institute is responsible for the recruitment of participants.

Table 2: Patient groups per research site.

End-user group	Country	Institute
Age-related impairments	Denmark	Danish Board of Technology (DBT)
Chronic pain	The Netherlands	Roessingh Research and Development (RRD)
Diabetes mellitus type 2	United Kingdom	University of Dundee (UDun)

The **inclusion criteria** for Chronic Pain (CP) are:

- 18 years or older
- Following treatment programs to cope with chronic pain, or about to start one.

The **inclusion criteria** for Diabetes Mellitus Type 2 (DM2) are:

- 18 years or older
- Diagnosed with diabetes mellitus type 2 by medical professional

The **inclusion criteria** for Age Related Impairments (ARI) are:

- 55 years or older
- Some form of (pre-) frailty that is determined by community nurse or healthcare professional.

The general **exclusion criteria** are:

- Not fluent in the language of the study site (Danish, Dutch or English);
- Unwilling to provide informed consent;
- Cognitive impairments that could hinder successful execution of the diary study.

3.3.2 Study design

The health information behaviour study will take the form of a diary study, a qualitative method in which the participants are followed for a longer period of time (one month) and record diary entries with respect to their information behaviour. We have opted for a diary study, as this type of study provides in-depth insights in the situations that trigger information behaviour, the specific actions taken, and the evaluation of the success of these actions. This fine-grained information will allow us to formulate requirements that enable the coaches to interact with patients properly.

The diary study will entail the following steps:

1. A pre-study workshop;
2. A diary study;
3. A post-study workshop.

In the *pre-study workshop*, the participants of the diary study gather per site. During the workshop, we will plenary discuss the participants'

- Health, following the one health approach by (Huber, et al., 2011), see Figure 4.
- Health journey;
- Motivation for living healthy

In the first part, we ask the participants to describe their health journey up to now. The positive and difficult moments and the people involved are also discussed. Then, we ask them how they perceive their health on six dimensions: bodily functions, mental functions & perceptions, daily functioning, spiritual/existential dimension, quality of life, and social & societal participation (see example in Figure 4). Last, they are asked what motivates them to live healthy and how positive and negative experiences influence them. A detailed description of the pre-study workshop protocol can be viewed in Appendix A.

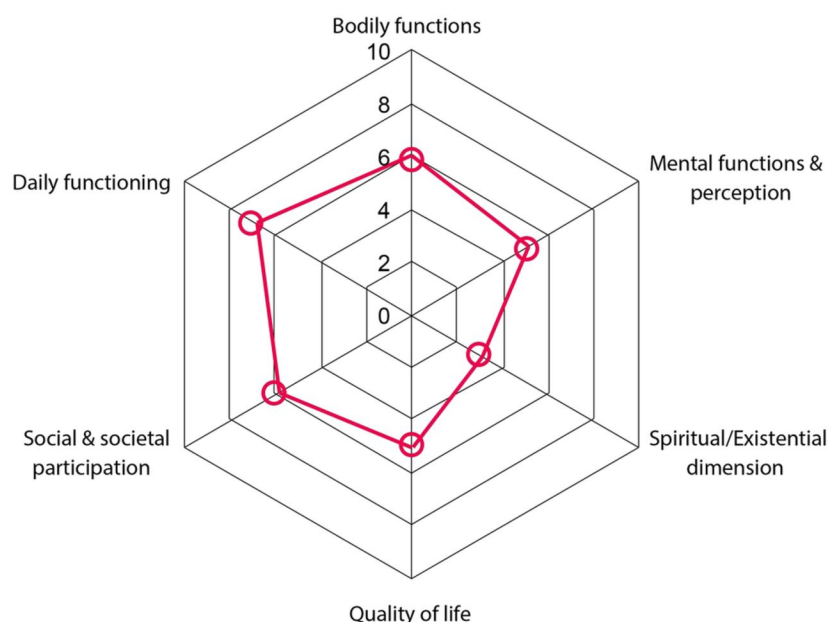


Figure 4: Six Dimension of Health (Huber et al., 2009).

After this, we will introduce the participants into the diary study. Section 0, Table 3 includes the detailed setup of the pre-study workshop. The information from these workshops were used to understand the health and technology background of the participants, which (partly) explains their information behaviour. The workshops were analysed by means of deductive thematic analysis (Braun & Clarke, 2006), meaning that the data will guide how we will code the participants' reactions to each question and exercise.

In the diary study we followed the participants for four weeks. During this period, they were asked about situations in which they sought, encountered or avoided health information and the factors that influenced their behaviours and decisions. Two diary forms were used, an interval-contingent diary and an event-contingent diary, to study both passive and active behaviours and situations. The diary entries are analysed by both the means of a codebook for close ended questions, and deductive thematic analysis (Braun & Clarke, 2006) for open-ended questions in the diary forms.

In the post-study workshop the main focus was on the evaluation of the diary study and the health journey. Based on the individual health journeys in the pre-study workshop, one health journey per patient group is created. In the post-study workshop, participants are asked about their opinions on these general health journeys for further improvement and validation. Also, we wanted to know how this effected their illness or treatment. Lastly, we ask participants about the Council of Coaches what types of coaches they would prefer and when or how they would use it. A full description of the post-study workshop protocol can be viewed in Section 3.3.2.2, Table 4.

3.3.2.1 Pre-study workshop protocol

The full protocol for the pre-study workshop is given in Table 3 below.

Table 3: Health Information Behaviour (HIB) Study - Pre-Workshop Protocol.

Phase	Time	Topic	Explanation	Materials
Introduction	09.00-09.15	Walk-in	-	Name tags Coffee/tea
	09.15-09.20	Welcome & introduction	-	
	09.20-09.25	Introduction of moderators	Explain backgrounds & role in study	PPT
	09.25-09.35	Introduction of participants	Describe shortly who you are and why you chose to participate.	
	09.35-09.45	Outline of the day	Short overview of the different topics today "Are there any questions so far?"	PPT
Questionnaires	09.45-09.50	Explanation questionnaires	"We are about to start with the questionnaires. Data will be analysed anonymously." "Please fill in these questionnaires as you feel it best describes your situation."	
	09.50-09.55	Distributing questionnaires +pens	Moderators distribute the questionnaires and pens to each participant	Manuel questionnaires + pens
	09.55-10.15	Filling in questionnaires	Participants fill in the questionnaires. Moderator stands by in case there are questions.	
Short break & set-up focus group	10.15-10.25	While participants have a short break, the moderators set-up the first focus group: patient journey.		Pens A3 sheets of the empty patient journey Audio recorder Coffee/tea
FG1 – Patient journey mapping	10.25-10.26	Turn on audio recorder	"Next, we are about to start with the focus group. "Everything is recorded on audio. We use this data to analyse this meeting afterwards." >Turn on audio recorder	
	10.26-10.35	Explanation focus group	You are going to write down your own patient journey on the sheet of paper before you. You are going to write down three things: 1- The different steps in your patient journey 2- The most positive and most difficult event in this step 3- The people who were involved in these steps You start on the patient journey sheet in the left circle 'the cause that started it'. Then, fill in the rectangles up to the right circle 'where you are now'. You don't have to fill in every rectangle, you just need to describe the different steps in your journey up till now." After that, fill in for each step the most positive and most difficult moments and the people who were involved in this step.	
	10.35-11.00	Filling in patient journey	Participants fill in their patient journey Moderator walks around during this time, making short notes of similarities/differences between the patient journeys	

	11.00-11.20	Discussion of patient journey	Question 1: 'How was it to fill in your own patient journey?' Follow up: <ul style="list-style-type: none"> - Why was it easy/difficult? - Do others also feel/think that? Question 2: I noticed this [similarity/difference] between your patient journeys. Could you explain this? → Ask questions on the notes you've made when participants were filling in their patient journeys	
Short break	11.20-11.30	-		Coffee/tea with snack
Explanation diary study	11.30-11.40	Presentation on diary study and diary forms	Moderator gives a short presentation on the diary study and the different types of diaries that are going to be used.	PPT
	11.40-11.55	Exercise with diary forms	Moderators distribute paper diary forms and ask participants to fill these in as if it were for yesterday.	Diary forms
	11.55-12.05	Discussion of diary forms	The diary forms are discussed. What went easy, what went difficult? Are the questions understandable and which questions were difficult to answer?	
	12.05-12.15	Summary of diary study and Q&A	Moderators give a short summary of the diary study and the forms. Participants can ask any questions they have.	PPT
Closure	12.15-12.17	-		-

3.3.2.2 Post-study workshop protocol

Table 4: Health Information Behaviour (HIB) Study - Post-Workshop Protocol.

Phase	Time	Topic	Explanation	Materials
Introduction	09.00-09.15	Walk-in	-	Name tags Coffee/tea
	09.15-09.20	Welcome & introduction	-	
	09.20-09.28	Outline of the day	Short overview of the different topics today <i>"Are there any questions so far?"</i>	PPT
	09.28-09.30	Turn on audio recorder	<i>"We are about to start. Everything is recorded on audio. We use this data to analyse this meeting afterwards."</i> >Turn on audio recorder	Audio recorder
Discussion of diary study	09.30-09.50	Theme 1: discussion of method	<i>Introduction: The last couple of weeks you have filled in the diary forms. We want to discuss with you study, what you thought of it, and the method. Was it easy or difficult filling in the diaries?</i> Questions: <ol style="list-style-type: none"> 1- Could you explain how you thought the study went? What went well, what went wrong? 2- How easy or difficult was it to filling out the diary forms? 3- How could this study be improved? 	
Short break	09.50-10.00			
Discussion of health	10.00-10.32	Turn on audio recorder	>Turn on audio recorder	Audio recorder

information situations	10.32-10.52	Theme 2: discussion of health information situations	<p>Start: <i>We want to discuss with you the different health information situations you encountered in the last month and how this affected your health.</i></p> <p>Questions:</p> <ol style="list-style-type: none"> 1) What were for you the most important health information situations you encountered? 2) How did these situations affect your health (positive or negative)? <p>Follow-up questions:</p> <ul style="list-style-type: none"> ➤ Were there large changes in your health the past four weeks? ➤ How did this influence you in searching information about your health? <ol style="list-style-type: none"> 3) Health has several aspects, such as physical health, mental health, social health, quality of life, etc. How did these health information situations affect these different aspects of your health? <p>Closure</p>	
Short break	10.52-11.00	-		Coffee/tea with snack
Theme 3: patient journey	11.00-11.02	Distribution patient journeys	Moderators distribute the patient journey for the corresponding patient group. (this is the patient journey based on pre-study workshop)	Patient group patient journeys
	11.02-11.04	Turn on audio recorder	>Turn on audio recorder	Audio recorder
	11.04-11.15	Evaluation of patient journey	<p><i>In the first workshop you all individually described your patient journey. Based on your input, we created one general patient journey. We would like to know if this is a realistic patient journey and why this is or isn't so.</i></p> <ul style="list-style-type: none"> ➤ Group discussion 	
Theme 4: Virtual coaches	11.15-11.25	Explanation virtual coaches	<p><i>We want to discuss with you how during your patient journey virtual coaches could possibly assist you in regard to your health-related issues and general health. But what are virtual coaches? We'd like to give you a view examples</i></p> <ul style="list-style-type: none"> ➤ Moderators give a short presentation on virtual coaches 	PPT
	11.25-11.27	Turn on audio recorder	>Turn on audio recorder	Audio recorder
	11.27-11.47	Discussion	<p><i>We want to discuss with you how during your patient journey virtual coaches could possibly assist you in regard to your health-related issues and general health. Based on</i></p> <p>Question 1: Where could or should virtual coaches play a role in healthcare? Please mark these places with an X on the section '1-Role of virtual coaches'</p> <p>Follow-up questions:</p> <ul style="list-style-type: none"> - For each X, what could the virtual coaches do in these stages? - What type of information would this virtual coach need to provide? <p>Question 2: What type of virtual coaches do you believe we should develop for this case? (e.g. physical activity coach, spiritual coach, etc.)</p> <p>Follow-up questions:</p> <ul style="list-style-type: none"> - How could a virtual coach motivate you for living healthy? <p>Closure</p>	<p><i>Respondents can write down on the patient journey what the virtual coach could do for each 'X' and the type of information they need at each 'X'.</i></p> <p>After each topic (what coaches should do & type of information), you have a group discussion</p>

Summary	11.47-12.00	Explain next steps in this study	Moderators give a short presentation on the next steps, what is to be done with these results in this project. Q&A with participants	PPT-6
Closure	12.00-12.10	-	-	-

3.3.3 Diary forms

This study follows the procedure of van Velsen et al. (2012) meaning that participants were asked once every day to fill in an online diary form. Before filling in the diary forms, the participant answered some entry questions to determine if s/he actively or passively consumed health information or avoided health information. Then, they are automatically referred to the corresponding diary forms (active, passive or avoidant). The complete diary forms can be viewed in Appendix A-1: Diary study – Diary forms.

The entry question is:

Did you search for or find information about your health today? Please choose the option that best describes with your situation:

1. I saw, heard, read something or talked with someone about my health
2. I had a specific question about my health
3. I did not encounter nor searched for health information

Option one leads to the passive diary form and the second option to the active diary form. If the participant chose option three, s/he is asked if s/he chose not to engage in health information (avoidance). They can describe this situation in an open text field.

If s/he did not deliberately choose to engage in health information behaviour, did not want any information which s/he couldn't find nor engaged in passive or active health information behaviour (as the previous questions asked about) we assume there wasn't any reason to motivation nor passive information triggers this day why he/she didn't engage in any type of health information behaviour. In that case, we ask the participant if there was a situation today in which they had to consider possible issues/problems in relation to their health.

Figure 5 below shows the chart flow of the entry questions for the diary forms.

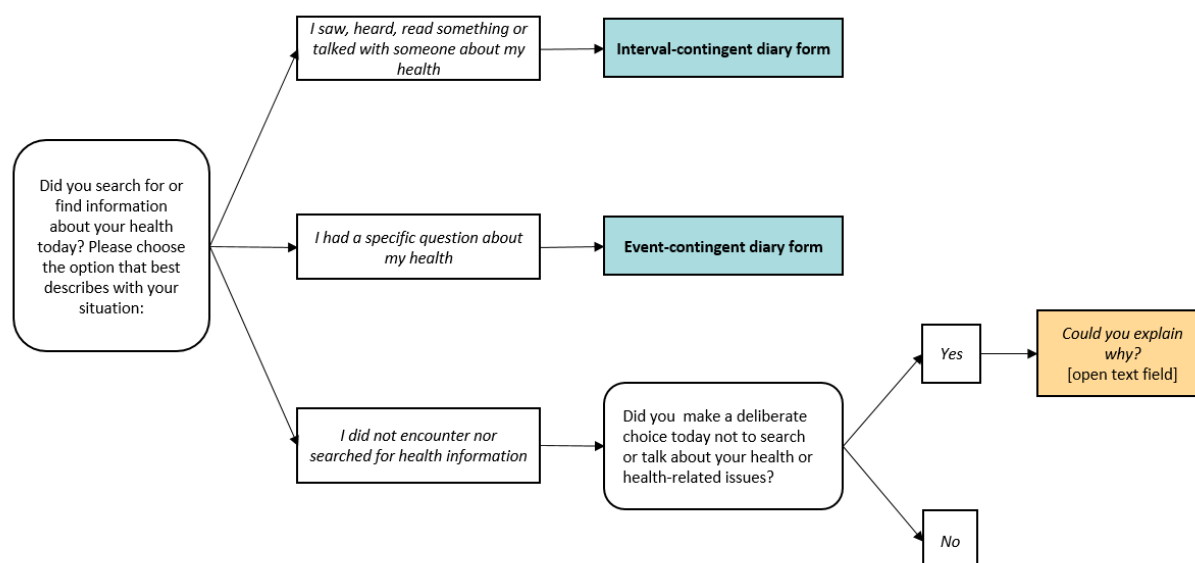


Figure 5: Flowchart of diary entry questions.

3.3.4 Questionnaires

An overview of the different questionnaires and items that are used in the pre-study workshop can be seen here below in Table 5. The complete questionnaires with items and their scales can be found in Appendix A-2: Questionnaires for pre-study workshop.

Table 5: Questionnaires in pre-study workshop.

Demographics	Gender	Male / female
	Date of birth	dd/mm/yyyy
	Disease	Chronic pain / diabetes / age-related impairment
	Co-morbidity	Do you have, besides [CP/DM2/ARI] other chronic conditions? If yes, could you name this condition?
	Educational level	Primary education / Lower secondary education / Post-secondary non-tertiary education / Upper secondary education / Higher education (bachelor or higher)
	Social engagement	Continuous
	Living situation	Living together / Alone / Other
	Technology preferences	MC
	Mass media preferences	5pt Likert scale: every day – never.
Health literacy	Three item scale – Chew et al. (2004)	5pt Likert scale: Always – never
One health	Bodily functions Mental functions & perception Spiritual Quality of life Social & societal participation Daily functioning	Scale 1-10
Health empowerment / Health-related self-efficacy	Adaption of the Diabetes Empowerment Scale (DES) (Anderson, 2000), 28 items, 3 subscales: 1: Managing the Psychosocial Aspect of personal health 2: Assessing Dissatisfaction and Readiness to Change: 3: Setting and Achieving Health Goals	5pt Likert scale: strongly agree – strongly disagree
Motivation for living healthy	Adaption of the SMS-II (Pelletier, 2013), 18 items questionnaire.	7pt Likert scale: not at all true – very true

3.3.5 Analysis

3.3.5.1 Diary forms

The diary entries were thematically analysed on the following aspect: (1) situational factors, (2) personal factors, (3) barriers, (4) type of information, (5) trustworthiness, and (6) outcomes of the situation. This study follows the analysis protocol of van Velsen et al. (2012). This protocol entails that close-ended questions are coded by a codebook, see appendix D. Open-ended questions are thematically analysed,

thereby following the guidelines of Braun & Clarke (2006). Then, these themes were coded based on the steps of Pope et al. (2000):

- 1) One researcher familiarizes his/herself with the data and creates a first coding scheme
- 2) Then, the researcher codes all diary entries based on this coding scheme. When this scheme needs to be adjusted, all data has to be recoded from the start. This is done until all data is coded without any adjustments to the coding scheme.
- 3) A second researcher codes a subset of the data based on the final coding scheme.
- 4) Disagreements and conflicts between the first and second researcher are discussed and alterations are made in the coding scheme to finalize it.
- 5) The first researcher uses this final coding scheme to recode all data entries and the second researcher independently recodes a subset.

3.3.5.2 Health journeys

The audio recordings from the focus groups were transcribed and the mapped individual health journeys were digitalized. The process from individual health journeys to one general health journey consisted of two phases. First, one researcher familiarized herself with the data and created one health journey for each patient group. A second independent researcher viewed this general health journey and the data from the respondents. Discrepancies were solved to finalize the health journey. In the second phase, the general health journey was given back to the patients for evaluation and discussion. Their input was used to finalize the health journeys. These can be viewed in Appendix A-3: Health journeys.

3.4 Results

3.4.1 Demographics

In total, 24 people participated in the study, of which there were seven older adults with age related impairments, five participants with chronic pain, and 12 participants with diabetes mellitus type 2.

Of the seven older adults there were four men (57.1) and three (42.9%) women. The average age was 66.14 years ($SD = 4.74$). As their highest finished education, three respondents (42.86%) mentioned a higher vocational education, one respondent (14.29%) a vocational education, one respondent (14.29%) a lower vocational education, and two respondents reported primary school (28.57%). Five respondents (71.43%) were living with their spouse and two respondents (28.57%) were living alone. The average health literacy was $m = 3.67$ ($SD = .27$). Six of the seven respondents (85.7%) used a PC or laptop at home of which five respondents (71.43%) also used a smartphone. Four respondents mentioned the use of a tablet (50%), for one respondent this was his only digital device. Two respondents (28.57%) mentioned having a smart TV at home.

The patient group with chronic pain consisted of one male (20%) and four female (80%) respondents with an average age of 51.4 years ($SD = 5.8$). Three participants completed vocational education (60%) and two respondent a higher vocational education (40%). All respondents were married. Average health literacy is 3.2 ($SD = .90$). All respondents use smartphones and PC/laptops at home. Four respondents (80%) used a tablet in addition and two respondents (50%) also used a game computer.

There were seven female (58.33%) and five male (41.7%) respondents in the diabetes type 2 group, with an average age of $m = 54.83$ ($SD = 8.58$). Half of the respondents (50%) completed a higher vocational education and the other half a vocational education. Seven respondents (58.3%) live with their spouse, four respondents (33.3%) live alone and one respondent (8.33%) has another living situation, with relative or friend. Their average health literacy is $m = 4.33$ ($SD = .64$). Ten respondents (83.3%) mentioned having a PC/laptop and smartphone. Seven respondents in addition use a tablet (58.3%), three respondents (25%) use a smartwatch, and one respondent (8.3%) a smart TV. One respondent only used a PC/laptop, and one respondent (8.33%) only uses a smartphone and tablet.

A complete overview of the demographics per respondent can be viewed in Table 6 below.

Table 6: Demographics of respondents (ARI, CP, DM2 patients).

Respondent ID	Sex	Age	Education	Living situation	Health Literacy	Technology usage
ARI-01	M	73	Vocational	Alone	3.3	Smartphone, laptop, tablet, smartwatch, smart TV
ARI-02	M	67	Lower vocational	Spouse	4	Smartphone, PC/laptop, tablet
ARI-03	M	70	Lower vocational	Spouse	3.3	Smartphone, laptop, tablet, smartwatch, smart TV
ARI-04	W	68	Higher vocational	Alone	4	Tablet
ARI-05	W	64	Higher vocational	Spouse	3.7	PC/laptop
ARI-06	W	61	Lower vocational	Spouse	3.7	Smartphone, PC/laptop
ARI-07	M	60	Higher vocational	Spouse	3.7	Smartphone, PC/laptop
CP-01	F	57	Vocational	Spouse	2.7	Smartphone, PC/laptop, tablet
CP-02	M	46	Vocational	Spouse	2.3	Smartphone, PC/laptop
CP-03	F	46	Vocational	Spouse	3	Smartphone, PC/laptop, tablet, game computer
CP-04	F	50	Higher vocational	Spouse	3.3	Smartphone, PC/laptop, tablet, game computer
CP-05	F	58	Higher vocational	Spouse	4.7	Smartphone, PC/laptop, Tablet
DM2-01	F	61	Higher vocational	Spouse	5	smartphone, PC/laptop, tablet
DM2-02	F	61	Higher vocational	Alone	5	Smartphone, PC/laptop
DM2-03	M	54	Higher vocational	Spouse	4.3	Smartphone, PC/laptop, tablet
DM2-04	F	50	Vocational	Friend /Family	6.7	Smartphone, PC/laptop, tablet, smart TV
DM2-05	M	70	Vocational	Alone	3	PC/laptop
DM2-06	M	63	Vocational	Spouse	4	Smartphone, PC/laptop, tablet
DM2-07	F	58	Higher vocational	Spouse	4.7	Smartphone, PC/laptop
DM2-08	F	53	Higher vocational	Spouse	4.3	Smartphone, PC/laptop, tablet
DM2-09	M	55	Vocational	Spouse	3.3	Smartphone, tablet
DM2-10	F	51	Vocational	Spouse	4.3	Smartphone, PC/laptop, tablet, smartwatch
DM2-11	F	40	Higher vocational	Alone	4.3	Smartphone, PC/laptop, tablet, smartwatch
DM2-12	M	42	Vocational	Alone	5	Smartphone, PC/laptop, smartwatch

3.4.2 Mass media activities

Older adults spend between two and three hours per day on watching TV ($M = 3.3$, $SD = .8$) and face-to-face contact ($M = 2.9$, $SD = 1.8$). About two hours per day on reading books or magazines ($M = 2.1$, $SD = 1.4$) and listening to the radio ($M = 2.1$, $SD = 2.2$). Older adults did not frequently use the computer for offline purposes ($M = .9$, $SD = .9$), social media ($M = .7$, $SD = .8$), and gaming ($M = .4$, $SD = .8$).

