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Guidelines design for compassion focused automated feedback in a homebased healthcare context

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Abstract

Compassion focused automated feedback given by home-based sensors to the users attends to the need to alleviate the growing burden on healthcare centres' capacities. It also addresses the impact of compassionate framing in message delivery, which involves recognizing suffering and acting to alleviate it, which are prime values in healthcare. There are two existing research gaps in this area, one is the transparency of feedback design methods, and the other is the need for a compassion design focus in technology revolving around healthcare. The research question guiding this thesis is: *How can compassionate focused automated feedback for homebased healthcare be designed?*

To address this question, this study employed the double diamond method, which comprises the discover, define, develop, and deliver phases; of which only the first three were followed. In the discovery phase a literature review on automated feedback design automated feedback's design and in health-related contexts was conducted. The definition and development phase consisted of the creation of the compassion focused guidelines. Two personas profiled after long-term and chronic illness patients were created to illustrate the guidelines. The guidelines are composed of (1) compassion-related elements (recognition of suffering, attempt to alleviate suffering, and personalisation) and (2) elements of automated feedback (humanisation, interactivity, and empathy).

This prototype of guidelines for home-based health sensors offers a semi structured approach for designing compassion focused automated feedback. This answers the research question. Future research should test these guidelines to assess its efficacy and refine the guidelines based on empirical user evaluations.

Keywords: compassion, compassionate focused automated feedback, compassionate design, home-based healthcare, health sensors, double diamond method.

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Introduction

The increase in long-term or chronic illnesses is overwhelming healthcare centre capacities, while the increasing complexity of new, more effective treatments aimed at improving quality of life is driving up healthcare costs (Ferlay et al., 2015; and Nguyen et al., 2017). Finding ways to manage these two obstacles has become urgent in order to preserve high-quality healthcare service. A promising solution is the use of home-based digital care, which refers to any kind of healthcare service provided to patients in their homes using digital technology such as remote monitoring. This kind of care has proven to reduce rehospitalizations, emergency department visits, hospital admissions, treatment delays, and hospital-related complications (Denecke et al., 2023; Garner et al., 2023; and Medina et al., 2022). As a result of remote monitoring in home-based digital care, early responses to a patient's symptoms lead to better symptom control, higher survival rates, better patient life quality (Santamaria et al., 2004), and lower overall healthcare system costs (Bartoli et al., 2009; and Noel et al., 2004). This can be especially relevant for users in rural areas, where access to certain kinds of assistance is particularly challenging due to the lack of professionals and health centres in these areas (Hicks et al. 2009; and Probst & Bhavsar, 2014), as well as for users with mobility challenges and patients who already need to visit health care facilities often.

At present, the active participation of health professionals is necessary for home-based digital care to function properly. So, while it is already significantly resource-saving, it does not completely address the insufficient number of professionals available given the increasing number of long-term and chronic diseases (Jha & Mehendale, 2022; Ugai et al., 2022; and Boutari & Mantzoros, 2022). Feedback-giving sensor technology refers to any technology that uses sensors to collect information and provides feedback to users based on the sensor data. It has shown the potential to tackle the lack of personnel quandary, as well as bringing other multiple benefits, such as providing patients with relevant information for self-care based on real-time data (Kris et al., 2011), allowing for quick responses to prevent patient deterioration and optimize their management (Kofoed et al., 2012), and relieving the workload of medical staff (Judson et al., 2020). In light of this, feedback-giving sensor technology holds significant potential to support professionals work in patient care alleviating their load for less complex tasks and providing with further real-time, relevant information to both professionals and users.

Automated feedback consists of the responses or messages generated by software without involving human intervention in its delivery (although it requires it in the feedback design process). It can be written, voiced, visual (images or visual cues), or combined. People can use it to receive guidance, information, and/or evaluations based on their actions or input. Healthcare professionals have utilized automated feedback to assist and guide patients during their treatment process, notify them about any health anomalies, and give them relevant circumstantial information. Automated feedback has proven useful in health care by providing motor training to patients with Parkinson's disease (Casamassima et al., 2014), supporting weight-loss management and health improvement in individuals with obesity (Orsama et al., 2013), easing the delivery of pregnancy health-related information (Chung et al., 2021), enhancing general well-being (Potts et al., 2023), monitoring for lung transplantation complications (Odisho et al., 2023), and aiding in the gait rehabilitation of stroke patients (Nieboer et al., 2021), among other applications. Research has shown that automated feedback has the potential to help users get quick attention in home-based healthcare, reducing the involvement of health professionals and travels to healthcare facilities.

However, there are some challenges to overcome in order to optimally benefit from automated feedback (Ginis et al., 2016; and Nieboer et al., 2021). Automated feedback systems can encounter some challenges that can affect users' trust in the aforementioned technologies, and health system, as well as the therapeutical relationship user-technology, and the efficacy of the interventions and the ongoing communication. Examples of these challenges can be technical problems (Fitzpatrick et al., 2017; and Potts et al., 2023), a lack of free text answers, and static flow interaction (Hauser-Ulrich et al., 2020); and framing challenges, like restricted capacity to show empathy due to a limitation to going outside their scripted design (Mitchell et al., 2021), misunderstanding of the messages (Moore et al., 2024), and patronization (Mennicken et al., 2016). Patronization implies a component of perceived condescension towards the user consequence of poorly framed support interactions. This can be consequence of lack of adaptability and personalisation to patients' reactions and knowledge, unsolicited advice, or being too directive or instructional. In the context of automated feedback systems, this risk must be carefully managed, especially when patients are expected to self-administer treatments and handle distressing situations at home without immediate professional guidance. Therefore, patients do not only need clear guidance and instructions, but also human qualities in the

system's responses, such as a supportive emotional tone and personalisation; as well as allow for user agency.

Paying