Chronic pain patients spend more time especially on face-to-face contact ($M = 4.3$, $SD = 1.7$). Listening to the radio ($M = 3$, $SD = 1.7$) and watching TV ($M = 2.8$, $SD = 1.5$) takes up around three hours each day. They also don't spend many hours on offline computing ($M = .8$, $SD = 1.3$) and gaming ($M = .4$, $SD = .9$), similar to the older adults' group.

Diabetes type 2 patients spend most time, around three hours per day, on face-to-face contact ($M = 3.3$, $SD = 1.7$) and watching TV ($M = 3.2$, $SD = 1$). General internet search ($M = 2.4$, $SD = 1$) and listening to the radio ($M = 2.3$, $SD = 1.6$) takes up about two hours each day. This patient group also does not spend a lot of time on gaming ($M = .4$, $SD = .7$).

In general, in all three groups the results indicate that most time is spent on watching TV, listening to the radio, and face-to-face contact. Gaming is considered as the activity that on average takes up the least amount of time. A complete overview of their mass media activities can be viewed here below in Table 7.

Table 7: Mass media activities per patient group (ARI, CP, DM2).

	ARI	CP	DM2
General internet search (h/day)	$M = 1.6$, $SD = 1$	$M = 3.2$, $SD = 1.6$	$M = 2.4$, $SD = 1$
Offline computing (h/day)	$M = .9$, $SD = .9$	$M = .8$, $SD = 1.3$	$M = 1.4$, $SD = 1.7$
Emailing (h/day)	$M = 1$, $SD = .0$	$M = 1.2$, $SD = .8$	$M = 1.5$, $SD = 1$
Social media (h/day)	$M = .7$, $SD = .8$	$M = 1.4$, $SD = 1.3$	$M = 1.3$, $SD = 1.1$
Phone (h/day)	$M = 1.3$, $SD = .5$	$M = .8$, $SD = .4$	$M = 1.1$, $SD = .9$
Texting/Whatsapp (h/day)	$M = 1$, $SD = .0$	$M = 1.6$, $SD = .5$	$M = 1.1$, $SD = .8$
Gaming (h/day)	$M = .4$, $SD = .8$	$M = .4$, $SD = .9$	$M = .4$, $SD = .7$
Listening to radio (h/day)	$M = 2.1$, $SD = 2.2$	$M = 3$, $SD = 1.7$	$M = 2.3$, $SD = 1.6$
Watching TV (h/day)	$M = 3.3$, $SD = .8$	$M = 2.8$, $SD = 1.3$	$M = 3.2$, $SD = 1$
Reading books/magazines (h/day)	$M = 2.1$, $SD = 1.4$	$M = 1.2$, $SD = .8$	$M = 1.8$, $SD = 1.4$
Face-to-face contact (h/day)	$M = 2.9$, $SD = 1.8$	$M = 4.3$, $SD = 1.7$	$M = 3.3$, $SD = 1.7$

3.4.2.1 Health assessment

All participants assessed their health on the six dimensions of (Huber, et al., 2011). A graphic representation of the scores on these dimensions of health per patient group can be seen in Figure 6. This figure shows that on average the older adults rate the various aspects of their health relatively high and the chronic pain patients relatively low.

Older adults with age-related impairments rated five out of the six health dimensions very positive with a score of eight or higher. Only bodily functions had a slightly lower score (Bodily functions: $M = 6.29$, $SD = 2.36$).

Patients with chronic pain gave the highest score to their social health ($M = 6.8$, $SD = 1.3$) and spiritual/existential health ($M = 6.2$, $SD = 2.2$). Daily functioning ($M = 4.4$, $SD = 1.3$) and bodily functions ($M = 4.2$, $SD = 1.3$) received the lowest scores.

Diabetes type 2 patients gave their quality of life ($M = 7.42$, $SD = 1.44$) and daily functioning (Daily functioning: $M = 7.42$, $SD = 2.43$) equally high scores, although the scores of daily functioning are more widely spread. Social and social participation ($M = 6.92$, $SD = 2.23$), mental functions & perceptions ($M = 7.08$, $SD = 1.68$), and spiritual/existential dimension ($M = 7.25$, $SD = 1.81$) also received positive scores. Bodily functions were more negatively evaluated with $M = 5.08$, $SD = 1.68$.

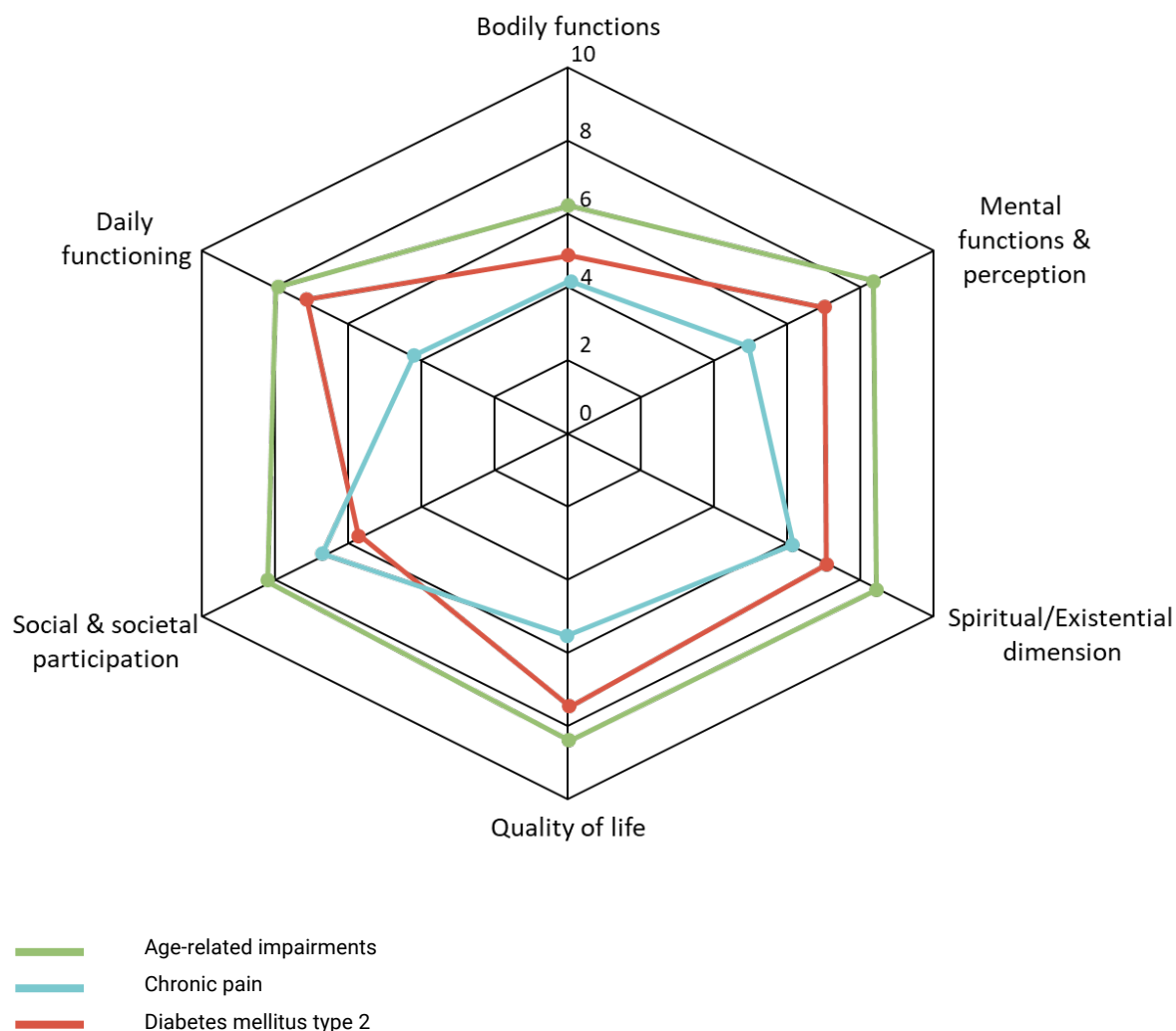


Figure 6: Average scores per health dimension per patient group (ARI, CP, DM2).

Regarding their health empowerment, the self-reported psychosocial self-efficacy of people to manage with their health and cope with health-related issues, no large differences were found between the three subscales of the questionnaire and the overall score. However, the chronic pain patients did have slightly lower scores (M and SD) on all subscales than the participants in the ARI and DM2 group, indicating that they perceive themselves as less able to manage their health, such as making health-related decisions, setting health goals, making changes for a better health, than the other patient groups. Table 8 here below shows the average means and standard deviations per subscale and for the overall score.

Table 8: Means and standard deviations per subscale and overall score of the DES for the three end-user groups (ARI, CP, DM2).

	ARI	CP	DM2
Managing the psychosocial aspects of health	<i>M</i> = 3.9, <i>SD</i> = .32	<i>M</i> = 3.18, <i>SD</i> = .57	<i>M</i> = 3.41, <i>SD</i> = .61
Assessing dissatisfaction and readiness to change	<i>M</i> = 3.83, <i>SD</i> = .34	<i>M</i> = 3.62, <i>SD</i> = .55	<i>M</i> = 4, <i>SD</i> = .32
Setting and achieving health goals	<i>M</i> = 3.8, <i>SD</i> = .36	<i>M</i> = 3.56, <i>SD</i> = .46	<i>M</i> = 3.7, <i>SD</i> = .46
Overall score	<i>M</i> = 3.84, <i>SD</i> = .3	<i>M</i> = 3.46, <i>SD</i> = .48	<i>M</i> = 3.7, <i>SD</i> = .45

Looking at the motivation for living healthy, an adapted questionnaire from the Sports Motivation Scale II of Pelletier et al. (2013), relative autonomy index (RAI) shows the extent to which individuals internalize a certain behaviour as part of one's own self. The higher this score is the more joy and satisfaction people experience in executing the behaviour or tasks and thus are more motivated.

From the three patient groups, we see that the RAI scores of the ARI patients (RAI = 32.9) are somewhat higher than the CP (RAI = 27.6) and DM2 group (25.6), indicating that the older adults are more autonomously regulate their behaviour to live healthy. The complete overview of each dimension of motivation per patient group can be seen in Table 9 below.

Table 9: Scores per motivation subscales (intrinsic, integrated, identified, introjected, external and a-motivation) and overall RAI score for all three patient groups (ARI, CP, DM2).

	ARI	CP	DM2
Intrinsic motivation	44.6	46.8	45
Integrated motivation	23.7	31.2	24.2
Identified motivation	14	13.8	13.2
Introjected motivation	-13.9	-15.6	-13.8
External motivation	-13.7	-21.6	-16.7
Amotivation	-21.9	-27	-26.3
Relative Autonomy Index (RAI) Score	32.9	27.6	25.6

3.4.3 Diary entries

In total 311 diary entries were collected. Of these diaries' entries were 91 (29.1%) situations described in which respondents actively searched for health information. There were 151 (48.2%) diary entries that described passive health information situations, and 71 (22.8%) diary entries in which avoidant situations were described. After reviewing the data, it became clear that respondents sometimes filled out a diary form for passive HIB, whilst actually describing an active HIB situation. For the older adults, this meant that twelve passive HIB situations were changed to active HIB situations, for chronic pain eight passive HIB were active HIB situations, and lastly for the diabetes patients, 12 passive HIB situations were regrouped under active HIB situations, and three active situations were regrouped under passive HIB situations.

An overview of the quantity of diary entries per HIB (active, passive, avoidant), can be seen in Table 10 below.

Table 10: Diary entries per patient group (ARI, CP, DM2).

	N	Active	Passive	Avoidant	Total
ARI	7	27	12	36	75
CP	6	14	19	10	43
DM2	12	51	120	25	196
Total	27	92	151	71	314

Next, per end-user group (ARI, CP, DMII) the results from the diary entries will be shown. First an overview is given of the sources and topics health information. Then, the motivations, actions and outcomes of active, passive and avoidant HIB will be explained in the subsequent sections. Second, the health journeys per end-user group will be described as well as the moments the users identified they would need support and the type of coach they prefer.

3.4.4 Health information behaviour of older adults with age-related impairments

3.4.4.1 Sources and topics of health information

Older adults searched for or encountered health information in 39 situations. During these active and passive HIB situations, the most common sources for information were conversations with other persons (71.8%) and the internet (25.6%). In one situation, 'other' (2.6%) was mentioned as a source for health information. Table 11 shows the complete overview of all sources and health topics of this end-user group.

In 89.3% of all conversations, older adults talked with health professionals, like physiotherapists, GPs, and nurses. Other conversions were held with a sports instructor (ARI-05), acquaintances (ARI-02) and with the sales person of a health shop (ARI-05). During Internet search strategies, health or medical websites were most frequently (60%) read by participants. In the 'Other' situation, one respondent contacted his GP by sending an e-mail during holidays (ARI-01).

The following topics of health information were identified during both active and passive HIB situations:

- 1) **Symptoms:** Participant(s) who had physical complaints or discomforts searched online for an explanation of their symptoms
- 2) **Treatment:** Participant(s) wanted more information on the treatment plans or searched for alternative treatment options
- 3) **Disease/condition:** Participant(s) or one of their relatives had (potentially) a specific health condition and they wanted more information on the condition;
- 4) **Physical activity:** Participant(s) received personal tips about improving physical activity or physical exercises
- 5) **Diagnostic process:** Participant(s) received information before undergoing medical tests
- 6) **Medical results:** Participant(s) received the results from the medical tests, such as blood results
- 7) **Information on medication:** Participant(s) searched for information on side effects or preparation of medication

Of these seven health topics, there were three topics that were unique for active or passive HIB situations. The topics 'Medication' and 'Medical results' only occurred in active HIB situations, while Diagnostic process was only present in passive HIB situations.

Table 11: Sources and topics of health information, type of device used in HIB situation and type of HIB (active or passive) of older adults with age-related impairments.

Source		Topics of health information	Device	HIB	Respondents
Internet	Google	<ul style="list-style-type: none"> Medication Disease/condition 	Tablet, Mobile	Active	ARI-03, ARI-05
	Health/medical information websites	<ul style="list-style-type: none"> Medication Treatment Disease/condition Symptoms 	<ul style="list-style-type: none"> PC/Laptop Mobile 	Active	ARI-01, ARI-05, ARI-06, ARI-07
	Unspecified website	<ul style="list-style-type: none"> Medication Disease/condition 	n.a.	Active	ARI-02, ARI-05
Conversation with person	Health professionals	<ul style="list-style-type: none"> Symptoms Physical activity Treatment Disease/condition Diagnostic process Medical results 	<ul style="list-style-type: none"> Face-to-face Mobile 	Active Passive	ARI-02, ARI-03, ARI-04, ARI-05, ARI-06, ARI-07
	Acquaintance	<ul style="list-style-type: none"> Disease/condition 	Face-to-face	Passive	ARI-02
	Sports instructor	<ul style="list-style-type: none"> Physical activity 	Face-to-face	Passive	ARI-05
	Sales person of health shop	<ul style="list-style-type: none"> Symptoms 	Face-to-face	Passive	ARI-05
Other	E-mail to GP	<ul style="list-style-type: none"> Medication 	PC/Laptop	Active	ARI-01

3.4.4.2 Active HIB

There were three main motivations for participants to search health information: (1) having a health condition and/or experiencing symptoms, (2) problems with current medication or treatment program, and (3) feelings of anxiety, worries, or frustration. Figure 7 shows the causes, actions and outcomes of these situations. In most cases, having a health issue or experiencing physical or mental symptoms was the main trigger for participants to search health information. In one case, a participant searched for health information because his spouse was having health complaints. Problems with medication or treatment took place when participants experienced negative side effects of medication or when they underwent alternative therapy options because the waiting period for seeing a medical specialist took too long. Respondent ARI-01: *'Have previously mentioned that I try some new pills through my doctor. It has now gone about a month and I feel no improvement. As I travel abroad tomorrow and am gone for a week, I cannot contact my doctor at the time.* Feelings of anxiety, worries, or frustration were triggers to search for health information when participants had concerns regarding the use of new medication, feeling frustrated when physical activity does not improve while following a physical activity treatment plan, and worries regarding the health of a family member.

Older adults with ARI mostly contacted a medical professional after which they had a diagnostic examination or started/adhered to treatment programs. In nine situations participants searched online. In three cases, this lead them to starting with self-treatment, such as following a self-help therapy they found online, or buying medication. Respondent ARI-01, who could not contact his doctor, started searching online on a hospital website. There, he found an online training program he could follow during his travels: *'I will therefore try with some psychological training before contacting my doctor'*. In another situation, one respondent thought she had to wait too long before seeing a secondary care specialist. She talked to her spouse, who recommended a primary care specialist, as an alternative treatment option, which is easier accessible and has shorter waiting periods.

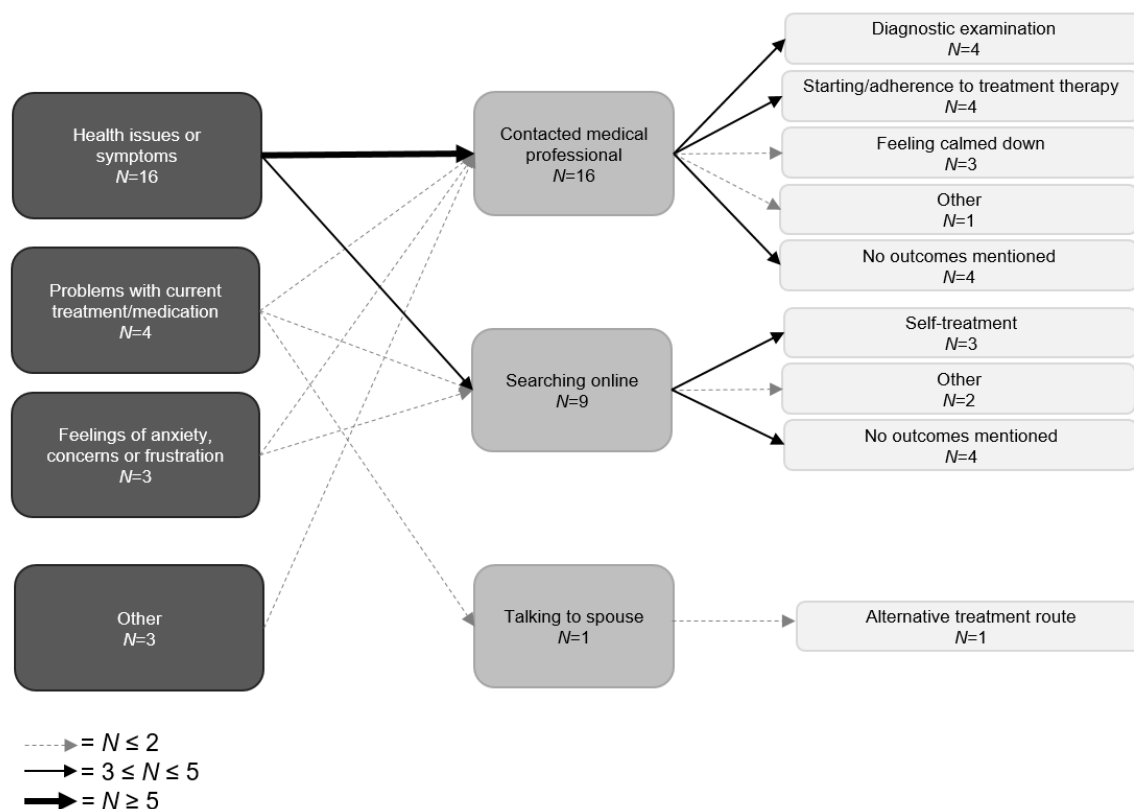


Figure 7: Causes, actions, and outcomes of active HIB situations of older adults with age-related impairments.

3.4.4.3 Passive HIB

Older adults passively received health information in twelve situations. During these situations, combinations of personal, social, environmental, and medical/health factors led participants to encounter and passively consume health information. Figure 8 here below shows per category feelings participant had during these situations, people that were involved, locations, and medical factors that influenced these situations.

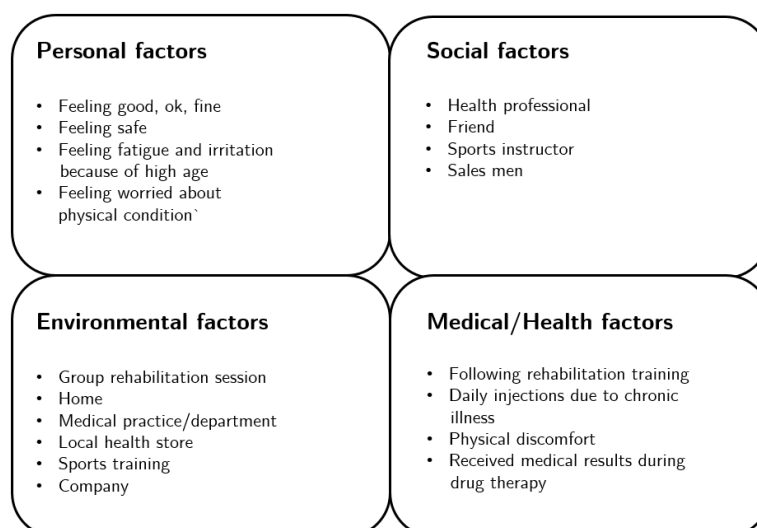


Figure 8: Personal, social, environmental and medical factors that trigger passive HIB situations among older adults with age-related impairments.

Below, two passive HIB situations are described in more detail, to illustrate how interactions between personal, social, environmental, and medical factors, influenced passive HIB situations among older adults.

Situation 1: Social encounter	Situation 2: At the local health store
Respondent ARI-02 was at his company (environmental), where he was drinking a cup of coffee with a friend (social). During this get together, he talked about fatigue and irritation because of high age (personal).	Respondent ARI-05 was at the local health store (environmental), where she talked to the salesman working there. She talked about feeling tired for a longer period (medical). She felt safe there talking about it (personal), because she knows the personnel there. She's been coming there for many years. She bought vitamin D to boost energy.

Based on the information older adults received in these passive HIB situations, they decided to continue with ongoing treatment or therapy, start a new treatment programme or engage in self-help treatment. Another outcome of these situations was 'adjustments in daily life' is illustrated by respondent ARI-05, who searches for ways that she can incorporate physical activity advice from his physiotherapist into her daily life to avoid further physical strain. She illustrates this by the following example: *"Most likely, I have overloaded my knee by carrying on grandchildren for the last 4 days. Now I tried to avoid that"*. Finally, in one situation an 'assistive aid' was an outcome that occurred in combination with therapy adherence. Here, the participant went to her physical therapist for one health condition and received a medical aid to prevent other health symptoms she did not come in for.

Table 12: Outcomes of passive HIB situations of older adults with age-related impairments.

Outcomes	Frequency	Respondents
Therapy adherence	5x	ARI-05
Self-treatment (medication/therapy)	1x	ARI-05
Adjustments in daily life	1x	ARI-05
Assistive aid	1x	ARI-05
No outcome mentioned	4x	ARI-02, ARI-04

3.4.4.4 Avoidant HIB

There were 36 situations in which older adults consciously decided not to search for health information. We identified five reasons for this decision, which are ranked from most frequently to least frequently mentioned: (1) No health cause, (2) Events/activities, (3) Holidays, (4) Time constraints, (5) Other. The first reason occurred when participants had no health problems or symptoms and thus did not feel the need to search health information. The second reason was mentioned when participants were occupied with social or family events, such as birthdays and activities with friends. ARI-05: *'I was invited to a summer house with some friends together with my oldest daughter and the two grandchildren'*. Third, during holidays participants did not want to search for health information. Fourth, participants sometimes had no opportunity to search for health information because of busy schedules. Fifth, in the other category there were various individual reasons that were mentioned only once. One participant was mentally occupied with becoming a grandparent (ARI-05). Another participant wanted to wait to see if he or she experienced side effects from medication before searching health information (ARI-01).

3.4.5 Health information behaviour of people with chronic pain

3.4.5.1 Sources and topics of health information

Chronic pain patients searched for or encountered health information in 22 situations. During these active and passive HIB situations, the most common sources for information were conversations with other persons (72.7%) and the internet (18.2%). In two (9.1%) situations, other types of sources are mentioned.

In 43.8% of all conversations, the patients talked with health professionals, such as a physical therapist, an occupational therapist, and neurologist. Also, conversations were held with friends and family members and acquaintances. During Internet search strategies, health and medical websites were most often visited.

The following topics of health information were identified during both active and passive HIB situations:

- 1) **Symptoms:** Participant(s) that had physical complaints or discomforts searched online for an explanation of their symptoms
- 2) **Treatment:** Participant(s) discussed their treatment programme with others
- 3) **Disease/condition:** Participant(s) had (potentially) a specific health condition and they wanted more information on the condition;
- 4) **Posture:** Participant(s) received personal tips about improving their posture to reduce pain.
- 5) **Diagnostic process:** Participant(s) received information before undergoing medical tests
- 6) **Mind-body connection:** Participant(s) were thinking or talking to other persons about how the mind can influence the physical body.
- 7) **Anxieties because of chronic illness:** Participants worry about their health
- 8) **Future prospects:** Participant(s) talked about how their future will look like in relation to their chronic health condition.
- 9) **Other people's personal experiences:** Participant(s) received information on the experiences of other people regarding their health conditions.
- 10) **Alternative treatment (non-conventional) options:** Participant(s) received information on alternative non-conventional treatment options (i.e. self-healing).

Table 13: Sources and topics of health information, type of device used in HIB situation and type of HIB (active or passive) of chronic pain patients.

Source		Topics of health information	Device	HIB	Participants
Internet (4x)	Health/medical websites (2x)	▪ Disease / Condition (2x)	▪ Tablet (2x) ▪ PC/Laptop (1x)	Active	CP-05
	Google (1x)	▪ Symptoms	▪ PC/Laptop	Active	CP-03
	Unspecified (1x)	▪ Symptoms	▪ Tablet	Active	CP-01
Conversation (16x)	Health professional (7x)	▪ Treatment (4x) ▪ Mind-body connection (2x) ▪ Diagnostic process	▪ Face-to-face	Passive	CP-02, CP-03, CP-04
	Friend (3x)	▪ Symptoms ▪ Future prospects on health ▪ Other people's experiences (1x) ▪ Mind-body connection	▪ Face-to-face (4x) ▪ Telephone (1x)	Passive	CP-01, CP-02,
	Family member (3x)	▪ Symptoms ▪ Future prospects on health ▪ Anxieties ▪ Posture	▪ Face-to-face (4x) ▪ Telephone (1x)	Passive (4x), Active (1)	CP-02, CP-05
	Acquaintance (2x)	▪ Treatment	▪ Face-to-face	Passive	CP-03

		▪ Other people's personal health experiences			
	Nonconventional healing teacher (1x)	▪ Treatment	▪ Face-to-face	Passive	CP-01
	Colleague (1x)	▪ Mind-body connection	▪ Face-to-face	Passive	CP-05
Other (2x)	Patient package insert	▪ Symptoms	▪ None	Active	CP-05
	Medical report	▪ Disease/condition	▪ Tablet	Passive	CP-05

3.4.5.2 Active HIB

The main motivation for chronic pain patients to search for health information was when they experienced health issues or symptoms (see Figure 9). Respondent CP-01 was experiencing much pain and was alternating between feeling warm and cold. She went searching online to find out if this was a common side-effect of the chronic illness she has. None of the online searches that were caused by experiencing symptoms or health issues led to any specific actions or outcomes. Respondent CP-05 was also experiencing health issues: Being under the weather and for several days now I have a nagging tickling cough. Do I have something in my house that could remedy this? (Translation from Dutch: *'Erg verkouden en al dagen een droge kriebelhoest. Heb ik iets in huis wat helpt?'*). She read the patient provider insert of a cough syrup she had at home. After reading it, she decided to buy another type of supplement.

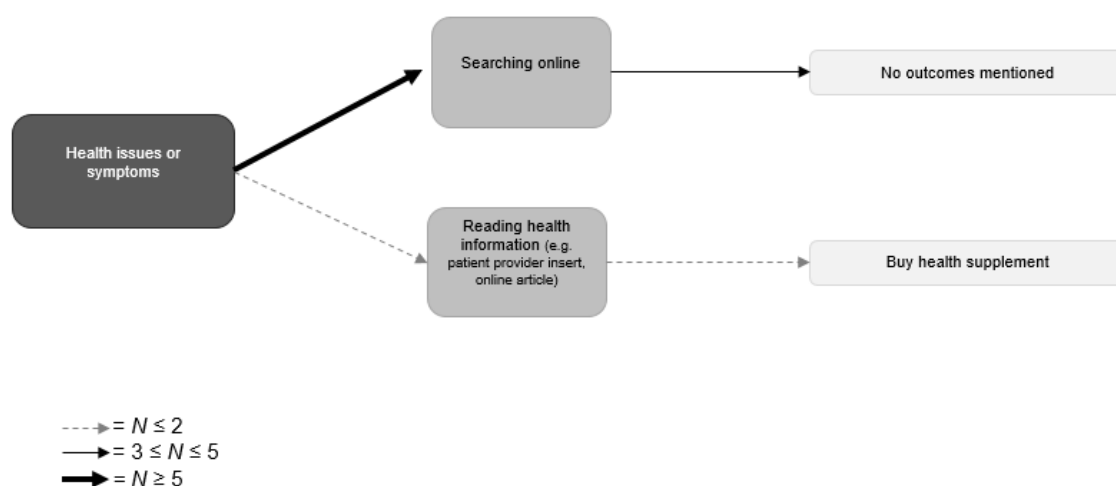


Figure 9: Causes, actions and outcomes of active HIB situations of multidisciplinary rehabilitation patients.

3.4.5.3 Passive HIB

Chronic pain patients passively received health information in seventeen situations. During these situations, combinations of personal, social, environmental, and medical/health triggers led participants to encounter and passively consume health information. Figure 10 here below shows per category feelings participant had during these situations, people that were involved, locations, and medical factors that influenced these situations.

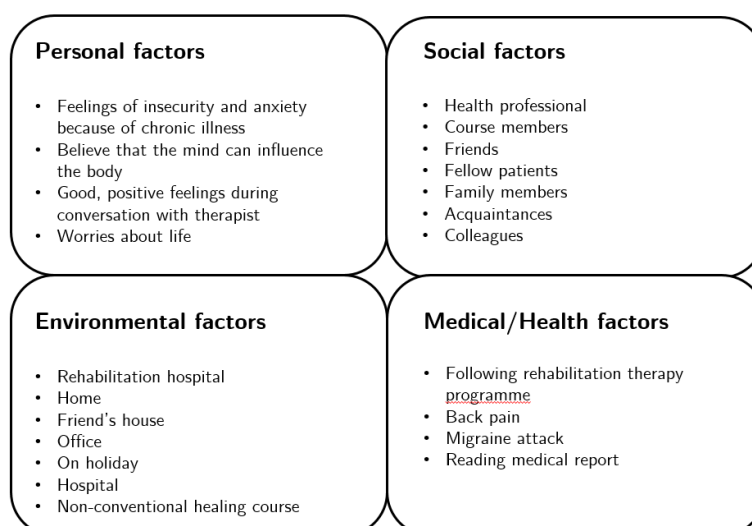


Figure 10: Personal, social, environmental and medical factors that trigger passive HIB situations among multidisciplinary rehabilitation patients.

Here below, two passive HIB situations are described in more detail, to illustrate how interactions between personal, social, environmental, and medical factors, influenced passive HIB situations among chronic pain patients.

Situation 1: Social encounter	Situation 2: At the office
Respondent CP-02 was visiting friends with his spouse (social, environmental). During this visit, he talked about the pain in his back and future prospects (medical). It is a topic on which he worries about a lot (personal). He feels insecure about his future. He will start a therapy programme at a rehabilitation centre (medical) and hopes that will improve his condition.	Respondent CP-05 went to her office (environmental) and talked with her colleagues (social) about her therapy programme at the rehabilitation centre (medical). During that conversation, one colleagues recommended a book for her to read. She wants to borrow that book.

Based on the information chronic pain patients received in these passive HIB situations, there were several outcomes, which can be viewed in Table 14. Respondent CP-05 decided to follow the advice of her son. She heard from him that she had a bad posture while sitting. This is something she wants to work on in the future. Respondent CP-01 was following an introductory course on non-conventional healing. There, someone told her about ways to cope with your pain. This is a topic she wants to learn more about. Respondent CP-03 was hospitalized because of a heavy migraine attack and needed to undergo a diagnostic process to identify the cause of the attack. In eleven situations, no outcomes of the passive HI situation were mentioned.

Table 14: Outcomes of passive HIB situations of multidisciplinary rehabilitation patients.

Outcomes	Frequency	Diary entries
Following advice from non-health professionals	2x	CP-05
Searching for health information	2x	CP-05
Learning about non-conventional treatment options	1x	CP-01
Therapy adherence	1x	CP-04
Undergoing diagnostic process	1x	CP-03

Contemplating about health topic	1x	CP-01
No outcome mentioned	11x	CP-01, CP-02, CP-03, CP-04

3.4.5.4 Avoidant HIB

There were 10 situations in which chronic pain patients consciously decided not to search for health information. There were: (1) Pain levels too high, (2) Holiday, and (3) Other. In four situations, participants were experiencing too much pain to engage in active HIB situations. Respondent CP-02 wrote that one day he did too much. Because of this in pain levels rose. Those higher pain levels, in combination with feeling quite tired, was a reason for him not to search for health information. Two situations of avoidant HIB situations because of holidays were described by respondent CP-05. In these situations, preparing for holidays and the holiday itself was a reason for her not to engage in HIB. 'Other' situations consisted of reasons for avoidant HIB which were only mentioned once. These reasons were mental overload, busy with other activities, events/activities and taking a leisure day. Mental overload can be explained by the diary entry of respondent CP-05. He had a lot on his mind and was constantly thinking about his health. As he stated: I keep thinking about it (red: my health) in my head and I cannot stop it. I just want some peace now and then (Original text: *'Het gaat maar door in mijn hoofd en kan het niet stoppen. Ik wil af en toe gewoon rust.'*). Because of this mental overload, he cannot focus on other things. Respondent CP-03 was having a day off, so she decided not to think about her health. Respondent CP-05 was busy doing house chorus, which distracted her from thinking about her health or healthy living.

3.4.6 Health information behaviour of people with diabetes mellitus type 2

3.4.6.1 Sources and topics of health information

Diabetes mellitus type 2 patients searched for or encountered health information in 171 situations. During these active and passive HIB situations, the most common sources for information were conversations with other persons (42.7%) and the internet (34.5%). Books, magazines or newspapers were mentioned in 6.4% of the HIB situations and television programs in 4.1% of the situations. In 12.3% of the HIB situations, participants mentioned other sources, such as emails, medical equipment (i.e. glucose meters) and food packaging labels. Table 15 shows the complete overview of each source and channel and the type of health information they sought there or encountered.

Diabetes type 2 patients most often talked to family members, health professionals and friends about their health. There were also some conversations with sports instructors and colleagues. During Internet search-strategies, the most common sources for health information were: (1) diabetes-specific health websites, (2) social media, (3) health/medical websites, and (4) google. For the category 'Books, magazines and newspapers', participants mostly identified newspapers as a source for health information.

The following topics of health information were identified during both active and passive HIB situations:

- 1) **Nutrition:** Participant(s) searched for or discussed with other the nutritional values of food products
- 2) **Blood sugar levels:** Participant(s) checked their blood sugar levels with glucose meters or discussed their blood sugar levels with others
- 3) **Diabetes:** Participant(s) searched for information on diabetes in general or discussed this topic with other people
- 4) **General health:** Participant(s) read articles, watched television programs and talked with others about general health topics that are not related to diabetes
- 5) **Research:** Participant(s) read research articles on diabetes and general health conditions
- 6) **Symptoms:** Participant(s), when experiencing physical complaints or discomforts, searched for an explanation of their symptoms

- 7) **Medication:** Participant(s) searched for information on side effects or preparation of medication
- 8) **Disease/condition:** Participant(s) searched or discussed information on a specific health condition
- 9) **Finances:** Participant(s) discussed about their health in order to receive financial compensation for health costs they made.
- 10) **Physical activity:** Participant(s) searched information on physical exercises or sports activities
- 11) **Treatment:** Participant(s) wanted more information on the treatment plans or searched for alternative or non-conventional treatment options
- 12) **Diagnostic process:** Participant(s) received information before undergoing medical tests
- 13) **Medical aids:** Participant(s) encountered or searched for information on medical aids (i.e. glucose meters, compression socks)
- 14) **Health information source:** Participant(s) searched for a new source for health information, specific for their health condition.
- 15) **Negative feelings:** Participant(s) thought or discussed about negative feelings, such as anxieties, insecurities or stress they have because of their illness.
- 16) **Medical results:** Participant(s) received the results from the medical tests or consultations with healthcare professionals

Table 15: Sources and topics of health information, type of device used in HIB situation and type of HIB (active or passive) of diabetes type 2 patients.

Source		Topics of health information	Device	HIB	Participants	
Internet (59x)	Diabetes-specific health website (23x)	Nutrition (7x)	PC/Laptop (11x)	Active (7x), Passive (15x)	DM2-01, DM2-02, DM2-03, DM2-04, DM2-06, DM2-07, DM2-11	
		General DM2 (7x)	Tablet (7x)			
		Blood sugar levels (2x)	Smartphone (5x)			
		Research (2x)				
		Symptoms (2x)				
		Medication				
		Self-management				
		Disease/condition				
	Social media (13x)	Nutrition (6x)	Smartphone (12x)	Passive (12x), Active	DM2-04, DM2-07, DM2-08, DM2-11, DM2-12	
Disease/condition	PC/Laptop					
Physical activity						
Research						
Treatment						
General DM2						
Medication						
Unspecified						
Health/medical website (11x)	Treatment (3x)	Smartphone (6x)	Active (8x), Passive (3x)	DM2-01, DM2-02, DM2-04, DM2-07, DM2-10, DM2-11, DM2-12		
	Medication (2x)	PC/Laptop (5x)				
	Symptoms (2x)					
	Research					
	Health information source					
	Medication					
	General DM2					
	Nutrition					

	Google	Nutrition Disease/condition Blood sugar levels Medication Symptoms	Smartphone (3x) PC/laptop (2x)	Active (5x)	DM2-05, DM2-10, DM2-11, DM2-12
	Apps/app store (2x)	Physical activity Diabetes	Tablet Smartphone	Active, Passive	DM2-03, DM2-08
	News site (3x)	Nutrition Medication Research	Smartphone (2x) Tablet	Passive	DM2-02, DM2-03, DM2-11
	Sports website (1x)	Physical activity	Tablet	Active	DM2-03
	Non-conventional health website	Treatment	Smartphone	Active	DM2-11
	Unspecified (3x)	Symptoms (2x) Nutrition	Smartphone (3x)	Active (3x)	DM2-02, DM2-10, DM2-11
Conver- sation (73x)	Family members (23x)	Nutrition (9x) Blood sugar levels (3x) Symptoms (3x) General health (2x) Negative feelings Medication Diagnostic process Medical equipment Treatment Unspecified	Face-to-face (21x) Telephone call Unspecified	Passive (20x), Active (3x)	DM2-01, DM2-02, DM2-03, DM2-04, DM2-05, DM2-06, DM2-07, DM2-09, DM2-10, DM2-11
	Health professionals (20x)	Diagnostic process (5x) Disease/condition (4x) Treatment (2x) Symptoms (2x) Medication Nutrition General health themes Medical equipment Physical activity Blood sugar levels General DM2	Face-to-face (18x) Telephone call (2x)	Active (6x), Passive (14x)	DM2-01, DM2-03, DM2-05, DM2-07, DM2-08, DM2-10, DM2-11, DM2-12
	Friends (14x)	General DM2 (3x) Blood sugar levels (3x) Medication (2x) Nutrition General health themes Symptoms	Face-to-face (13x) Telephone call	Passive (14x)	DM2-01, DM2-02, DM2-04, DM2-05, DM2-06, DM2-07, DM2-09

		Medical equipment Medical results Treatment			
	Colleagues (5x)	Blood sugar levels Physical activity General DM2 Negative feelings Symptoms	Face-to-face	Active (1x), passive	DM2-10, DM2-12
	Sports instructor (3x)	Physical activity (3x)	Face-to-face	Passive	DM2-01, DM2-12
	Acquaintance (2x)	General DM2 Disease/condition	Face-to-face	Active, Passive	DM2-02
	Strangers (2x)	General health Disease/condition	Face-to-face	Passive	DM2-01, DM2-07
	Boots chemist	Medication	Face-to-face	Active	DM2-06
	Local Citizen's advice worker	Finances	Face-to-face	Passive	DM2-03
	Citizen's Advice – hearing board	Finances	Face-to-face	Passive	DM2-03
	Barber	Disease/condition	Face-to-face	Passive	DM2-12
	Medical secretary	Treatment	Telephone call	Passive	DM2-07
	Customer at work	Physical activity	Face-to-face	Passive	DM2-10
Book, magazine, newspaper (11x)	Newspaper (8x)	General health themes (3x) Nutrition Medical equipment Treatment Research Physical activity	N.a.	Passive	DM2-01, DM2-02
	Carb counting book	Nutrition	N.a.	Active	DM2-10
	Diabetes leaflet	Disease/condition	N.a.	Passive	DM2-05
	Unspecified	Medication	Tablet	Passive	DM2-09
Television program (7x)	BBC (5x)	Treatment Nutrition General health themes Research Medical equipment	Television set	Passive	DM2-01
	Channel 5	Nutrition	Television set	Passive	DM2-02
	Unspecified	Nutrition	Television set	Passive	DM2-01
Other (21x)	Email (9x)	Research (4x) General DM2 (2x) Nutrition (2x)	Smartphone (5x) PC/Laptop (3x) Unspecified (1x)	Passive (7x), Active, (2x),	DM2-02, DM2-03, DM2-07, DM2-11

		Medical equipment			
	Food label (4x)	Nutrition (4x)	N.a.	Active	DM2-01, DM2-09, DM2-10, DM2-11
	Medical equipment (6x)	Blood sugar levels (5x) Symptoms	N.a.	Active	DM2-06, DM2-10
	Health practice	Medication	Smartphone	Passive	DM2-03
	Cinema advertisement	Research	N.a.	Passive	DM2-09,
	Health store	Nutrition	N.a.	Active	DM2-10
	Unspecified	Symptoms	N.a.	Active	DM2-06

3.4.6.2 Active HIB

There were five main motivations for diabetes type 2 patients to search for health information and one leftover category containing motivations that only occurred once or twice. In Figure 11 below, a graphical overview is provided of the main causes, actions and outcomes of active HIB situations among diabetes type 2 patients.

The five main causes were: (1) Health issues or symptoms, (2) preparing or having a meal, (3) preparing for sports class or activity, (4) contemplating to join a diet program or just started a diet program, and (5) feelings of anxiety, concerns or frustration. Unique for diabetes type 2 patients is that when checking their blood sugar levels, the results affected the outcome of that situation. When the blood sugar levels were normal, they could resume their daily activities. However, when the levels were low, they had to take protective measures, such as eating fast acting carbs, cancelling sports activities or informing their spouse about their low blood sugar levels.

An example of a situation in which a health issue or symptom triggered an active search strategy is given by participant DM2-06. He woke up one morning feeling sick and dizzy. He checked her blood sugar levels which were normal. He undertook no further actions. Preparing for or having a meal was often a trigger for participants to actively search for nutritional values of foods or calorie contents. Participant DM2-10 was at home preparing dinner. She was wondering how many carbs there were in spaghetti Bolognese. She checked their carb book and programmed the information in her glucose meter, that tells her how much insulin she has to take. In another situation, a participant had difficulty finding the nutritional information. Participant DM2-11 was, while preparing dinner, discussing with her husband how healthy the meal was. She went online to calculate the calorie content of the meal. She felt unsure because there exist good and bad carbohydrates.

The diabetes type 2 patients prepared for physical exercises or sports training by searching for pre-workout snacks that would help them retain normal blood sugar levels and by checking their blood sugar levels before the activity. Participant DM2-10 intended to do a run. Before starting, she checked her blood sugar levels to know if these were high enough to sport. The glucose levels were too low for her to exercise.

Some diabetes type 2 patients just started a diet program or were thinking about joining one. This was for them a motivation to search for health information, such as was the case for participant DM2-07. He was waiting for an appointment and thinking about an email to register for a low-carb program she received. She searched some information online, after which she decided to join the program. As she stated: *'Good to double check and make me feel more confident'*.

Last, some participants were had negative feelings like anxieties, sadness or stress. This motivated them to search online for health information. Participant DM2-01 was discussing with family members the effects of diabetes on life expectancy. She felt anxious about this topic and searched more information online. No further outcomes were mentioned.

Examples of the 'Other' category are situations in which a participant received new medication after a visit from the doctor and searched online for more information (DM2-01), a participant who felt confused by all the conflicting health information available and searched for a trustworthy source of evidence-based health information (DM2-02), and a participant (DM2-08), who spoke with her diabetes nurse about managing her medication while preparing for a medical procedure.

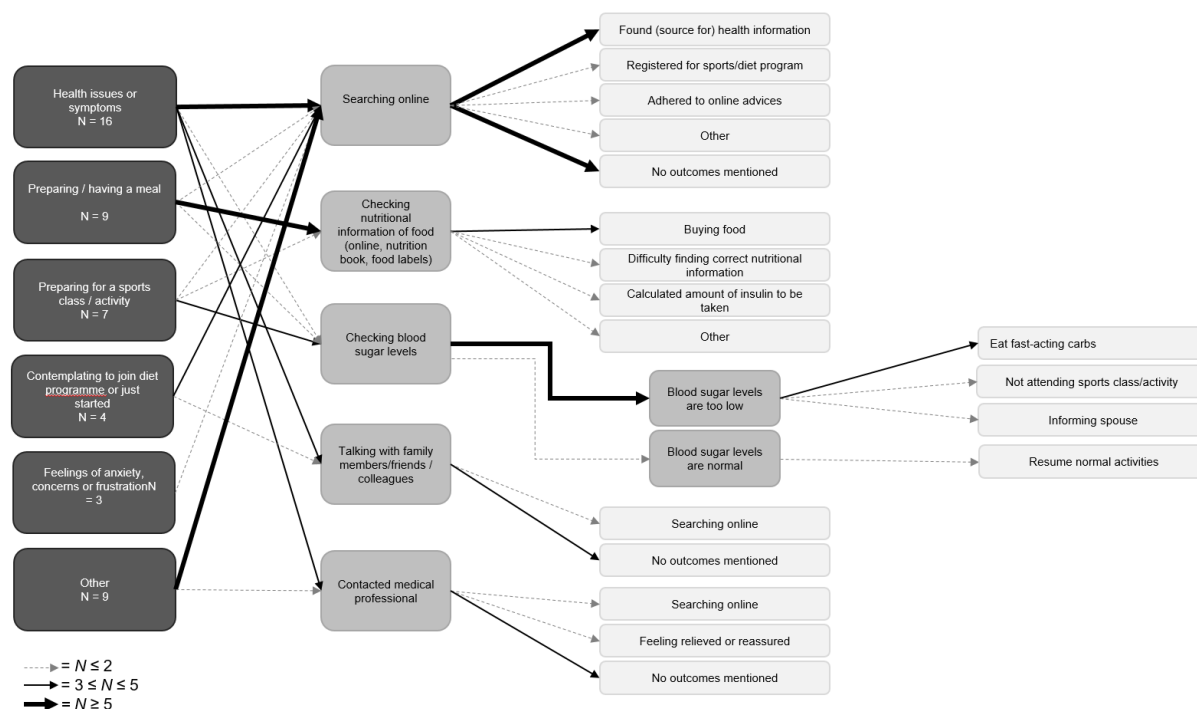


Figure 11: Causes, actions and outcomes of active HIB situations of diabetes type 2 patients.

3.4.6.3 Passive HIB

Diabetes type 2 patients passively received health information in 120 situations. During these situations, combinations of personal, social, environmental, and medical/health factors led participants to encounter and passively consume health information. Figure 12 here below shows per category feelings participant had during these situations, people that were involved, locations, and medical factors that influenced these situations.

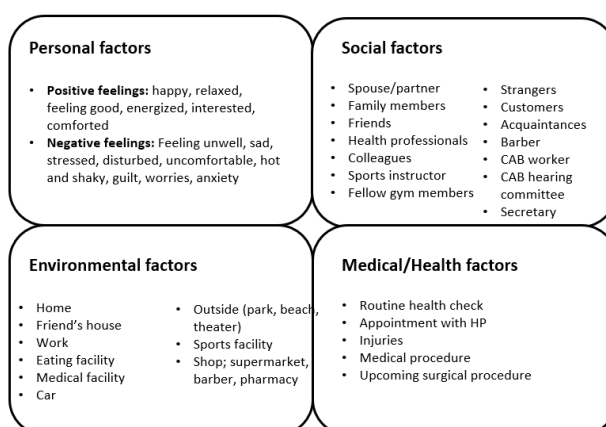


Figure 12: Personal, social, environmental and medical factors that trigger passive HIB situations among diabetes type 2 patients.

Next, in two passive HIB situations the interplay between personal, social, environmental and medical factors are described in more detail.

Situation 1: At the diabetes clinic	Situation 2: Social encounter
Participant DM2-10 was at her routine health check-up at the diabetes clinic (environment), where she spoke to the diabetes nurse (social). They talked controlling blood sugar levels while exercising. Also, she asked the nurse if a new glucose meter would be available for her.	Participant DM2-01 was having coffee with a friend (social) in a garden centre (environmental). She felt relaxed (personal), while discussing how having diabetes affects her daily life.

After encountering health information, diabetes type 2 patients undertook actions in 24 situations. Most often, they made decisions or plans to act on the information received, not the actual action itself. For example, participant DM2-10 stated '*I diarized the [read: glucose meter] as it isn't available until November 2018*'. Also, talking to family members and health professionals was often an outcome of a passive HIB situation. After encountering health information, participant DM2-05 wrote: '*Passed info to my daughter who has [red: chronic illness]*'. In three situations, participants consciously decided not to take any further actions because of various reasons. In one of these situations, the participant questioned the validity of the newspaper article she read: '*I thought it was too simplistic and the header was misleading*'. In another situation, a participant searched for more information on glucose meter after reading an email that contained an article about non-invasive glucose meters. She wrote: '*I looked into buying my own glucose monitor but felt confused and didn't purchase one*'.

Two times participants made concrete plans for physical activities, instead of planning on doing activities. For example, participant DM2-10 registered for a running contest. In nine situations, participants DM2-02 did not specify their actions.

Table 16: Outcomes of passive HIB situations of diabetes mellitus type 2 patients.

Outcomes	Frequency	Participants
Planning on taking action	6x	DM2-02, DM2-03, DM2-08, DM2-10
Talking with family member	4x	DM2-02, DM2-05, DM2-11
No actions	3x	DM2-02, DM2-05
Talking with health professional	2x	DM2-03
Scheduling physical activities	2x	DM2-07, DM2-12
Monitoring blood sugar levels	2x	DM2-06, DM2-11
Registered for participation in nutrition program	1x	DM2-03
Request for financial aid	1x	DM2-03
Following online diabetes self-management platform on social media	1x	DM2-11
Appointment for medical examination	1x	DM2-05
Adherence to exercise program	1x	DM2-12
Reading medical brochure	1x	DM2-07
Unspecified	9x	DM2-02, DM2-01, DM2-08, DM2-07

3.4.6.4 Avoidant HIB

There were 25 situations in which diabetes type 2 patients consciously decided not to search for health information. We identified four reasons for this decision, which are ranked from most frequently to least frequently mentioned: (1) Time constraints, (2) No health cause, (3) Negative feelings (i.e. stressed, worries), (4) Other. In many situations, participants were too busy with work, chores around the house

or other activities to think or worry about their health. As participant DM2-06 wrote: *'Too busy finishing off refitting a new bathroom no time to think about health issues'*. One participant (DM2-07) mentions how she keeps herself occupied with other tasks to refrain from worrying about her health. She wrote down in their diary: *'Just too busy as per usual. I find when I am busy non-stop I simply don't have time to worry about health issues. It is 22:30 right now and I am only just getting down to my emails'*. The second reason for avoiding health information is when participants had little to none health problems and thus had no need to search for information. The third reason is that participants feel that thinking about their health or diabetes affects their mood negatively. Participant DM2-04 wrote that he does *'not wanting to obsess about my diabetes'*, and participant DM2-11 wrote *'Sometimes I feel I think too much about my health and it affects my mood'*. Finally, in the 'Other' category a number of reasons were mentioned that only occurred once. Examples were technical barriers, no access to WiFi (DM2-08), going on holidays (DM2-06), and *'taking a day off from thinking about my medical problems'* (DM2-07).

3.4.7 Health journeys

3.4.7.1 Health journey of older adults with age-related impairments

For an older adult, his (or her) age-related complaints start most often with some slight physical discomfort or problems, *"It started with sudden knee pain"* (ARI-01). He visits their GP to know the cause of this discomfort. The GP sends him to the hospital for tests and scans before giving a diagnosis. However, in most cases, no clear cause of the pain or discomfort is found. The older adult goes back home while receiving medication to relieve his symptoms, *"first went to a doctor who recommended a week with painkillers (ipren) and intensive physiotherapist-help with other people that also has knee problems"* (ARI-05). A couple of weeks or even months later, the older adult has a severe medical incident, like fall down the stairs or a heart attack. He is rushed back to the hospital, undergoes more extensive tests and scans and finally receives the correct diagnosis, *"I felt that after my heart attack, this was the first time I was really taken serious"* (ARI-02), and *"The problem wasn't the knee but my left hip"* (ARI-01). After a while, sometimes an operation is needed, he goes back home with the right medication and treatment program. His condition stabilizes, he even feels sometimes, his condition is actually better than before the whole journey, *"It sometimes become better by the end of the journey. It may also be that you get completely healed in the end, and then the condition is not worsened"* (ARI-02). A graphic representation of this health journey can be viewed in Figure 13 below.

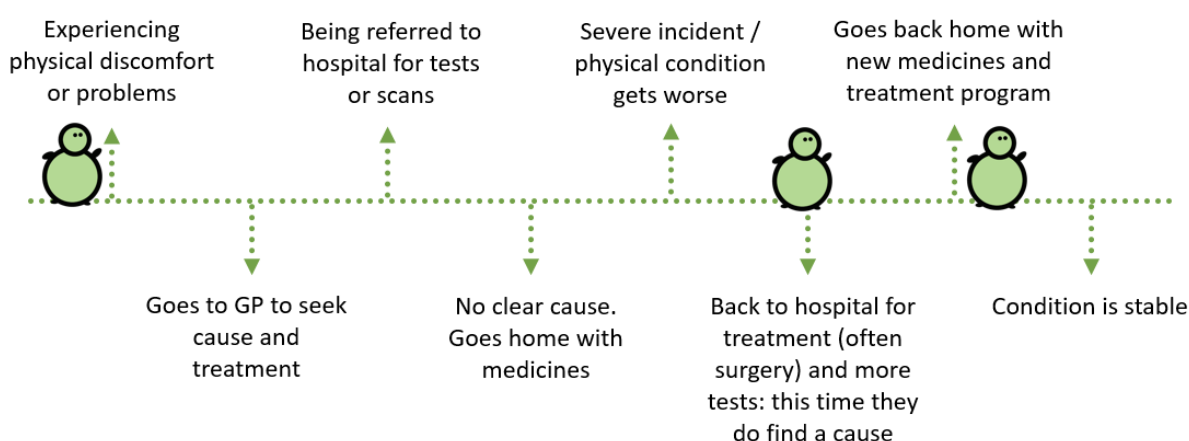


Figure 13: Health journey of older adults with age-related impairments. Each blob-coach represents a moment in the health journey where patients indicated they would have liked more information and/or virtual coaching.

Moments of intervention

Three main moments were identified in the health journey where older adults thought a virtual coach could assist them: (1) before the start of the health journey, (2) before a surgery, and (3) after they go back home with the right diagnosis and treatment program.

The first moment is before the health journey actually begins: *“As a conversation about how to get through the course. It could also help with a beep that tells you to remember the daily walk, but my smartwatch already does that”* (ARI-03). Although, participants ARI-01, ARI-02, and ARI-03 did mention it was difficult to imagine how to use the Council of Coaches preventive, they said they could possibly use it only if the technology was of high quality and that it could actually help them in getting a better physical shape.

A second moment is before a surgery, where virtual coaches could give guidance on preparing for the surgery and how get back in shape after a surgery, as ARI-07 states: *“The virtual coaches would be good to have before and after an operation to help by preparing the patient before the operation (what would be good to eat, how much, how much physical activity can you do afterwards, etc.)”*.

The last moment is near the end of the health journey, after having had a surgery of finally receiving the right diagnosis. The older adults go back home from the hospital and tries to adjust to the daily routines again. They are motivated to get their physical condition back to its old level. Respondents ARI-07 and ARI-08 explain how this moment could be a possibility for a virtual coach: *“Afterwards [red: after surgery] it would be good if the coaches have a more guiding character, and can help you with your exercises and how to go forward.”*. Also, ARI-03 states: *“Maybe, in the end of a health journey it could be nice with a coach which you can talk to about how you can feel even better”*.

Types of coaches and information

The older adults mentioned the following types of coaches as considered relevant for them:

- Medical guidance coach
- Diet coach
- Sports coach
- Mental coach
- Not: physical therapy coach

The medical guidance coach is several times mentioned as a coach who could help them with their medical issues, such as telling them when to go to the doctor, having knowledge of the individual's medical history, and advice of medication, such as side-effects and proper medication usage. ARI-04 says: *“Absolutely in the connection to the contact with the GP. Here the coach could refer to the history of illness (eg previous cancer course) and warn about apparent common symptoms (eg back pain) that have a particular risk of being a sign of something worse (eg cancer again)”*. ARI-01, ARI-02, ARI-03 would like a coach that helps them to decide if they have to go to a GP. They give the following example *“If you have a back injury, then the coach must ask questions to understand it. How does it hurt, what did you do, etc.?”*. ARI-02, ARI-07, and ARI-08 would especially like a coach that gives information on the medication they take. Side-effects and correct usage and doses are important. As ARI-02 states: *“Maybe it could also help by telling; How does this medicine work and how should I take it, what can happen the next 48 hours. A calming and guiding function”*. ARI-01, ARI-02, ARI-03 would also like it if this type of coach could be a bit critical and *“... tell you what happens if you don't take your pills”*.

ARI-01 mentioned also a dietician should be valuable to the coach-team and ARI-01, ARI-02, and ARI-03 in addition would like a sports and mental coach, *“Most important: One can calm the patient down and show care, psychological help”*. ARI-07 ARI-08 are worried this type of coaches are not intelligent enough to give psychological support. The sports coach should also notify them on local events: *“The sports supervisor who finds that you like playing ball, and then finds a good place for playing ball to a fair price, where they also have a specific team for the elderly!”*

Four respondents (ARI-01, ARI-02, ARI-03, ARI-05) had difficulty visualizing a physical therapist as a coach for the council, because he said: *“When I am at the physiotherapist, he can look at my movements and correct me when I do something wrong. I am worried that this can't be the case with a council of coaches”* (ARI-05).

3.4.7.2 Health journey of people with chronic pain

The health journey of chronic pain patients usually starts with a (work-related) accident or experiencing sudden pain, *"I worked many years at a greengrocer's and there I often had to lift heavy things. Presumably, that's the reason I ruined my back. They think. But of course, that manifests itself years later"* (CP-03). They go to their GP (or in case of a severe accident immediately go to the hospital), who refers them to the hospital for some tests and/or CT/MRI-scans. When the cause is found, they sometimes have a surgery. Then they go back home. The pain is manageable for a few years, most patients go back to work (although they do have to have an adjusted workplace or switch to a different function within the company) and are able to take care of their family, *"I left the company I used to work for. Through a relative of my wife I could have an adjusted job function in his (read: relative's) organization. I discussed with [read: institute for employee insurance] if I could do that. A job that was not so bad for my back. Because I was partly incapacitated for work. So, I transferred to that [read: relative's] company"* (CP-02). However, a few years later the pain resurfaces or is heavily increasing in the same or other places in their body, *"I have been pain-free for one year after the back surgery"* (CP-03). They go again to their GP, try out pain relief medication and have more tests at the hospital. This time, a (new) cause is usually found. This can be a relief for them, as participant CP-01 explains: *"Then you have something, a confirmation of your pain "*. There is a surgery (or second surgery for some patients) after which they are go back home. This time however, the pain does not reduce to a manageable level, but remains quite severe. They cannot go back to work and are not as able to take care of their family as before. A series of visits begins where they go to their GP, who refers them to a medical specialist, like a neurologist or rheumatologist, who sends them to a physical therapist. When that does not help, they go back to the GP or specialist, and the sequence starts again, *"Osteopath, then again GP. Referred to another rheumatologist. (...) Did not listen, sent me home with paracetamol. Then to the neurologist"* (CP-01). When there is little improvement over time, their GP or medical specialist refers them to Roessingh Centre for Rehabilitation for pain rehabilitation therapy. A graphic representation of this health journey can be viewed in Figure 14 below.

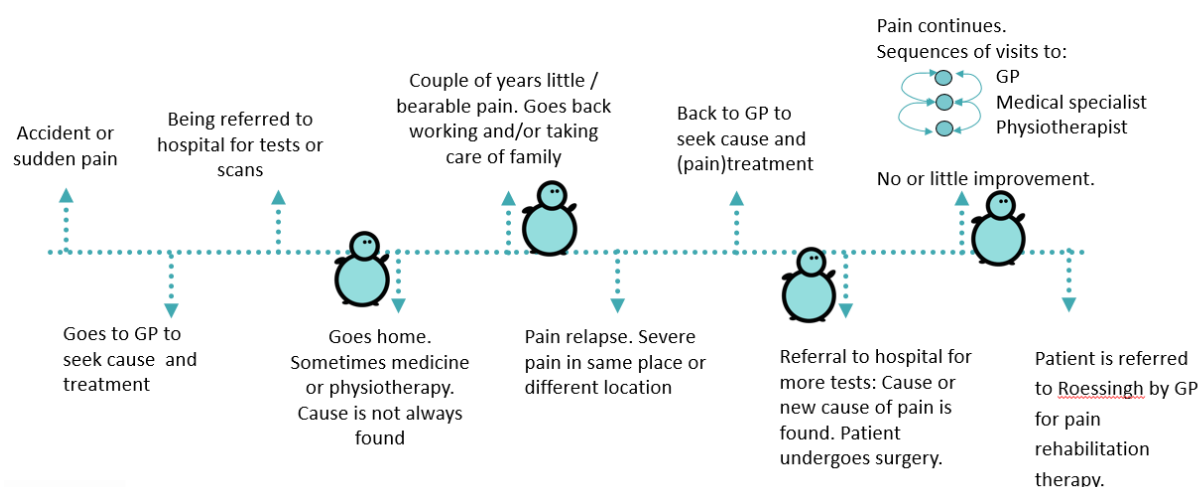


Figure 14: Health journey of chronic pain patients. Each blob-coach represents a moment in the health journey where patients indicated they would have liked more information and/or virtual coaching.

Moments of intervention

The chronic pain patients identified four moments in their patient journey where virtual coaching and extra information could have supported them: (1) after going home the first time, having had some medical tests/scans but no definite diagnosis; (2) during the years where the pain is on a relatively low or manageable level; (3) when they go back to the hospital for more tests and/or surgery, and; (4) after the surgery when they are 'stuck' in a loop of going to the GP, being referred to a medical specialist, being referred to a (physical) therapist.

The first moment is when they have had an accident or severe pain, the GP prescribes more medical tests/scans, but (often) no diagnosis is found. They go back home with medical or (physical) therapy. Respondent CP-01 states that virtual coach could be effective in this stage for mental and physical

coaching, on dealing with the pain in daily life: *"I think at this point, you would like support on the ways to handle this physically. It does not have to be only mentally".* Respondent CP-03 also would like support in finding the cause of the pain: *"You go home, sometimes with medicines or physical therapy. The cause is not always found. And then you want to know what the cause is. On that moment, you would like to consult someone".*

The second moment of intervention is right after the first. This is during the years the pain is low and they go back to work and taking care of their family. As respondent CP-01 states: *"Yes, maybe, it depends, it could also be here [red: at this stage] with prevention (..) yes, guarding the quality of life, I'm not sure if it is possible, but okay (..) for example a virtual coach that shows you how perform the exercises".* Respondent CP-02 would also like work-related advice in this stage: *"Maybe advice on the things you have to be careful for (..) In the meantime, I got an adjusted work-place, but I did not get any guidance on what I could and could not do with my back".*

During the third moment, before going to the hospital for surgery, respondent CP-03 would like advice on the surgery, what will happen after the surgery (how she would feel) and/or possible alternatives: *'I think before a surgery, I would like advice if I should do that surgery. I did not do that, but if people tell you 'the only option is the surgery, nothing else', I would like to know the outcomes of that surgery".*

In the last identified moment of intervention, respondent CP-02 would like more support on physical exercises, and CP-04 wants alternative treatment options. The physical exercises should be in line with or give information on the exercises the physical therapist prescribes. Respondent CP-04 explains why she wants more alternative treatment options: *"In that stage, you have had a long process behind you and of course you yourself has been looking and informing [red: on health and treatment]. But then you go back to the specialist and there you are again in the same loop of physical therapy. But you have had that already, every time, for 20 years actually".*

Types of coaches and information

The following types of coaches were considered important for patients with chronic pain:

- Physical therapy coach
- Occupational therapist
- Mental coach
- Medical coach
- Physician coach
- Pain coach

Respondents CP-01, CP-02, CP-03 and CP-05 mention a physical therapy coach as useful for the Council of Coaches. Respondent CP-02 says: *"Maybe on posture. A person so that you would do more therapy at home (..) [red: explanation on] posture. That you don't have a hollow back when it should be curved".* Respondent CP-05 wanted more information on how to ease the pain and what she can do to lessen the pain (more exercising, other medication, etc.).

Respondents CP-02 and CP-03 would also like an occupational coach, that helps them with their daily life activities. For CP-02 this should be more work-related, guidance on adjusting the workplace and job function, whereas CP-03 likes advice and tips on daily functioning, as she says: *"Occupational therapy. That helps me more than any other therapy. (..) I believe, how to get up out of a chair, I think that is important".*

A mental coach was mentioned by CP-01 as important during the phase that you have pain but don't know how to deal with this in daily life. The coach should help patients on expressing their fear and guiding them to retain their quality of life: *"I can imagine, when you are [read: at this stage] you can take away [read: symptoms] from the patient, because then you have a completely different perspective: someone goes home, but the cause is not found. "How does this influence you? What are you afraid of? That someone should also speak out, what they fear or think of. Yes, and from there possible, I don't know if that would be possible, but that you're going to draw up a plan online with someone".*

Respondent CP-04 mentioned a type of medical coach that gives advice on treatment options. As she explains: *"I would have liked to have heard from the specialist, not after she gave me another referral for*

the GP, that there was [read: pain rehabilitation therapy] was available. Then I would have already enlisted last year in May/June. That would save me a lot of months”.

Respondent CP-05 also mentioned a physician as a coach. Someone who can give a summary of all the medical tests that you (red. patient) have been through. She says: “I would like that all the doctors together examine my clinical profile and that one doctor draws a final conclusion [red: based on mutual agreement with other physicians]”. The same respondent also mentions that a pain coach would be nice, who provides some background on pain and its consequences. Also, the patient could discuss with the pain coach to assess whether certain factors influences the pain.

3.4.7.3 Health journey of people with diabetes mellitus type 2

The health journey of diabetes mellitus type 2 patients usually begins when they experience physical symptoms, like feeling tired all the time, having trouble with sleeping, frequent toilet breaks at night, etc. DM2-G02-03 described it as “Tiredness - Lethargic to life in general”. They consult their GP who advises to take a blood test. From this test, it becomes clear the patient has diabetes mellitus type 2. Sometimes their GP wants to do additional tests because he is not sure about this diagnosis or because, when diagnosed with DM2, s/he wants to know if there are diabetes-related health issues, such as eye- or foot problems. When diagnosed with DM2, the patient goes to information events organised by the hospital (DM2-G01-01, DM2-G01-02, DM2-G01-04,) or talk with their GP (DM2-G01-03, DM2-G02-06, DM2-G02-08, DM2-G02-09) in which he or she learns more about this condition. They also learn more on how they can control their diet to treat their condition and they receive medication. Then starts a ‘trial-and-error’ period in which they try to keep their blood sugar levels stable, by following dieting treatments and medication, for example as DM2-G02-05 says: “Hypos more frequent. Need to eat if not hungry”. The journey of DM2-G01-02 illustrates how first it went very well, “Changed shape drastically, lost weight. Results of tests spectacular, very good”. However, later it became more difficult: “Couldn’t maintain food choices. Started craving sugar” and “Put on weight. Test results not nearly as good”. They have frequent check-ups with the diabetes nurse, which can result in trying other medication or adapting their diets. This cycle continues until they can keep their blood sugar levels fairly well under control (of course, the periodic check-ups by the diabetic’s nurse will continue). As DM2-G02-05 explains in her health journey: “Much More Settled. Can Control Levels better. Can plan for meals out etc. On insulin, victosa and metformin”. A graphic representation of this health journey can be viewed in Figure 15.

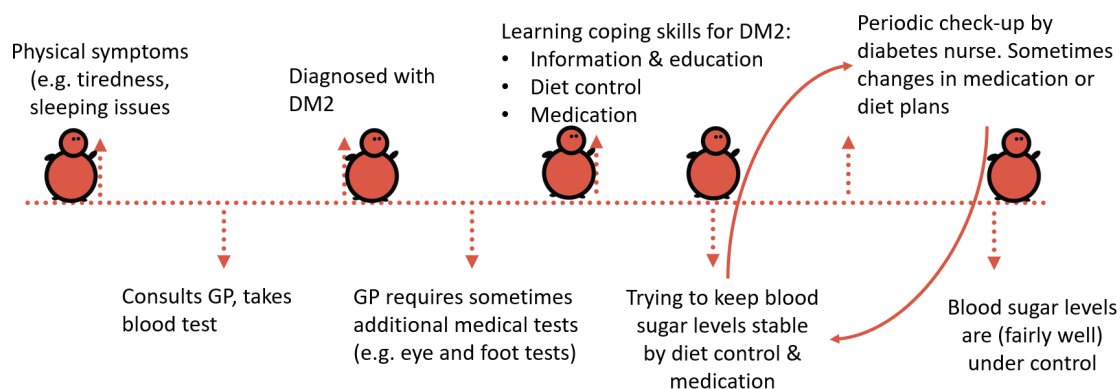


Figure 15: Health journey of diabetes mellitus type 2 patients. Each blob-coach represents a moment in the health journey where patients indicated they would have liked more information and/or virtual coaching.

Moments of intervention

The diabetes type 2 patients mentioned five stages in their health journeys where a virtual coach could assist them: (1) when they experience some physical symptoms, but have not yet been diagnosed with DM2, (2) After they are diagnosed with DM2, (3) when they learn more on diabetes and how to manage their diabetes, such as with diet and medication, (4) when they try to implement strategies in their daily

lives to keep their blood levels stable, and (5) when they have their blood sugar levels fairly well under control.

During the first stage, the participants named a medical/health coach who could help them getting insights in their symptoms, to identify patterns they experience or to more information on symptoms. Important is that the virtual coach does not give a diagnosis; this is task for the doctor. As one female respondent says: *"this is not going to give you a definitive answer, a virtual assistant, but it could point you in a direction that would help you make, come down and make that choice. You know, should I go to my doctor or should I not be so silly?"*. After having received the diagnosis of DM2, participants have a need for reassurance and encouragement, to feel: *"it is not the end of the world"* (UK-G01-04). They need mental and emotional support to come to terms with the diagnosis. Before and during the education phase, where they receive information and education on DM2 and how to manage blood sugar levels with diet control and medication, almost all participants agreed that a virtual coach would be helpful. The focus should be on education and moral support. They also mention it takes sometimes a long while between receiving the diagnosis and attending the information events. A one female respondent explains: *"Here's your diagnosis and, you know, here's all the information you need. And the other thing I kind of struggled with because part three's really when you get left in limbo I thought. It's like I really struggled emotionally with coming to terms with the fact that I've got this and how am I going to live my life? What do I need to do now? And I did actually seek out counselling at that stage. So, it would have been good if I could have found it easier to access that."* A virtual coach could help bridge that period, as another female respondent says: *"So I think that's where a coach could be useful because you can't get counselling these days for love nor money. It's months you have to wait to get an appointment if you're feeling depressed or anything."* The fourth stage, when trying to keep their blood sugar levels stable, a coach that monitors the results and their progress would be nice to have. Especially on diet and medication, the participants would like more insights and feedback on their performance. Some respondents like the idea of a medication reminder, as one explains: *"Definitely a medication reminder. Have you got to a stage that you can input right, this is what I'm meant to take three times a day and you get an app notification that pops up, a wee box that gives you a wee buzz, a wee app notification like a Facebook notification, something like that that sets an alarm that goes off."* Lastly, when they know how to keep their blood sugar levels stable (in the last phase), they do like to have ongoing support and motivation. Also, information on new treatment options was mentioned, as well as a coach that positively reinforces them to work on their health.

Types of virtual coaches

The following types of coaches were considered relevant and helpful for patients with DM2:

- Medical/health coach
- Physical activity coach
- Pharmacist coach
- Diet coach
- Spiritual / wellbeing coach
- Mental coach

The medical/health coach is mentioned mostly during the first phase, when they experience symptoms but do not know the cause of it. A health coach that monitors their symptoms and gives advice would be helpful during that stage, as one respondent explains: *"so for the first one, just obviously your general healthcare app. Being able to put in your symptoms. And obviously come up with a few diagnoses. Obviously, you will not get the answers straight off from that. But it might give you an indication that obviously this – you then need to go to your GP"*. The physical activity and diet coach are mentioned during the education phase and 'trial-and-error' period, where they follow diets and do physical exercises to lose weight. A mental coach can support DM2 patients after they received the diagnosis, to help them cope with accepting this illness. As one male respondent says: *"I think that stage I actually, I was convinced that they were wrong and it took me ages before I would kind of come around that and agree with them that, "Okay maybe I have got a problem."* Participants also frequently mentioned a spiritual or wellbeing coach in several stages: (1) when they are diagnosed with DM2, (2) during the education and information stage, and (3) in the last stage when they have their blood sugar levels under control. As

one respondent says: *“So, for me, it would be how to control my insulin. So that I could exercise. So that’s where maybe the health coach would come in. And tell you that you have to eat so much carbs.”* Several respondents also mention an option that you can scan food in supermarkets to know how much carbs and sugar is in it, as they often struggle with buying healthy food. One female respondent explains, she would like practical support for important events: *“When you’re going to eat. So it’s like an idiot’s guide, so if you’re doing a wedding here’s what you should do. Here’s the best thing to carry with you.”* DM2 patients prefer to be encouraged and motivated in a positive manner and receive emotional support for dealing with their health condition. Also, when they are able to manage their blood sugar levels, ongoing support from a spiritual coach is preferred.

3.5 Discussion

In this longitudinal diary study among potential end-user groups, a first step is taken to gather user requirements as input for further development of the Council of Coaches. Insights were gathered on: (1) health topics; (2) where and how patients consume health information; (3) the stages the patients go through in their health journey; (4) moments of intervention by virtual coaches, and; (5) the preferred types of virtual coaches. These results served as a basis for drafting the requirements (see Section 7). As this is a living document, the list of requirements will be extended and/or revised when the data collection is completed for the diabetes type 2 group chronic pain patients – and after additional insights are collected through other means during the project.

Although specific differences per end-user group were identified, there were overlaps in the health topics, health journeys, the moments of intervention, and the types of virtual coaches they prefer. As for health topics, peer counselling, the sharing of experiences and talking to someone who has been through similar processes, is considered important for both patient groups. Looking at their health journeys, each journey starts with accidents or physical problems where the correct diagnosis is often not found until there is a severe cause or medical incident that requires more extensive medical tests or scans. Both older adults and the chronic pain patients mentioned virtual coaches to assist them during this phase, as a monitoring tool (e.g. if pain increases), or as a means to assist them with daily activities. Further, virtual coaches were identified in both patient groups as a valuable tool before and after surgery, to help them prepare for the operation, what to do, what to expect, and giving them advice on how to get back in shape after the surgery.

Differences were found in the types of virtual coaches the patient groups mentioned and the information it should provide. Where chronic pain patients especially like a physical therapy or occupational therapist, older adults have difficulty visualizing such a coach, as they think this type of therapy works best in a face-to-face setting. Furthermore, chronic pain patients prefer a monitoring function, to know over a longer period of time if their pain increases, whereas older adults like coaches that give diet advice or coaches that have a social component (e.g. notifies users about local sports/health events). These results indicate that there are general elements for the Council of Coaches that can be applied across different patient groups, although there should be specific features developed for each specific patient group.

These results and the corresponding user requirements that follow from this study will support other work packages in the iterative design process of the Council of Coaches. First, the user needs, health journeys and health topics can serve as input for determining coaching strategies and coaching actions in WP3 and WP5. Second, the identified personal and contextual factors should be fed into the knowledge base of the system (WP3). Third, user commentaries on the virtual coaches could be used for determining the appearance of the virtual coaches and the interaction between user and computer (WP6). Lastly, the functional requirements support the process of drafting the technical specifications in the ARCADE framework adopted in WP7, and implementing these in the final Council of Coaches demonstrator in WP7.

3.5.1 Limitations

The sample size for the chronic pain patients’ group was also lower than expected. Unfortunately, four participants cancelled their participation causing the sample size to drop below the necessary threshold of five respondents per group. This is due to the fact that this group was about to start or just started

an intensive 12-week rehabilitation program which took quite a heavy toll on them, both physically and mentally.

A second limitation is that the study design was slightly adapted for the chronic pain patients. The protocol was discussed with a chronic pain psychologist, who advised us to lower the frequency of the daily diary forms to three times per week instead of every day. This was done to prevent mental overload among this vulnerable patient group. Also, the pre- and post-study workshops were changed from group sessions to individual interviews, again to minimize their effort and possible overload. The quantity of diary entries should be read with this limitation in mind.

Last, even though every participant received elaborate explanations about the diary forms, participants had at times troubles with the form and to decide if a situation was in fact a health information situation. Self-report methods are not ideal, but are the most suitable instruments to prevent privacy intrusion in the daily life or online behaviour of participants.

3.5.2 Future steps

The next steps are to communicate the findings to the technical integration team to support the iterative design process of the prototypes. The latter shall be done by designing information sheets per patient group. During preparation for the upcoming technical integration week (October 8th-12th 2018), the requirements shall be discussed with this team during Skype meetings and during the technical integration week, a presentation shall be given on the results and user requirements.

3.6 Requirements

The following requirements are elicited from the diary study. For a detailed overview, see Section 7 at the end of this document.

- **D2.3-F1** - The systems must provide a 'buddy' or 'peer counsellor' as one of the coaches.
- **D2.3-F2** - The coaches must be able to explain the sources they base their information on.
- **D2.3-F3** - The system must provide coaches that reflect the different aspects of health, as defined by Huber (physical health, mental health, social health, spiritual health, quality of life, daily functioning).
- **D2.3-F4** - The system could adapt itself with respect to tone of voice (positive, negative, humorous) by learning from compliance with given advice.
- **D2.3-F5** - The system should allow a medical professional to activate a health education module on a specific topic or disease (e.g., diabetes T2, losing weight) for an individual end-user.
- **D2.3-F7** - The system should incorporate all information in the end-user's medical record when providing personal advice.
- **D2.3-F8** - The system should provide the option for the end-user to provide consent of using all his/her personal health information, right after registration, rather than asking for permission to use selected snippets of information during use (e.g., demographics, data related to medication use, data related to allergies).
- **D2.3-F9** - The coaches could provide information about local health-related events that are of interest for an individual end-user.
- **D2.3-F10** - The coaches should remind the end-user that he or she has forgotten to take his or her medication.
- **D2.3-F11** - The coaches could explain the interpretation of common medical tests (e.g., CRP blood test) and interpret the end-user's values with respect to reference values.
- **D2.3-F12** - The system could display instruction videos of exercises that were prescribed by a physical therapist.
- **D2.3-F13** - The system must offer monitoring assistance for patients with a chronic disease to detect exacerbations.
- **D2.3-F14** - The system could monitor physical and mental workload, and must intervene when the workload becomes too much for an individual end-user.
- **D2.3-F16** - The coaches should monitor the occurrence of life events that happen to an end-user (e.g., divorce, losing a job), and should take this into account in their coaching strategy.

- **D2.3-C1** - The system content must be written with B1 (or equivalent in other countries) proficiency in mind.
- **D2.3-C2** - The system should provide the most common symptoms of each medication that an end-user is using.
- **D2.3-C3** - The coaches in the council should have an empathic tone of voice.
- **D2.3-C4** - The system must facilitate ACT treatment.
- **D2.3-C5** - The health information that the coaches provide must be based on credible sources (e.g., scientific papers, medical protocols, official health information websites, like "*voedingscentrum*", "*thuisarts*", municipal health services, centers for disease control).
- **D2.3-C6** - The coached could support end-users before and after an operation (in terms of diet, physical activity).
- **D2.3-C7** - The coaches should be able to explain the treatment protocol for a disease.
- **D2.3-S1** - The appearance of the coaches should be in line with their role (e.g., the physical coach should be physically fit).

Appendix A-1: Diary study – Diary forms

Active diary form

Id	Question	Answer options
Part 1: Situation description		
1	What question did you have about your health? Or what did you want to know more about?	[Open text field]
2	Could you describe the situation in which this question arose? Please describe it as detailed as possible, such as where you were and what was happening in this situation.	[Open text field]
3	Were there other people with you or involved in this situation? If so, could you describe who were involved?	<ul style="list-style-type: none"> • Yes, namely [open textfield] • No
4	How did you feel during this situation?	[Open text field]
Part 2: Searching health information		
5	Where did you initially start searching?	<ul style="list-style-type: none"> • Internet (website, social media, blog, community, etc.) • Book, magazine or newspaper • Television program • Radio program • Talking with someone • Other, namely [open textfield]
	➤ If Q5 = Internet (website, social media, blog, community, etc.)	
6	On which internet site?	[open text field]
7	Which device did you use?	<ul style="list-style-type: none"> • PC / Laptop • Tablet • Mobile / Smartphone • Other, namely [open text field]
	➤ If Q5 = Book, magazine or newspaper	
8	In which book, magazine or newspaper?	[Open text field]
9	Which device did you use?	<ul style="list-style-type: none"> • PC / Laptop • Tablet • Mobile / Smartphone • Other, namely [open text field]
	➤ If Q1 = Television program	
10	Which TV program?	[Open text field]
11	On which channel?	[Open text field]
12	Which device did you use?	<ul style="list-style-type: none"> • PC / Laptop • Tablet • Mobile / Smartphone • Television set • Other, namely [open text field]
	➤ If Q5 = Radio program	
13	Which radio program?	[Open text field]
14	On which channel?	[Open text field]
15	Which device did you use?	<ul style="list-style-type: none"> • PC / Laptop • Tablet • Mobile / Smartphone • Radio set • Other, namely [open text field]
	➤ If Q5 = Talking with someone	
16	With whom did you talk?	[Open text field]
17	How did you talk to each other?	<ul style="list-style-type: none"> • Face-to-face

			<ul style="list-style-type: none"> • Telephone call • Video call • Texting / whatsapp • Other, namely
	➤ If Q5 = Other		
	18	Could you describe where and how you searched for health information?	[Open text field]
	19	Did you use a device, like a smartphone, tablet or a laptop? If so, which one?	<ul style="list-style-type: none"> • Yes, namely [open text field] • No
Part 3: Finding health information			
	20	Did you find the information you wanted?	<ul style="list-style-type: none"> • Yes • No
	If Q20 = Yes		
	21	Where did you eventually find the information you were searching for?	<ul style="list-style-type: none"> • Internet (website, social media, blog, community, etc.) • Book, magazine or newspaper • Television program • Radio program • Talking with someone • Other, namely [open textfield]
	➤ If Q21 = Internet (website, social media, blog, community, etc.)		
	22	On which internet site?	[open text field]
	23	Which device did you use?	<ul style="list-style-type: none"> • PC / Laptop • Tablet • Mobile / Smartphone • Other, namely [open text field]
	➤ If Q21 = Book, magazine or newspaper		
	24	In which book, magazine or newspaper?	[Open text field]
	25	Did you use a device, like a smartphone, tablet or a laptop, to read this book, magazine or newspaper? If so, which one?	<ul style="list-style-type: none"> • Yes, namely [open text field] • No
	➤ If Q21 = Television program		
	26	Which TV program?	[Open text field]
	27	On which channel?	[Open text field]
	28	Which device did you use?	<ul style="list-style-type: none"> • PC / Laptop • Tablet • Mobile / Smartphone • Television set • Other, namely [open text field]
	➤ If Q21 = Radio program		
	29	Which radio program?	[Open text field]
	30	On which channel?	[Open text field]
	31	Which device did you use?	<ul style="list-style-type: none"> • PC / Laptop • Tablet • Mobile / Smartphone • Radio set • Other, namely [open text field]
	➤ If Q21 = Talking with someone		
	32	With whom did you talk?	[Open text field]
	33	How did you talk to each other?	<ul style="list-style-type: none"> • Face-to-face • Telephone call • Video call • Texting / Whatsapp • Other, namely:
		Which device did you use?	<ul style="list-style-type: none"> • PC / Laptop

			<ul style="list-style-type: none"> • Tablet • Mobile / Smartphone • Other, namely [open text field]
	➤ If Q20 = No		
	34	Could you describe why you didn't find the information you wanted?	[Open text field]
Satisfaction with health information (only visible if Q20= yes)			
	35	How trustworthy did you find the information you acquired?	<ul style="list-style-type: none"> • Very trustworthy • Trustworthy • Neither trustworthy nor untrustworthy • Untrustworthy • Very untrustworthy
	36	How satisfied are you with this information?	<ul style="list-style-type: none"> • Very satisfied • Satisfied • Neither satisfied nor dissatisfied • Dissatisfied • Very dissatisfied
	37	How satisfied are you with the process of finding information?	<ul style="list-style-type: none"> • Very satisfied • Satisfied • Neither satisfied nor dissatisfied • Dissatisfied • Very dissatisfied
	38	Did you do anything with this information?	<ul style="list-style-type: none"> • Yes, I did [open textfield] • No
	➤ If Q37 = Yes		
	39	How motivated were you do something with this information?	<ul style="list-style-type: none"> • Very motivated • Motivated • Neither motivated nor unmotivated • Unmotivated • Very unmotivated
Additional remarks			
40		Do you have any additional remarks or questions?	[Open text field]

Passive diary form

Id	Question	Answer options
Part 1: Situation description		
1	Where did you encounter health information? Please choose the answer that best describes your situation.	<ul style="list-style-type: none"> • Internet (website, social media, blog, community, etc.) • Book, magazine or newspaper • Television program • Radio program • Talking with someone • Other, namely [open textfield]
2	Could you briefly describe the message or topic of the health information you encountered?	[open textfield]
3	Where there other people with you when you saw/heard/read this information? If so, who?	[Open text field]
4	Could you describe where you were during this situation?	[Open text field]
5	How did you feel during this situation?	[Open text field]
	➤ If Q1 = Internet (website, social media, blog, community, etc.)	
6	On which internet site?	[open text field]
7	Which device did you use?	<ul style="list-style-type: none"> • PC / Laptop • Tablet • Mobile / Smartphone • Other, namely [open text field]
	➤ If Q1 = Book, magazine or newspaper	
8	In which book, magazine or newspaper?	[Open text field]
9	Did you use a device, like a smartphone, tablet or a laptop, to read this book, magazine or newspaper? If so, which one?	<ul style="list-style-type: none"> • Yes, namely [open text field] • No
	➤ If Q1 = Television program	
10	Which TV program?	[Open text field]
11	On which channel?	[Open text field]
12	Which device did you use?	<ul style="list-style-type: none"> • PC / Laptop • Tablet • Mobile / Smartphone • Television set • Other, namely [open text field]
	➤ If Q1 = Radio program	
13	Which radio program?	[Open text field]
14	On which channel?	[Open text field]
15	Which device did you use?	<ul style="list-style-type: none"> • PC / Laptop • Tablet • Mobile / Smartphone • Radio set • Other, namely [open text field]
	➤ If Q1 = Talking with someone	
16	With whom did you talk?	[Open text field]
17	How did you talk to each other?	<ul style="list-style-type: none"> • Face-to-face • Telephone (landline) • Mobile telephone / smartphone • Video chatting (e.g. Skype, Facetime) • Texting / Whatsapp
	➤ If Q1 = Other	

	18	Could you describe how you encountered this information?	[Open text field]
	19	Did you use a device? If so, which one?	<ul style="list-style-type: none"> • Yes, namely [open text field] • No
Satisfaction with health information			
20		How trustworthy did you find the information you acquired?	<ul style="list-style-type: none"> • Very trustworthy • Trustworthy • Neither trustworthy nor untrustworthy • Untrustworthy • Very untrustworthy
21		How satisfied are you with this information?	<ul style="list-style-type: none"> • Very satisfied • Satisfied • Neither satisfied nor dissatisfied • Dissatisfied • Very dissatisfied
22		How satisfied are you with the process of finding information?	<ul style="list-style-type: none"> • Very satisfied • Satisfied • Neither satisfied nor dissatisfied • Dissatisfied • Very dissatisfied
23		Did you do anything with this information?	<ul style="list-style-type: none"> • Yes, I did [open textfield] • No
	➤ If Q26 = Yes		
	24	How motivated were you do something with this information?	<ul style="list-style-type: none"> • Extremely • Moderately • Somewhat • Slightly • Not at all
Additional remarks			
25		Do you have any additional remarks or questions?	[Open text field]

Avoidant diary form

Id	Question	Answer options
Part 1: Situation description		
1	Did you make a deliberate choice not to search for health information today?	<ul style="list-style-type: none"> • Yes • No
➤ If Q1 = Yes		
	2 Could you explain why you chose not to search for health information today?	[Open text field]
➤ If Q1 = No		
	3 Was there today a situation or event in which you had to take into account possible issues or problems in relation to your health?	<ul style="list-style-type: none"> • Yes • No
➤ If Q3 = Yes		
	4 Could you describe this situation in which a potential problem or issue in relation to your health arose? Please describe it as detailed as possible, such as where you were and what you were doing.	
	5 Were there other people with you or involved in this situation? If so, could you describe who were involved?	<ul style="list-style-type: none"> • Yes, namely [open textfield] • No
	6 How did you feel during this situation?	[Open text field]
Additional remarks		
7	Do you have any additional remarks or questions?	[Open text field]

Appendix A-2: Questionnaires for pre-study workshop

Project name : Council of Coaches
Country : United Kingdom
Organization : University of Dundee
Research part : Pre-study workshop
Date : dd-mm-yyyy
Respondent :
Unique identifier :

Questionnaire 1: Your health

We would like to ask you how you rate several aspects of your health on a scale from 1 to 10. Please encircle your answer. Do not use half points.

Example question and scoring:

We would like to ask you to rate your dinner last night. Please rate your meal on a scale from 1 to 10.

Good 1 2 3 4 5 6 7 8 9 10

We would like to ask you to rate your dinner last night. Please rate your meal on a scale from 1 to 10.

Wrong 1 2 3 4 5 6 7 8 9 10

Please fill in the following questionnaire:

We would like to ask you to rate the health of your body. Do you feel fit? Do you experience pain? And can you sleep and eat well? Please rate this on a scale from 1 to 10.

1 2 3 4 5 6 7 8 9 10

We would like to ask you to rate how mentally fit you are. Can you concentrate well? Do you feel happy? Do you feel like you are in control of your life? Please rate this on a scale from 1 to 10.

1 2 3 4 5 6 7 8 9 10

We would like to ask you to rate how fulfilling your life is. Do you have a lust for life? Do you have ideals that you want to reach? Are you grateful for the things life gave you? Please rate this on a scale from 1 to 10.

1 2 3 4 5 6 7 8 9 10

We would like to ask you to rate the quality of your life. Do you enjoy life? Do you feel safe? Do you think your life is well-balanced? Do you live comfortably? Please rate this on a scale from 1 to 10.

1 2 3 4 5 6 7 8 9 10

We would like to ask you to rate your social life. Do you have enough friends? Do you have other people to do fun things with? Do you have support of others? Do you feel like you belong somewhere? Please rate this on a scale from 1 to 10.

1 2 3 4 5 6 7 8 9 10

We would like to ask you to rate how well you can take care of yourself. Can you cope with money? Can you work? Do you know your boundaries? Can you ask for help? Please rate this on a scale from 1 to 10.

1 2 3 4 5 6 7 8 9 10

Questionnaire 2: Health information

We would like to ask you three questions regarding health or medical information. Please mark the box of your chosen answer. If you made a mistake, please use (..) for your wrong answer and then mark the correct answer,

Example question and scoring:

How often do you go swimming?

- Good
- ☐ Every day
 - ☐ Often
 - ☐ Sometimes
 - ☒ Occasionally
 - ☐ Never

Please fill in the following questionnaire:

1. How often do you have problems learning about your medical condition because of difficulty understanding written information?

- ☐ Always
- ☐ Often
- ☐ Sometimes
- ☐ Occasionally
- ☐ Never

2. How confident are you filling out medical forms by yourself?

- ☐ Extremely
- ☐ Quite a bit
- ☐ Somewhat
- ☐ A little bit
- ☐ Not at all

3. How often do you have someone help you read hospital materials?

- ☐ Always
- ☐ Often
- ☐ Sometimes
- ☐ Occasionally
- ☐ Never

Questionnaire 3: Living healthy

On the next page, you will see 19 statements on living healthy. We would like to ask you why you would want to live healthier. Or, if you already have quite a healthy lifestyle, why you do this.

You can rate each statement on a scale from 1 to 7:

1 = Completely disagree

2 = Mostly disagree

3 = Slightly disagree

4 = Disagree nor agree

5 = Slightly agree

6 = Mostly agree

7 = Completely agree

Please mark the box of your answer. Do not use half-points. If you made a mistake, use (..) for the wrong answer and then mark your correct answer.

Example question and scoring

Good

I love to eat Brussels sprouts.

	X					
1	2	3	4	5	6	7

I love to eat Brussels sprouts.

	X	(X)				
1	2	3	4	5	6	7

Wrong

I love to eat Brussels sprouts.

		X				
1	2	3	4	5	6	7

I love to eat Brussels sprouts.

	X	X				
1	2	3	4	5	6	7

On the next page, the questionnaire begins. Please rate all of the 18 statements on the question:

Why would you adopt a healthy lifestyle?

Why would you adopt a healthy lifestyle?

- 1 Because people around me reward me when I do.
- 2 Because it gives me pleasure to learn more about living healthy.
- 3 Because I would feel bad about myself if I did not do it.
- 4 Because living healthy reflects the essence of whom I am.
- 5 Because through living healthy, I am living in line with my deepest principles.
- 6 Because I think others would disapprove of me if I did not.
- 7 Because it is very interesting to learn how I can live healthy.
- 8 So that others will praise me for what I do.
- 9 Because I have chosen this way of life as a way to develop myself.
- 10 It is not clear to me anymore; I don't really think my place is in living healthy.
- 11 Because it is one of the best ways I have chosen to develop other aspects of myself.
- 12 Because I feel better about myself when I do.
- 13 Because I find it enjoyable to discover new performance strategies.
- 14 Because I would not feel worthwhile if I did not.
- 15 Because living healthy is an integral part of my life.
- 16 Because people I care about would be upset with me if I didn't.
- 17 Because I found it is a good way to develop aspects of myself that I value.
- 18 I used to have good reasons for living healthy, but now I am asking myself if I should continue.
- 19 I don't know anymore; I have the impression that I am incapable of living healthy.

	Completely disagree	Mostly disagree	Slightly disagree	Disagree nor agree	Slightly agree	Mostly agree	Completely agree
1							
2							
3							
4							
5							
6							
7							
8							
9							
10							
11							
12							
13							
14							
15							
16							
17							
18							
19							

Questionnaire 4: Health beliefs

On the next page, you will see 28 statements on health beliefs. We would like to ask you to what extent you agree with each statement.

You can rate each statement on a scale from 1 to 5:

1 = Strongly disagree

2 = Disagree

3 = Neutral

4 = Agree

5 = Strongly agree

Please mark the box of your answer. Do not use half-points. If you made a mistake, use (..) for the wrong answer and then mark your correct answer.

Example question and scoring

Good

I believe that I am a good cook.

				X		
1	2	3	4	5	6	7

I believe that I am a good cook.

				X	(X)	
1	2	3	4	5	6	7

Wrong

I believe that I am a good cook.

					X	
1	2	3	4	5	6	7

I believe that I am a good cook.

				X	X	
1	2	3	4	5	6	7

On the next page, the questionnaire begins. Please rate all of the 28 statements.

In general, I believe I ...

	Strongly disagree	Disagree	Neutral	Agree	Strongly agree
1 ...know what part(s) of taking care of my health that I am satisfied with.	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>
	1	2	3	4	5
2 ...know what part(s) of taking care of my health that I am dissatisfied with.	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>
	1	2	3	4	5
3 ...know what part(s) of taking care of my health that I am ready to change.	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>
	1	2	3	4	5
4 ...know what part(s) of taking care of my health that I am not ready to change.	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>
	1	2	3	4	5
5 ...can choose realistic health goals.	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>
	1	2	3	4	5
6 ...know which of my health goals are most important to me.	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>
	1	2	3	4	5
7 ...know the things about myself that either help or prevent me from reaching my health goals.	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>
	1	2	3	4	5
8 ...can come up with good ideas to help me reach my goals.	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>
	1	2	3	4	5
9 ...am able to turn my health goals into a workable plan.	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>
	1	2	3	4	5
10 ...can reach my health goals once I make up my mind.	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>
	1	2	3	4	5
11 ...know which barriers make reaching my health goals more difficult.	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>
	1	2	3	4	5
12 ...can think of different ways to overcome barriers to my health goals.	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>
	1	2	3	4	5
13 ...can try out different ways of overcoming barriers to my health goals.	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>
	1	2	3	4	5
14 ...am able to decide which way of overcoming barriers to my health goals works best for me.	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>
	1	2	3	4	5

Questionnaire continues on the next page

In general, I believe I ...

	Strongly disagree	Disagree	Neutral	Agree	Strongly agree
15 ...can tell how I'm feeling about my health.	1	2	3	4	5
16 ...can tell how I'm feeling about caring for my health.	1	2	3	4	5
17 ...know the ways that my health can cause stress in my life.	1	2	3	4	5
18 ...know the positive ways I cope with health-related stress.	1	2	3	4	5
19 ...know the negative ways I cope with health-related stress.	1	2	3	4	5
20 ...can cope well with health-related stress.	1	2	3	4	5
21 ...know where I can get support for having and caring for my health.	1	2	3	4	5
22 ...can ask for support for having and caring for my health when I need it.	1	2	3	4	5
23 ...can support myself in dealing with my health.	1	2	3	4	5
24 ...know what helps me stay motivated to care for my health.	1	2	3	4	5
25 ...can motivate myself to care for my health.	1	2	3	4	5
26 ...know enough about health to make self-care choices that are right for me.	1	2	3	4	5
27 ...know enough about myself as a person to make health care choices that are right for me.	1	2	3	4	5
28 ...am able to figure out if it is worth my while to change how I take care of my health.	1	2	3	4	5

End of questionnaire

Questionnaire 5: Demographics

We would like to ask you some questions about yourself. Please fill in the following questions.

1. What is your gender?

☐

Male

☐

Female

2. When is your birthday?

DD	MM	YYYY

3. What is your highest level of education?

☐

Primary education

☐

Lower secondary education

☐

Post-secondary non-tertiary education

☐

Upper secondary education

☐

Higher education (bachelor or higher)

4. What is your living situation?

☐

Living with spouse

☐

Living with friend/family member/other

☐

Living alone

5. How many people do you consider your friend? Please write down the number.

6. Please select all devices you use at home. You can choose multiple answers.

☐

Smartphone

☐

PC / laptop

☐

Tablet

☐

Smartwatch

☐

Game computer

☐

Other, namely:

The questionnaire continues on the next page

7. Here below you find an overview of several activities. Please indicate how many hours per day you spend on each activity.

Activity	How many hours per day do you spend on each of the following activities?											
1. General Internet search	<input type="checkbox"/>	Not at all	<input type="checkbox"/>	0-1 h	<input type="checkbox"/>	1-2 h	<input type="checkbox"/>	2-3 h	<input type="checkbox"/>	3-4 h	<input type="checkbox"/>	More than 4 hours
2. Doing offline computing	<input type="checkbox"/>	Not at all	<input type="checkbox"/>	0-1 h	<input type="checkbox"/>	1-2 h	<input type="checkbox"/>	2-3 h	<input type="checkbox"/>	3-4 h	<input type="checkbox"/>	More than 4 hours
3. Emailing	<input type="checkbox"/>	Not at all	<input type="checkbox"/>	0-1 h	<input type="checkbox"/>	1-2 h	<input type="checkbox"/>	2-3 h	<input type="checkbox"/>	3-4 h	<input type="checkbox"/>	More than 4 hours
4. Online chatting / Social media	<input type="checkbox"/>	Not at all	<input type="checkbox"/>	0-1 h	<input type="checkbox"/>	1-2 h	<input type="checkbox"/>	2-3 h	<input type="checkbox"/>	3-4 h	<input type="checkbox"/>	More than 4 hours
5. Using the telephone	<input type="checkbox"/>	Not at all	<input type="checkbox"/>	0-1 h	<input type="checkbox"/>	1-2 h	<input type="checkbox"/>	2-3 h	<input type="checkbox"/>	3-4 h	<input type="checkbox"/>	More than 4 hours
6. Text messaging / Whatsapp	<input type="checkbox"/>	Not at all	<input type="checkbox"/>	0-1 h	<input type="checkbox"/>	1-2 h	<input type="checkbox"/>	2-3 h	<input type="checkbox"/>	3-4 h	<input type="checkbox"/>	More than 4 hours
7. Playing video games	<input type="checkbox"/>	Not at all	<input type="checkbox"/>	0-1 h	<input type="checkbox"/>	1-2 h	<input type="checkbox"/>	2-3 h	<input type="checkbox"/>	3-4 h	<input type="checkbox"/>	More than 4 hours
8. Listening to radio	<input type="checkbox"/>	Not at all	<input type="checkbox"/>	0-1 h	<input type="checkbox"/>	1-2 h	<input type="checkbox"/>	2-3 h	<input type="checkbox"/>	3-4 h	<input type="checkbox"/>	More than 4 hours
9. Watching television	<input type="checkbox"/>	Not at all	<input type="checkbox"/>	0-1 h	<input type="checkbox"/>	1-2 h	<input type="checkbox"/>	2-3 h	<input type="checkbox"/>	3-4 h	<input type="checkbox"/>	More than 4 hours
10. Reading books and magazines for pleasure	<input type="checkbox"/>	Not at all	<input type="checkbox"/>	0-1 h	<input type="checkbox"/>	1-2 h	<input type="checkbox"/>	2-3 h	<input type="checkbox"/>	3-4 h	<input type="checkbox"/>	More than 4 hours
11. Talking face-to-face with a person	<input type="checkbox"/>	Not at all	<input type="checkbox"/>	0-1 h	<input type="checkbox"/>	1-2 h	<input type="checkbox"/>	2-3 h	<input type="checkbox"/>	3-4 h	<input type="checkbox"/>	More than 4 hours

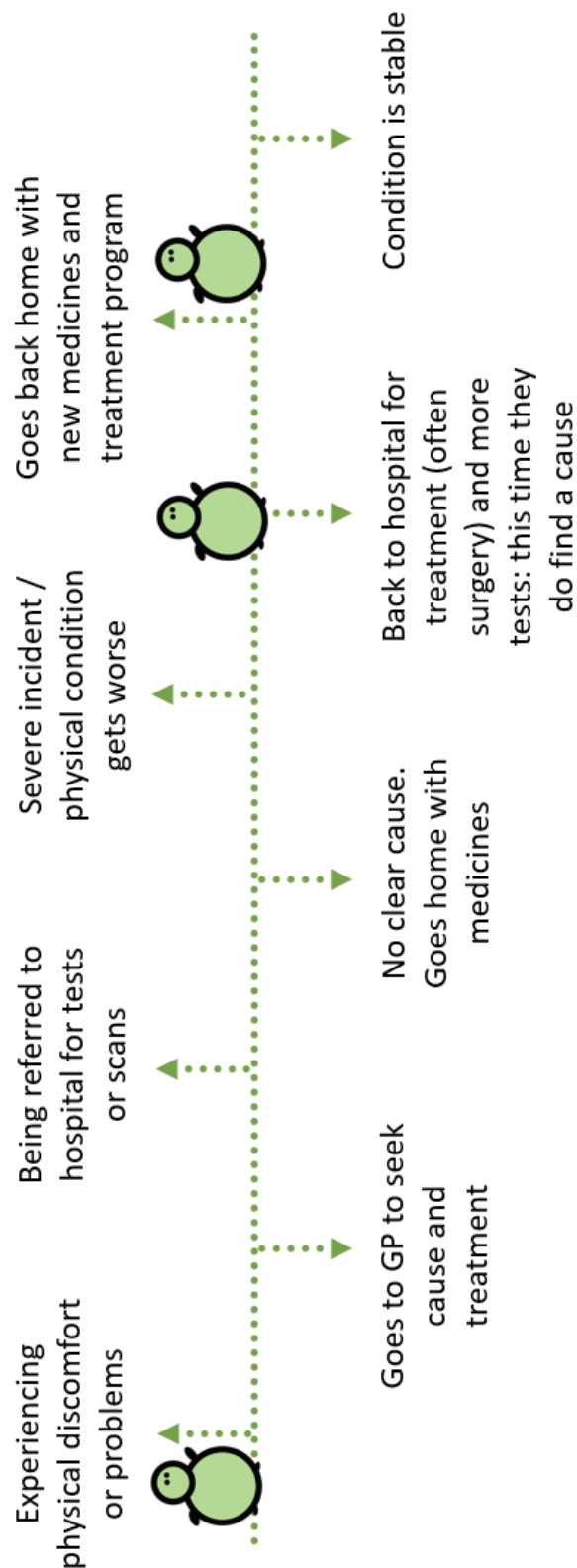
End of questionnaire

This is the end of the whole document. Please return it to the moderator.

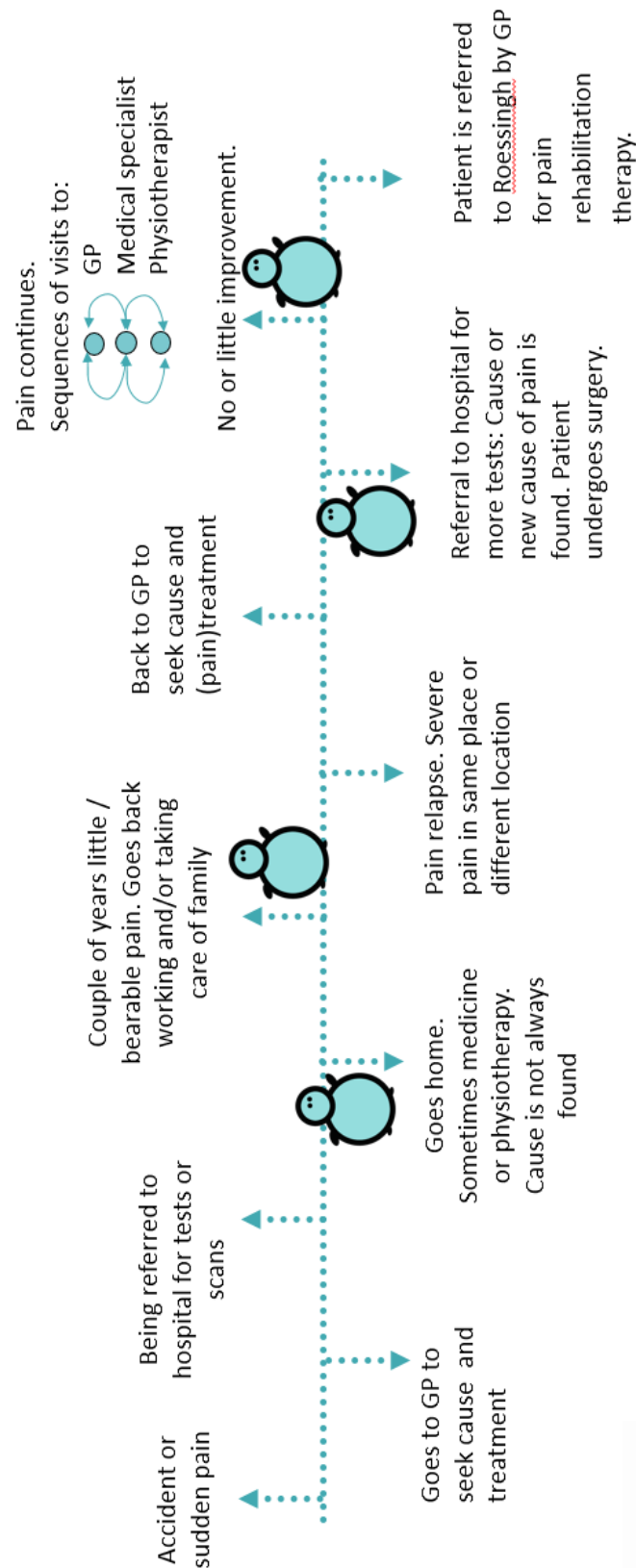
Do not write your name down on this document.

Appendix A-3: Health journeys

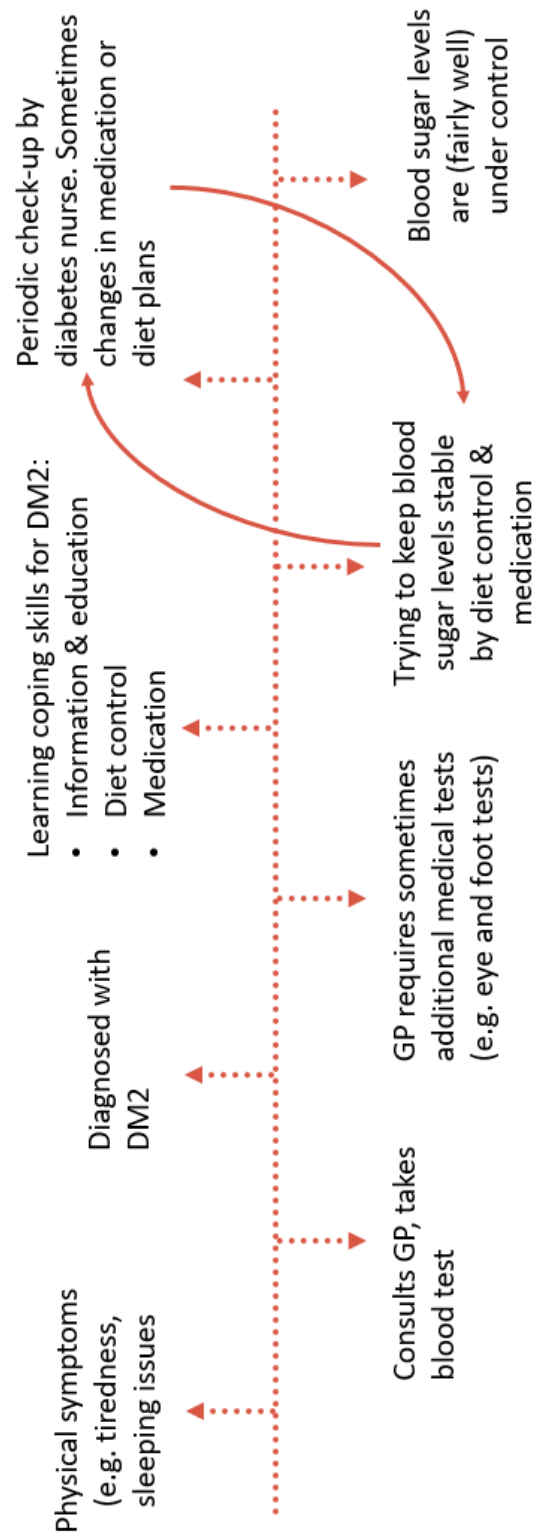
Patient group 1 – ARI

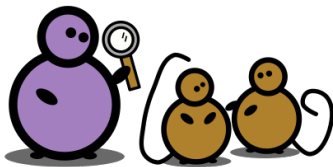


Patient group 2 – CP



Patient group 3 – DM2





Part B: Additional studies

1. Patient Consultation Corpus
2. Study on the persuasiveness of virtual agents

4 Patient Consultation Corpus

4.1 Abstract

Background: Language resources for studying doctor-patient interaction are rare, primarily due to the ethical issues related to recording real medical consultations. Rarer still are resources that involve more than one healthcare professional in consultation with a patient, despite many chronic conditions requiring multiple areas of expertise for effective treatment.

Methods: In this study, we designed and constructed the Patient Consultation Corpus; a multimodal corpus of simulated consultations between a patient (portrayed by an actor), and at least two healthcare professionals with different areas of expertise. The patient would play a pre-determined “role” based on predefined personas, while the professionals acted naturally according to their own expertise.

Results: As well as the transcribed text from each consultation, the corpus also contains audio and video recordings for each consultation: the audio consists of individual tracks for each participant, allowing for clear identification of speakers; the video consists of two framings for each participant — upper-body and face — allowing for close analysis of behaviours and gestures. We have performed selected annotations according to three annotation schemes.

Discussion: The result of this work is a useful resource for studying the same type of group interactions as the Council of Coaches project is aiming to virtually reproduce. Instead of generating immediate requirements for the project as a whole, the work described here should be seen as a first step in a longer process of understanding multi-party health coaching on various domains.

4.2 Introduction

To gain insight into what the interaction between the coaches and the user in the Council of Coaches should look like, interactions as similar as possible to our intended interactions need to be observed and modelled so they can be used by the coaches. However, observing this kind of interaction between real patients and real medical practitioners is difficult. Consultations with more than one medical practitioner rarely takes place, and would be hard to find. Furthermore, the observation itself might change the interactions during the consultation itself and lead to incorrect data. Hence, role-playing sessions involving medical practitioners trying to coach an actor-patient during a consultation were recorded audio-visually by University of Dundee. Three different actors took part in this study: “Male”, “Female 1” and “Female 2”. They were assigned to play several different personas, namely an anxious, unengaged, know-it-all, or normal patient. Descriptions of these personas are summarised in Table 17 below. All personas describe patients that have recently been diagnosed with Type 2 diabetes. The recorded sessions are summarised in Table 18. Note that the data collected through these sessions are being used in multiple work packages for different purposes. We therefore focus here on the annotation of the data to analyse verbal and non-verbal behaviour of medical practitioners and translate these outcomes to design appropriate behaviours for the coaches in Council of Coaches. The annotation of the data will help us to understand how real-life professionals behave towards each other and older adults with (health) concerns and different dispositions in a group interaction. This will lead to requirements for our system to make sure the coaches can showcase the right behaviours and the system can assess when the appropriate times are to have them showcase certain behaviours.

Table 17: The four different patient personas used in the Patient Consultation Corpus.

Patient type	Description
Anxious	Is scared about their diabetes diagnosis; has a friend who recently had a limb amputated due to Type 2 diabetes.
Unengaged	Is not interested in the medical advice being given; feel they don't have enough time to follow what their doctor is telling them.
Know-it-all	Searches the web for medical advice, which they trust more than that given to them in face-to-face consultations with practitioners; believes in “fad” diets.
Normal	Listens to advice and tries their best to follow the doctors' instructions; designed as a “benchmark” patient.

4.3 Method

The recordings of the sessions in Table 18 will be annotated using different annotation schemes by members of the University of Dundee, Sorbonne University, and the University of Twente. Each partner will focus on different aspects of the interaction. The focus of each of these annotation schemes is described below in Section 4.3.1. The video materials are not being fully annotated. Instead, an impressionistic selection is being made of interactions of interest to all annotating partners and the Council of Coaches project as a whole. The insights obtained from the annotation of the recordings will be translated into functional and non-functional requirements for the Council of Coaches technology.

Table 18: Patient interview sessions.

Session ID	Actor	Type of patient	Practitioners involved
S1	Male	Know-it-all	General practitioner, diabetes practitioner
S2	Male	Normal	General practitioner, diabetes practitioner
S3	Female 1	Unengaged	Podiatrist, general practitioner
S4	Female 1	Anxious	Podiatrist, general practitioner
S5	Female 1	Normal	Podiatrist, general practitioner
S6	Female 1	Know-it-all	Podiatrist, general practitioner
S7	Female 2	Unengaged	General practitioner, motivational interviewer, dietician
S8	Female 2	Know-it-all	Motivational interviewer, dietician
S9	Female 2	Normal	Motivational interviewer, dietician

4.3.1 Focus and annotation schemes

4.3.1.1 University of Dundee

Members from the University of Dundee will focus on the structure of arguments made during the interaction. In order to do this we use Inference Anchoring Theory (IAT) – a philosophically grounded theory which has been developed to capture relationships between argument structures and dialogue structures (Budzynska, et al., 2014), (Janier & Reed, Corpus resources for dispute mediation discourse., 2016). By considering the illocutionary force of utterances, IAT allows us to represent illocutionary structures which link locution nodes (L-nodes) to information nodes (I-nodes). Moreover, given that some speakers' communicative intentions cannot be determined without knowing the broader context of the dialogue – that is, what an utterance is responding to – IAT assumes that it is only by considering the relation between L-nodes that some illocutionary forces can be inferred. As a consequence, these illocutionary structures are anchored in transition nodes (TA-nodes) and can target I-nodes or scheme nodes (S-nodes) (to elicit inference or conflict relations between propositions) (Budzynska, Janier, Reed, & Saint-Dizier, 2016). IAT is therefore a framework developed for the analysis of dialogues in order to elicit argumentative structures.

By making the illocutionary forces of locutions apparent, the model allows us to identify argumentative dynamics which have been generated by dialogical moves. The IAT graphical representations of dialogical structures and the attached illocutionary and argumentative structures represent a valuable framework for fine-grained analyses of discourse.

This theory is very well suited to our goal of building a dialogue game from our corpus of patient interviews, since our corpus consists of natural language dialogue and IAT provides a way of linking dialogue argumentative dynamics via the analysis of speech acts.

An IAT analysis is therefore composed of several elements eliciting argument structures and dialogical dynamics via the representation of illocutionary connections, as summarized below:

- The right-hand side of a graph displays the dialogical structure with:

- Locution nodes: the content of the utterances preceded by the speaker's identification
- Transition nodes: the transitions between the locutions (or rules of dialogue) (TA-nodes)
- The left-hand side of a graph displays the argumentative structure with:
 - Information nodes: the propositional content of each locution (in front of the corresponding locution node)
 - Relations of inference: they connect premises to conclusions (RA-nodes)
 - Relations of conflict: they connect conflicting information nodes (CA-nodes)
- The relation between the dialogical and the argumentative structure:
 - Illocutionary forces connecting a locution node to the corresponding information node
 - Illocutionary forces connecting a transition node to scheme node (i.e. that can only be derived from the transitions between locutions)
 - Indexical illocutionary forces connecting a transition node to an information node (more details are given with the example presented below)

Let's consider the simple example below, taken from the Council of Coaches corpus, and describe its IAT analysis in Figure 16 below. The dialogue in Example 1 involves Linda, a patient, and Bob, a podiatrist, who are talking about the necessity to have a monofilament done. The full annotation of the excerpt can be seen as <http://corpora.aifdb.org/couch> as argument maps 13748 and 13749. Further annotated examples can be seen at the same link.

- a) **Linda:** *But could I have pins and needles and still be feeling everything on my feet when they do that?*
- b) **Bob:** *You could have pins and needles but still feel...but the sensation would be abnormal on your feet.*
- c) **Linda:** *Right, okay, I don't know what you mean.*
- d) **Bob:** *So, by that I mean you could...say, for instance you were walking around barefoot, okay, or you had a pair of shoes that didn't fit properly even though you had pins and needles in your feet that's still a symptom of nerve damage [...].*

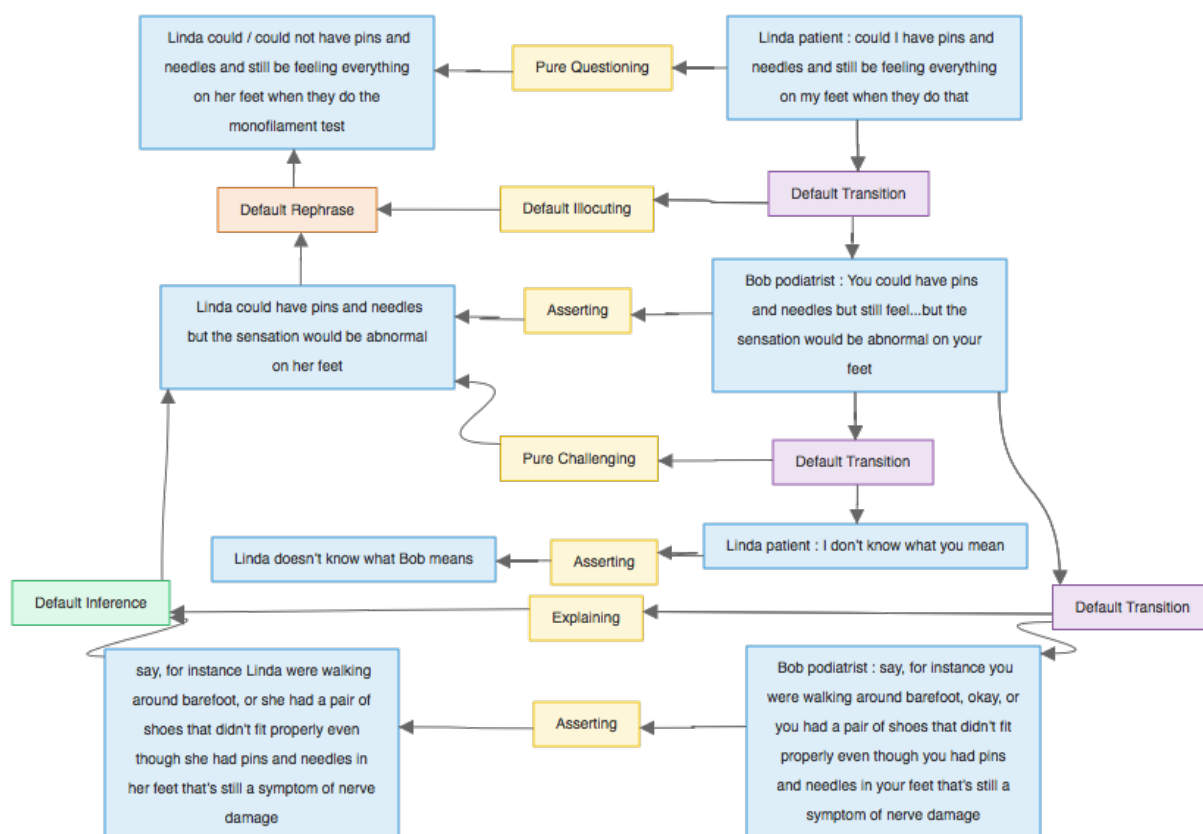


Figure 16: OVA+ analysis of "Linda" example.

The figure has been produced in OVA+, an interface for the analysis of arguments online, accessible from any web browser at ova.arg-tech.org (Janier, Lawrence, & Reed, 2014). It is a tool allowing what the developers of the Argument Interchange Format (AIF) have advocated, i.e. the representation of arguments and the possibility to exchange, share and reuse argument maps (Reed, Wells, Devereux, & Rowe, 2008). The system therefore relies on annotation schemes of a wide variety of theories, including IAT.

On the right-hand side of the figure, one can see the dialogical structure, with the speakers' locutions and the transitions between locutions which represent the dialogical relevance of moves, represented by Default Transition nodes (e.g. Bob answered 1d as a response to Linda's challenge in 1c).

The left-hand side of the figure represents the argumentative structure: the proposition *"say, for instance Linda were walking around barefoot, or she had a pair of shoes that didn't fit properly even though she had pins and needles in her feet that's still a symptom of nerve damage"* is inferentially related to *"Linda could have pins and needles but the sensation would be abnormal on her feet"*; this is represented by the Default Inference node. This means that the first proposition is the conclusion and it is supported by one premise. Here, Bob is explaining something to Linda because she did not understand (see the Pure Challenging node linking Linda's second move to Bob's first utterance). As we will see with the different examples throughout this work, argumentative structures can also elicit argumentation, counter-argumentation – represented by Default Conflict nodes (when a proposition is in conflict with another) – and rephrasing, that is the relationship between propositions which have the same pragmatic meaning but may have a different linguistic surface (Konat, Budzynska, & Saint-Dizier, 2016) – represented by Default Rephrase nodes. IAT can also handle reported speech by unpacking the propositional content of a reported speech and the propositional content of a reporting speech.

Dialogical structures can make apparent argumentative structures only through the representation of the illocutionary structures, which are composed of illocutionary connections anchored in locutions and those anchored in transitions. Locutions have illocutionary connections which represent the speaker's communicative intention. In the example, for instance Linda's first move is a Pure Question. The concept of illocutionary connections is borrowed from Speech Act Theory (Austin, 1975), (Searle, *Speech acts: An essay in the philosophy of language*, 1969), and (Searle & Vanderveken, 1985) for some speech acts, it is however impossible to determine what the speaker's intention is without knowing what the speech act is responding to; IAT solves this problem by taking into account the relationship between locutions (Budzynska, Janier, Reed, & Saint-Dizier, 2016). For example, here, we know that, when he says *"by that I mean you could...say, for instance you were walking around barefoot, okay, or you had a pair of shoes that didn't fit properly even though you had pins and needles in your feet that's still a symptom of nerve damage"*, Bob is explaining only because this is a response to Linda's challenge. Taken independently, the speech acts in 1b and 1d are merely claims but, considered together, they obviously perform an illocutionary act.

These illocutionary connections are anchored in transition nodes because they exist only in virtue of the dialogical dynamics. Such illocutionary connections target the corresponding schemes in the argumentative structure: here Explaining is anchored in the transition node between Linda's challenge and Bob's answer, and targets the Default Inference node which holds between Bob's Assertions. Note also that some illocutionary connections are indexical: such illocutionary connections are also anchored in TAs, however they target a propositional content, rather than schemes. In the analysis of Example 1, Linda's utterance *"I don't know what you mean"* shows that she wants Bob to explain, therefore, the Pure Challenging illocutionary connection targets the propositional content of Bob's first utterance. In the following analyses, argument structures do not consider enthymemes since only actual text is analysed; as a consequence, only propositions which have been uttered are represented.

Information nodes to precisely reflect the propositional contents (for instance, full names must replace the pronouns used in locutions); this is necessary to represent the argument structure more accurately.

The IAT analysis of Example 1 shows that IAT is well suited for the exploration of argument structures in dialogical contexts. It reveals the argumentative structure of the dialogue via the detailed analysis of dialogical dynamics (i.e. Linda challenging Bob's first utterance and Bob answering the challenge).

Not only IAT accurately reveals how dialogical acts work together to create arguments, but it also, and most of all, shows that the considering of the relationship between locutions, that is Transition nodes, is necessary to describe speakers' behaviours in a dialogue. IAT therefore indicates that argument structures are created in virtue of dialogical exchanges, and that the representation of utterances alone is not sufficient to understand the dynamics of argumentative dialogues.

Despite the inherent complexity of dialogues, it turns out that dialogical interactions contain valuable elements for the recognition of argument structures, evidenced by IAT analyses (Budzynska, et al., 2014). In Yaskorska and Janier (2015), the authors drew some conclusions from the analytical and statistical study of the Moral Maze dialogues. The high frequency of AQs in the Moral Maze revealed that speakers tend to present their claims under the form of questions, which is a useful mechanism for one to give her own opinion, as well as to trigger an interlocutor's agreement or disagreement. It has also been shown that the realization of argumentation does not always take the form of an Assertion being challenged and a second Assertion responding to the challenge. The information provided by the analyses have also allowed discovering that speakers mainly argue with Assertions and Assertive Questions.

It cannot be concluded that such behaviours occur in all dialogues; however, they provide a hint about how speakers argue in moderated real-life dialogues. Moreover, the inter-annotator agreement of the corpus studies ($k = 0.68$) (Janier, 2017) shows that IAT is stable and a reliable framework for the analysis of dialogical arguments.

4.3.1.2 Sorbonne University

Members from Sorbonne University will focus on the non-verbal communication during the interaction. To gain insight into this, we mainly make use of the MUMIN annotation scheme by (Allwood, Cerrato, Jokinen, Navaretta, & Paggio, 2007) to annotate various non-verbal behaviours displayed during interaction.

The MUMIN multimodal scheme is developed for the annotation of multimodal communicative behaviours. Three communicative functions namely, feedback, turn management and sequencing are used in the scheme. Feedback provides information about the interactions through signals ex., facial expressions, turn management regulates the interaction flow ex., turn gain, turn hold, and sequencing deals with the organisation of a dialogue in meaningful sequences. For this study our main focus will be on gaze, turn-taking, hand movements and facial expressions.

4.3.1.3 University of Twente

Members from the University of Twente will focus on the intent behind communication, the form of communication and interpersonal stance during the interaction. To gain insight into this, three annotation schemes are under consideration by the University of Twente members. These are annotation schemes based on the Verbal Response Modes (VRM) by Stiles (1992), the Interaction Process Analysis (IPA) by Bales (1951), and the Interpersonal Circumplex (IPC) by Leary (1957). Each will be briefly described here.

The VRM taxonomy by Stiles (1992), is a theory and an annotation method from the field of psychology used to classify speech acts, and can classify them for a broad range of purposes. It is not focused on the content of what people say, but instead puts the focus on what people do when they say it. It is to be used to describe the relationship of the speaker to another person in any sort of discourse. Each utterance is coded both for its grammatical form as well as its pragmatic intent.

Bales' IPA is a theory and an annotation method from the field of social psychology focused on small, face-to-face group interaction and is focused on investigating measures of leadership in this group interaction. In IPA leadership consists of socio-emotional leadership and instrumental leadership. Socio-emotional leadership is focused on holding the group together as a group, and instrumental leadership is focused on getting the group's task done.

IPC by Leary, also known as Leary's Rose, is a theory and an annotation method from the field of psychology focused on the interpersonal behaviour that people showcase and what stance they take during an interaction. The circumplex can be divided by using two opposites, which are (1) hate versus

love and (2) submissive versus dominant. This leads to four quadrants, which are hate-submissive, hate-dominant, love-submissive and love-dominant. These quadrants can be further subdivided, as they are a continuum on which interpersonal behaviour can be placed.

4.4 Results & Discussion

In this section we have presented a multimodal corpus of consultations between patients portrayed by actors, and two or more healthcare professionals. The corpus consists of seven consultations in which two or three healthcare professionals carry out a consultation with a patient that is being portrayed by an actor playing to a specified persona. This use of healthcare simulation overcame significant ethical and practical issues that would have arisen with using real consultations. Ethically, it is difficult to record patient consultations without affecting the process of the consultation itself. Practically, consultations between a patient and multiple healthcare professionals (at the same time) are rare, but are nevertheless useful – for instance, in identifying areas of overlap between two specialisations as and when they arise. The personas portrayed by the actors were created using an iterative design process that took into account a range of factors to ensure that the patients were as realistic as possible. These included personality traits, as well as types of complications that might be faced by patients with their specific medical condition. We also annotated a small excerpt from the corpus from three different perspectives: dialogue and argumentation, using Inference Anchoring Theory (IAT); physical behaviours, using the MuMIN annotation scheme; and coaching styles, using Verbal Response Modes (VRM), Interaction Process Analysis (IPA), and Interpersonal Circumplex (IPC). The richness of the resulting annotations is evidence of the richness of the data. In future work, we will annotate the entire corpus from the three perspectives described above. This will further enrich the available data, but will also act as a catalyst for identifying overlapping areas between the different schemes.

We performed a study on informal reflections by healthcare professionals, and found that the simulated consultations were shown to be novel in that they were highly collaborative, yet realistic in terms of the representation of genuine patient interactions and concerns. We expect that the resulting dataset will prove useful to policy makers in healthcare delivery, and researchers in domains such as non-verbal behaviours, dialogue, argumentation, medical interactions and health coaching.

4.5 Requirements

The nature of this “study” is such that it did not generate any immediate requirements for the project as a whole.

5 Study on persuasiveness of virtual agents

5.1 Abstract

Background: Virtual humans need to be persuasive in order to promote behaviour change in human users. Design features of the virtual agent like its role, its non-verbal behaviours are critical in persuasive communication. Therefore, the main focus of this study was to understand whether having multiple agents was more effective than having single agent in persuasion task.

Methods: Along with gender and status (authoritative & peer), we also look at type of focus employed by the agent i. e., user-directed where the agent aims to persuade by addressing the user directly and vicarious where the agent aims to persuade the user, who is an observer, indirectly by engaging another agent in the discussion. 209 participants were randomly assigned to one of the 12 conditions and presented with a persuasive message by one or several virtual agents. A questionnaire was used to measure perceived interpersonal attitude, credibility and persuasion.

Results: Results indicate that credibility positively affects persuasion. In general, multiple agent setting, irrespective of the focus, was more persuasive than single agent setting. Although, participants favoured user-directed setting and reported it to be persuasive and had an increased level of trust in the agents, the actual change in persuasion score reflects that vicarious setting was the most effective in inducing behaviour change. In addition to this, the study also revealed that authoritative agents were the most persuasive.

Discussions: The main finding of this evaluation study is that, a multiple agent setting was more effective than a single agent. The results of the study indicate that agents were successful in persuading the users. The expertise of the agent influenced the perceptions of credibility, and credibility mediated the influence of the agent's expertise on persuasion. This study shows the importance of the effects of the behaviours and persuasion strategies employed by the agents on the user. These results were used to elicit user requirements for the development of the coaches and to model the interactions between the coaches and the user.

5.2 Introduction

Persuasion, often referred to as 'attitude change', is one of the fundamental aspects of social interactions (Cialdini & Cialdini, 2007). It can be defined as a conscious and intentional act, where one or more people attempt to create, modify, reinforce, or extinguish beliefs, attitudes, intentions, motivations, and/or behaviours within the constraints of a given communication context (Gass & Seiter, 2015). Effective persuasion depends on several factors, such as the person who is persuaded, the argument and the person/system providing the persuasive message.

Design features of the virtual agent like its role, its non-verbal behaviours are critical in persuasive communication (Bailenson, Blascovich, & Guadagno, 2008). Our aim is to develop a behaviour change support system that is effective in persuading users to maintain a healthy lifestyle. To understand how to design such a system, it is therefore important to understand the preferences of the users (i.e. features related to the appearance style, group composition, e. g., single or multiple agents in different roles) and to measure the impact of these features on the effectiveness of the behaviour change support system. In this preliminary study toward our aim, we aim to understand the effects of agent's gender and role on user's persuasion in a single agent and multiple agent setting through an evaluation study. Results from this study will provide guidelines in developing agents that will be able to handle conversations successfully and be effective in user behaviour changes.

An evaluation study that is focused on understanding the effects of gender and role (authoritative and peer) on user's persuasion in single agent (dyadic) and multiple agent setting (vicarious: the process where the aim is to persuade the audience rather than the person with whom a proponent is directly engaged in discussion; and user-directed: where the aim is to persuade the person with whom a proponent is directly engaged in discussion) was conducted. Participants were presented with a persuasive message by one or several virtual agents (see for example Figure 17), and a standard questionnaire was used to measure perceived interpersonal attitude, credibility and persuasion.

5.3 Method

The experiment is based on 2 x 2 x 3 design. The variables include agent gender (male vs. female), status (authoritative vs. peer) and persuasion type (multiple agent user-directed vs. multiple agent vicarious vs. single agent). Since we are also studying the effects of gender, in multiple agent condition, a male agent and a female agent were present and only the roles are altered. In vicarious persuasion, the status of both speaker and addressee agent will always be the same and only the gender is altered. Table 19 below provides the overview of the twelve conditions used in the study.

Table 19: Overview of the twelve experimental conditions (F: Female, M: Male, A: Authoritative, P: Peer).

Type	Composition	Condition
Single Agent	FA	C1
	MA	C2
	FP	C3
	MP	C4
Multiple Agent (user-based)	FA+MA	C5
	FA+MP	C6
	FP+MA	C7
	FP+MP	C8
Multiple Agent (vicarious)	FA persuades MA	C9
	MA persuades FA	C10
	FP persuades MP	C11
	MP persuades FP	C12

5.3.1 Participants

For this study we collected responses in two stages. Initially 282 participants were recruited from Crowdfunder. There were no specific inclusion or exclusion criteria, other than participants having to be able to understand the language used in the study. A total of 156 responses were removed from the collected data due to inconsistencies and non-naivety as several participants did not adhere to the instructions and responded multiple times. We therefore considered the responses to be not genuine. We also collected 79 responses by contacting respondents through mailing lists. In total, 205 participants took part in the evaluation study where 55% were male ($n = 113$) and 45% were female ($n = 92$). 46% of the participants were between the age range of 21-30 years, 22% between 31-40, and 15% between 41-50 and 14% above 50 years old. The participants came from different cultural backgrounds with the three most prominent groups from, North America (37%), Europe (27%), and Asia (20%).

5.3.2 Procedure

The participant began the study by filling in the demographics data i.e., age, gender and education level followed by accepting the consent form. The study is divided into three main steps, (1) pre-questionnaire, (2) answering questionnaire after watching a video clip with persuasive dialogue (collected 3 times i.e., one per given movie genre), (3) post-questionnaire. The pre-questionnaire is designed to measure the extent to which the participant is persuadable. Along with this the participant also provides information about overall openness and comfort towards technology and interest in movies. A short introductory clip was designed using a virtual agent who presented the study. The age of the agent was in its 30s and its appearance was smart casual. This was done in order to familiarize the participants with the animations of the virtual agents to avoid collecting responses based on the first impression generated. The users are first presented with a short textual description of three movies

of a given genre and asked to rate the likeliness of watching the movies respectively. Once the ratings are provided, the user is assigned randomly to one of the 12 conditions specified above and presented with a persuasive video clip about the movie. Since we want to measure the persuasion in user, we opted to show the clip corresponding to the movie that received lowest rating by the user. The clip generally is 60s - 90s long, consisting of virtual characters presenting opinion and information about the movie. The participants were again asked to rate the likeliness of watching the movie again followed by questionnaire to measure attitude, perceived credibility, and perceived persuasiveness. This step is repeated again for the other two movie genres. The condition does not differ between the genre of movies and remains the same throughout the experiment. Finally, a post-questionnaire is used to measure persuasiveness, trust in the agents, overall satisfaction and intention to continue using the system.

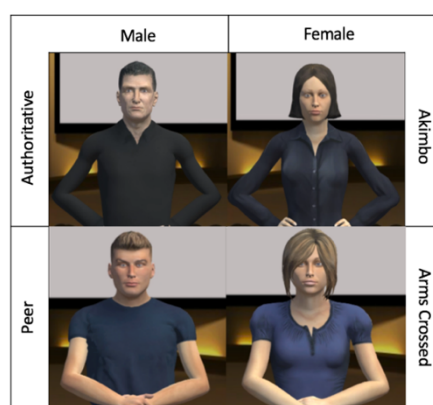


Figure 17: Four appearances modelled to fit authoritative and peer agent role.

5.4 Results

Attitude was measured using eight adjectives from Leary's interpersonal attitude circumplex (Leary, 1957). In terms of user's gender, male users reported agents to be more "distant" in comparison to female users ($p=0.029$) as well as, perceived the agents to be arrogant ($p=0.030$) and forceful ($p=0.008$). There was no significant effect of the user's gender on the rest of the attributes. In terms of agent's role, authoritative agents were considered more forceful ($p=0.024$) compared to peer agents but they were also considered to be more helpful ($p=0.0034$). There was no significant difference regarding agent's gender on the perceived attitude. Agents were considered to be warmer ($p=0.041$) and helpful ($p=0.030$) in multiple agent setting over single agent setting.

There was a statistically significant difference in the credibility of the agents: authoritative agents were considered more credible ($p=0.0006$) than peer agents (i.e., trustworthy ($p=0.003$), reliable ($p=0.0007$) and shows expertise ($p=0.001$)). Male users reported agents to be more credible than female users ($p=0.025$). There was no significant effect of agent's gender on the perceived credibility. There was a statistically significant difference in credibility ($p=0.0003$) over the twelve conditions. We further performed ad-hoc test with bonferroni correction. There was a statistically significant difference between following pairs: (C6 - C11: $p=0.029$), (C9 - C11: $p=0.002$), (C12 - C11: $p=0.0007$). Figure 19 shows the mean perceived credibility value for each condition.

Participants reported high persuasion with the multiple agent setting (C5 - C12) in comparison with single agent setting ($p=0.05$). Male user's reported high persuasion ($p=0.015$) compared to their female counterparts. However, agent's gender did not have any significant effect on persuading the user. Authoritative agents were reported to be more persuasive than peer agents ($p=0.0004$). There was a statistically significant difference in persuasion ($p=0.00002$) over the twelve conditions. We further performed ad-hoc test with bonferroni correction. There was a statistically significant difference

between following pairs: (C4 - C9: $p=0.048$), (C4 - C12: $p=0.016$), (C6 - C11: $p=0.015$), (C9 - C11: $p=0.001$), (C12 - C11: $p=0.0004$). Figure 19 shows the mean perceived persuasion value for each condition. Further, participants who scored to be 'easily persuadable' reported to be more persuaded ($p=0.0175$) than those who scored to be 'not easily persuadable'.

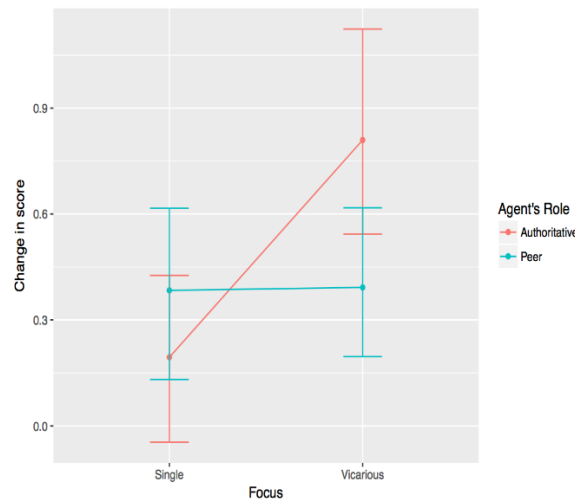


Figure 18: Interaction of agent role * type of persuasion on perceived persuasion ($p = 0.035$). Authoritative agents were more persuasive in multiple-agent setting (vicarious) than in single-agent setting.

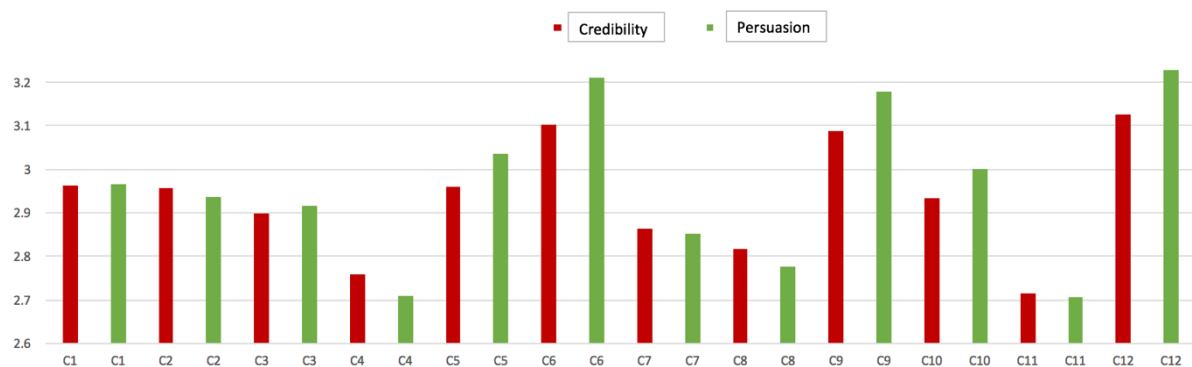


Figure 19: Mean value of change in rating recorded from the participants after watching the persuasive message. Vicarious persuasion (C5-C8) was the most effective in persuading the participants to reconsider the rating.

5.5 Discussion

The main focus of this research work was to understand whether having multiple agents was more effective than having single agent in persuasion task. We also wanted to understand the effects of gender and status on user-persuasion. In order to study this, we had three settings: single agent user-directed, multiple agents and user-directed, and multiple agents vicarious. The agent appearance, non-verbal behaviours and verbal content was manipulated to fit the status of authoritative or peer agent and it remained the same across gender, age and the conditions.

Our main finding is that a multiple agent setting was more effective than a single agent. The persuasiveness questionnaire revealed that participants reported being more influenced by the user-directed multiple agent setting. However, we measured the mean change in rating, for each condition and this revealed that vicarious setting was more effective in persuading the user to change their score than user-directed setting. Since the difference between the settings was not statistically significant, we suggest that there is a strong tendency in the result that needs to be further verified with more participants.

The likeliness score of watching a film before and after the persuasive clip, indicates that agents were successful in persuading the users to reconsider their decision about wanting to watch a film. 153 participants reconsidered their rating at least once and increased the rating. Participants who were grouped under 'easily persuadable' reported significantly higher persuasion from both authoritative and peer agents and the change in scores indicate the same.

Authoritative agents were reported to be more credible regardless of the gender of the agent and participants reported higher level of trust in the information provided by them, indicating that the authoritative agents were perceived as competent. Additionally, they were also reported to be more persuasive than peer agents. The most effective setting for authoritative agents was in vicarious setting cf. Figure 18. The least effective setting was when both the agents were peer.

Further, the agents in the multiple setting (user-directed) were considered to be more credible than a single agent and also users reported that they would consult the agents again and would recommend it to friends. This setting was also more helpful and users reported high satisfaction. 39% of the users in single agent setting preferred to have multiple agents with different perspective while only 16% preferred to have one agent condition. From the above results it is quite evident that multiple agent condition is indeed more effective, in particular, when vicarious persuasion is used.

5.5.1 Limitations

Although the sample size for this study was lower, results indicate a significant relation between the type of persuasion used and agent attribute i.e., status on user's persuasion. Future work will include collecting a larger sample of data and performing a detailed analysis focusing on the effects of status and persuasion type with multiple agents. Also, we aim to make the study more interactive, where the participant will be able to communicate with the agents and focus on studying the effectiveness of agents in various other domains e.g., healthcare, education.

5.6 Requirements

The following requirements are elicited from this study. For a detailed overview, see Section 7.

- **D2.3-F23** - The virtual coaches should incorporate vicarious persuasion strategies.
- **D2.3-I3** - End-users must interact with multiple coaches instead of a single coach.
- **D2.3-S3** - The appearance of the virtual coaches could be competent/authoritative when providing important information.



Part C: Outcomes

1. Description of internal process to emphasize relevant project requirements
2. Overview of user requirements

6 Internal session: prioritizing project requirements

The process of defining what has been termed ‘the project requirements’ in the COUCH project is a way to make use of the insights and deliberation among project partners to keep steering the general direction of the project in a responsible direction, while following the objectives as set out in the project’s Grant Agreement document. Thus, the project-requirement prioritization process is an exercise to keep engaging the general design principles:

- The user is in control
- Council of Coaches should be more engaging than a single-coach solution

The High-Level Requirements, the process of identifying them and the ongoing process of negotiation, in which these requirements continuously are kept at the centre of attention for the consortium in direct and indirect ways, is a powerful tool to uncover tacit knowledge in the project and to anticipate future obstacles and dilemmas, internal to and connected with the project in general and the development of the technology in particular. By continuous deliberation about the requirements and how they, their context and connectedness to other issues and conditions of the project and beyond are developing as the project takes form, an informed and comprehensive approach to responsible and user-centred technology development is ensured. The High-Level Requirements process is closely connected to the Council of Coaches RRI Vision and general RRI work, and some High-Level Requirements overlap with RRI requirements. This interconnectedness adds further to strengthen the responsible and informed foundation of the project.

The High-Level Requirements is the product of an internal process in the consortium, where the Project Management and the RRI officers together identified a bulk list of the top nine ‘hot spot’ areas, which had previously been identified through RRI work, technical integration workshops and consortium meetings. These nine areas were analysed and then regrouped under five thematic headlines:

- Holistic/differentiated models of health
- Knowledge base
- User experience and interaction with the applications
- Legal & ethics compliance regarding data collection
- Coaching style and conduct

These themes, together with the bulk list (presented below in Table 20), gave rise to the first round of ‘High-Level Requirements Negotiations’; a telco-facilitated roundtable discussion facilitated by Project Management and RRI officers. This first round of negotiations had the purpose of prioritizing the identified High-Level Requirements, in order to construct a list specifying in what order to deliberate the requirements in depth. The participants of these negotiations are the relevant partners of the consortium, representing the various stakeholders of the Council of Coaches project; the Description of Action (DoA), RRI perspectives, user perspectives, exploitation, the architecture etc. Each participant was asked to vote for the three most vital requirements, in relation to urgency in time, from 1-3, 3 being the highest priority. This initial voting manoeuvre then resulted in the formal Negotiations Map, where each High-Level Requirement will be debated thoroughly, one by one, in a formalized procedure throughout the remainder of the project.

Table 20: Original voting sheet for the High-Level Requirements.

Themes		Perspectives *							Votes
		A	B	C	D	E	F	G	
1) Holistic/Differentiated models of health			1		1	2	3		7
HLR1	Huber's model of health								
HLR10	Disagreement between coaches								
2) Knowledge base		2	3	1	3		2	3	14
HLR2	Addressed health topics								
HLR11	How to keep healthcare knowledge up-to-date								
3) User experience and interaction with the applications		3	2	2					7
HLR4	"Deep" character (coach) design								
HLR7	Choosing the visual/thematic style								
4) Legal & ethics compliance regarding data collection		1		3	2	3		2	11
HLR5	Privacy-by-design in data collection								
HLR6	Built-in informed consent								
HLR3	Coach-as-a-sensor								
5) Coaching style and conduct						1	1	1	3
HLR8	Sports coach vs. motivational interviewing style								
HLR9	Course of coaching sessions								
<p>You can vote for three themes. Rank them by giving them 3,2, and 1 points respectively.</p> <p>* Each letter (A, B, C, D, E, F, G) represents the participants from the different consortium sites.</p>									

Below a list of the High-Level Requirements (in prioritized order). Up till the release of prototype 2, only the Knowledge Base (see Section 6.1.2.1) has been the subject of a round of High-Level Requirements Negotiations. The remaining High-Level Requirements will be discussed from M13 to M24.

6.1.1 Theme 1: Holistic/differentiated models of health

6.1.1.1 HLR1: Huber's Model of Health

Source: Proposal (Objective 1)

Criteria: The Huber's Model of Health' aspects: bodily functions, mental functions & perception, spiritual/existential dimension, quality of life, social & societal participation, and daily functioning will be the 6 criteria's to assess a person's health during Council of Coaches evaluations and will be the foundation to formulate improvements in health.

6.1.1.2 HLR10: Disagreement between coaches

Source: RRI issue #3, D2.1

Open Question: A holistic model of health including various sources of health knowledge may generate various and even conflicting answers to a specific problem. How to deal with conflicting advice in practice?

6.1.2 Theme 2: Knowledge base

6.1.2.1 HLR2: Addressed Health topics

Source: Proposal (Objective 1)

Criteria: The project should address the defined domains (physical, cognitive, mental, social) and defined target groups (elderly, diabetes type2, chronic pain). COUCH Functionalities should cover the 12 elements of the matrix (Figure 20) below.

	Domain			
	Physical	Cognitive	Social	Mental
Age Related Impairments				
Diabetes Type 2				
Chronic Pain				

Figure 20: Example matrix of health domain topics per patient group.

6.1.2.2 HLR11: How to keep healthcare knowledge up-to-date

Source: RRI issue #4, D2.1

Criteria: Recommendations provided by the coaches should be in line with the latest scientific insights and recommendations from e.g. the World Health Organization, where applicable.

6.1.3 Theme 3: User experience and interaction with the applications

6.1.3.1 HLR4: "Deep" character (coach) design

Source: Proposal (Objectives 2 & 4)

Criteria: The engagement of the end user should be increased to provide the added value of Council of Coaches.

6.1.3.2 HLR7: Choosing the visual / thematic style

Source: General Brainstorm

Open Question: What should the visual / thematic style of the whole prototype be? What is the effect of "cartoony" vs "realistic" appearances on e.g. trust, engagement?

6.1.4 Theme 4: Legal & ethics compliance regarding data collection

6.1.4.1 HLR3: Coach-as-a-Sensor

Source: Proposal (Objective 3)

Criteria: We need a number of example cases in which we extract “health” *information* from the user through a dialogue interaction (without sensors) and develop it into “*knowledge*” that can be used in the knowledge database – the “Coach-as-a-Sensor” concept.

6.1.4.2 HLR5: Privacy-by-design in data collection

Source: General Brainstorm (on how can we go beyond the state of the art, on the scientific level)

Some aspects are quite simple: multiple coaches, dialogue between multiple coaches, how virtual coaches will interact with each other, how to implement RRI issues in a project. For the HBAF it is more or less the same as in a one coach application. Therefore, we aim to go beyond the SOA by incorporating Privacy by Design’.

Criteria: Data collection through sensors and dialogue history should be done in a privacy-by-design way (e.g. quickly derive higher level conclusions and disregard raw input data: how can we aggregate “personal” information to “non-personal” knowledge)

6.1.4.3 HLR6: Built-in informed consent

Source: RRI Brainstorm Copenhagen (and go beyond State of the Art)

Criteria: Providing informed consent for collecting and storing data should be an integral part of the coaching process, not an auxiliary process.

6.1.5 Theme 5: Coaching style and conduct

6.1.5.1 HLR8: Sports coach style vs. motivational interviewing style

Source: RRI intervention Valencia / General Brainstorm

Open Question: Should it be possible to choose between coaching styles? Who should decide on the style in each case? Should an option to choose between styles of coaching be built into the application?

6.1.5.2 HLR9: Course of coaching sessions

Source: RRI Brainstorm Valencia / General Brainstorm

Open Question: In real-life coaching, ethical conduct implies that the course of coaching sessions discontinues when the original problem initiating the relation between a coach and client is solved. Old age, diabetes and chronic pain do not go away. Should there be an end point for a clients’ involvement with Council of Coaches?

6.2 Requirements

The following requirements are elicited from this study. For further discussions on the higher-level requirements will yield additional requirements. For a detailed overview, see the overview of generated user requirements in Section 7.

- **D2.3-F3** - The system must provide coaches that reflect the different aspects of health, as defined by Huber (physical health, mental health, social health, spiritual health, quality of life, daily functioning).
- **D2.3-F22** - The system should use the 6 dimensions of Huber’s model of health to create a profile of end-user’s health.
- **D2.3-S2** - The virtual coaches should be more than just a ‘talking head’. Virtual coaches should be designed as interesting “characters”.

7 Overview of user requirements

In this section we provide an overview of all the requirements that are defined based on the previously described studies, in the sections below, these requirements are divided into the FICS components:

- Section 7.1: Functions and Events
- Section 0: Interaction and Usability
- Section 7.3: Content and Structure
- Section 7.4: Style and Aesthetics

7.1 Functions and events

ID:	D2.3-F1
Requirement:	The systems must provide a 'buddy' or 'peer counsellor' as one of the coaches.
Source:	ARI post study workshop, CP diary entries, stakeholder interviews.
Rationale:	People want to learn from experiences from their fellow patients.
Priority:	Must.
History:	

ID:	D2.3-F2
Requirement:	The coaches must be able to explain the sources they base their information on.
Source:	ARI post study workshop.
Rationale:	People want to be able to trust health information and want to know where it originates from.
Priority:	Must.
History:	

ID:	D2.3-F3
Requirement:	The system must provide coaches that reflect the different aspects of health, as defined by Huber (physical health, mental health, social health, spiritual health, quality of life, daily functioning).
Source:	ARI post study workshop, CP post study interview, CP diary entries, stakeholder interviews, HLR negotiations.
Rationale:	People experience that health consists of different aspects and want to be coached in all of them.
Priority:	Must.
History:	

ID:	D2.3-F4
Requirement:	The system could adapt itself with respect to tone of voice (positive, negative, humorous) by learning from compliance with given advice.
Source:	ARI post study workshop, stakeholder interviews.
Rationale:	People prefer different tones of voice when being counselled for improving health.
Priority:	Could.
History:	Possible conflict with C3.

ID:	D2.3-F5
Requirement:	The system should allow a medical professional to activate a health education module on a specific topic or disease (e.g., diabetes T2, losing weight) for an individual end-user.
Source:	ARI Post study workshop, stakeholder interviews.
Rationale:	After a diagnosis or consult, healthcare professionals start health education.
Priority:	Should.
History:	

ID:	D2.3-F6
Requirement:	The system should provide triage on whether to visit a general practitioner or physical therapist, or none at all, on all types of complaints (possibly linked to F7).
Source:	ARI post study workshop, ARI diary entries, CP diary entries, stakeholder interviews.
Rationale:	People are insecure on whether they need to visit their general practitioner.
Priority:	Should.
History:	

ID:	D2.3-F7
Requirement:	The system should incorporate all information in the end-user's medical record when providing personal advice.
Source:	ARI post study workshop, CP diary entries, stakeholder interviews.
Rationale:	People feel it's annoying if they have to explain their health situation numerous times.
Priority:	Should.
History:	

ID:	D2.3-F8
Requirement:	The system should provide the option for the end-user to provide consent of using all his/her personal health information, right after registration, rather than asking for permission to use selected snippets of information during use (e.g., demographics, data related to medication use, data related to allergies).
Source:	ARI post study workshop.
Rationale:	People dislike being interrupted for providing consent.
Priority:	Should.
History:	

ID:	D2.3-F9
Requirement:	The coaches could provide information about local health-related events that are of interest for an individual end-user.
Source:	ARI post study workshop, stakeholder interviews.
Rationale:	People want to work on their health locally and in a social setting.
Priority:	Could.
History:	

ID:	D2.3-F10
Requirement:	The coaches should remind the end-user that he or she has forgotten to take his or her medication.
Source:	ARI post study workshop, stakeholder interviews.
Rationale:	People forget to take their medication.
Priority:	Should.
History:	

ID:	D2.3-F11
Requirement:	The coaches could explain the interpretation of common medical tests (e.g., CRP blood test) and interpret the end-user's values with respect to reference values.
Source:	ARI diary entry.
Rationale:	People want to understand what their medical tests mean.
Priority:	Could.
History:	

ID:	D2.3-F12
Requirement:	The system could display instruction videos of exercises that were prescribed by a physical therapist.
Source:	ARI diary entries, CP post study interview, stakeholder interviews.
Rationale:	People want to know whether they still perform exercises correctly after instructions at the physical therapy office.
Priority:	Could.
History:	

ID:	D2.3-F13
Requirement:	The system must offer monitoring assistance for patients with a chronic disease to detect exacerbations.
Source:	CP post study interview, CP diary entries, stakeholder interviews.
Rationale:	People want when their symptoms are serious and increasing, and they want to prevent a full-scale exacerbation.
Priority:	Must.
History:	Possible conflict with F14.

ID:	D2.3-F14
Requirement:	The system could monitor physical and mental workload, and must intervene when the workload becomes too much for an individual end-user.
Source:	CP diary entries, stakeholder interviews.
Rationale:	People overwork themselves physically and/or mentally without noticing.
Priority:	Could.
History:	Possible conflict with F13.

ID:	D2.3-F15
Requirement:	The coaches should be up-to-date about the advice their fellow coaches have given and should take this into account into their own conversation and/or advice.
Source:	stakeholder interviews.
Rationale:	You don't want conflicts to happen in advice and different advices should be in line.
Priority:	Should.
History:	

ID:	D2.3-F16
Requirement:	The coaches should monitor the occurrence of life events that happen to an end-user (e.g., divorce, losing a job), and should take this into account in their coaching strategy.
Source:	ARI diary entries, stakeholder interviews.
Rationale:	Life events affect the end-user's health on several dimensions.
Priority:	Should.
History:	

ID:	D2.3-F17
Requirement:	The system must offer monitoring assistance for decline due to old age to detect instances where professional is necessary.
Source:	Stakeholder interviews.
Rationale:	Older adults develop short cuts to deal with age-related impairments instead of seeking professional help.
Priority:	Must.
History:	Possible conflict with F14.

ID:	D2.3-F18
Requirement:	The coaches in the system must collaborate to work on overarching individual health goals for the end-user.
Source:	Stakeholder interviews.
Rationale:	Patients want clear goals to work on their health (not different goals for different health domains).
Priority:	Must.
History:	

ID:	D2.3-F19
Requirement:	The system should provide end-users the opportunity to give permission to share snippets of personal health information (e.g., activity data, medical history) with caregivers whenever the needs arises or a caregiver requests them.
Source:	Stakeholder interviews.
Rationale:	People want to be able to control what will and will not be shared with caregivers.
Priority:	Should.
History:	

ID:	D2.3-F20
Requirement:	The system could allow an end-user to include their real-life caregivers as virtual coaches in their council of coaches.
Source:	Stakeholder interviews.
Rationale:	Caregivers would like remote monitoring for their patients.
Priority:	Won't have.
History:	

ID:	D2.3-F21
Requirement:	The system should to send a notification to a (informal) caregiver of the end-user when one of the following health issues occur: not taking medication, being physically inactive, a situation of mental overload.
Source:	Stakeholder interviews.
Rationale:	To ensure medical safety (currently, this information doesn't always reach caregivers).
Priority:	Should.
History:	

ID:	D2.3-F22
Requirement:	The system should use the 6 dimensions of Huber's model of health to create a profile of end-user's health.
Source:	HLR negotiations.
Rationale:	The Huber's Model of Health' aspects: bodily functions, mental functions & perception, spiritual/existential dimension, quality of life, social & societal participation, and daily functioning will be the 6 criteria used to assess effectiveness of the system as a whole.
Priority:	Should.
History:	

ID:	D2.3-F23
Requirement:	The virtual coaches should incorporate vicarious persuasion strategies.
Source:	Study: Evaluation on the effects of agent's gender, role and focus on user's persuasion.
Rationale:	Users were persuaded to a higher level when the coaches used vicarious persuasion i.e., one agent persuading the other agent.
Priority:	Should.
History:	

7.2 Interaction & usability

ID:	D2.3-I1
Requirement:	The system should allow the end-user to choose one coach that leads the discussion with the end-user.
Source:	Stakeholder interviews.
Rationale:	Patients often have a preference for a caregiver. Giving him/her the main voice works more in convincing.
Priority:	Should.
History:	

ID:	D2.3-I2
Requirement:	End-users should interact with the interface via clicks on buttons only (no use of sliders, swipe mechanisms, etc.).
Source:	Stakeholder interviews.
Rationale:	People get confused when there are multiple interaction possibilities within one system.
Priority:	
History:	

ID:	D2.3-I3
Requirement:	End-users must interact with multiple coaches instead of a single coach.
Source:	Study: Evaluation on the effects of agent's gender, role and focus on user's persuasion.
Rationale:	The results from the study on user persuasion by virtual agents indicated that users were more persuaded as multi-agent setting provided different perspectives on the topic.
Priority:	Must.
History:	

7.3 Content & structure

ID:	D2.3-C1
Requirement:	The system content must be written with B1 (or equivalent in other countries) proficiency in mind.
Source:	ARI post study workshop.
Rationale:	End-users consist of many people with low literacy.
Priority:	Must.
History:	

ID:	D2.3-C2
Requirement:	The system should provide the most common symptoms of each medication that an end-user is using.
Source:	ARI post study workshop / diary entries.
Rationale:	People often want to know whether the symptoms they experience are due to their medication.
Priority:	Should.
History:	

ID:	D2.3-C3
Requirement:	The coaches in the council should have an empathic tone of voice.
Source:	ARI post study workshop.
Rationale:	End-users experience empathy as comfortable and a low barrier.
Priority:	Should.
History:	Possible conflict with F4.

ID:	D2.3-C4
Requirement:	The system must facilitate ACT treatment.
Source:	ARI post study workshop, CP post study interview, CP diary entries, stakeholder interviews.
Rationale:	People want to learn how to integrate their illness or condition into their daily lives.
Priority:	Must.
History:	

ID:	D2.3-C5
Requirement:	The health information that the coaches provide must be based on credible sources (e.g., scientific papers, medical protocols, official health information websites, like "voedingscentrum", "thuisarts", municipal health services, centers for disease control).
Source:	ARI post study workshop, CP diary entries, stakeholder interviews.
Rationale:	People want to be able to trust the health information they receive.
Priority:	Must.
History:	

ID:	D2.3-C6
Requirement:	The coached could support end-users before and after an operation (in terms of diet, physical activity).
Source:	ARI post study workshop, CP post study interview.
Rationale:	People want to be coached in uncertain times.
Priority:	Could.
History:	

ID:	D2.3-C7
Requirement:	The coaches should be able to explain the treatment protocol for a disease.
Source:	ARI diary entries, CP post study workshop, stakeholder interviews.
Rationale:	People want to know which other options they have for treatment outside the one they are receiving.
Priority:	Should.
History:	

ID:	D2.3-C8
Requirement:	The coaches could support a discussion with patients with chronic pain about whether or not they are still capable of working, and if so, how they should adapt themselves or their workspace.
Source:	Stakeholder interviews.
Rationale:	Patients with chronic pain want to keep working as long as possible, but are unaware of how to make adjustment with regard to their condition.
Priority:	Could.
History:	

ID:	D2.3-C9
Requirement:	The coaches could provide older adults coaching on maintaining an independent life (e.g. reminding them on daily routines, birthday reminders, reminders on (social) events they planned, etc.).
Source:	Stakeholder interviews.
Rationale:	Older adults want to be self-reliant, but as they grow older, the loss of memory could interfere with that desire.
Priority:	
History:	

7.4 Style & Aesthetics

ID:	D2.3-S1
Requirement:	The appearance of the coaches should be in line with their role (e.g., the physical coach should be physically fit).
Source:	ARI post study workshop.
Rationale:	People need consistency between the coach appearance and their advice.
Priority:	Should.
History:	

ID:	D2.3-S2
Requirement:	The virtual coaches should be more than just a 'talking head'. Virtual coaches should be designed as interesting "characters".
Source:	HLR negotiations.
Rationale:	The engagement of the end user should be increased to provide the added value of a council of coaches.
Priority:	Should.
History:	

ID:	D2.3-S3
Requirement:	The appearance of the virtual coaches could be competent/authoritative when providing important information.
Source:	Study: Evaluation on the effects of agent's gender, role and focus on user's persuasion.
Rationale:	Users reported high credibility and trustworthiness for authoritative agents in comparison to peer agents.
Priority:	Could.
History:	

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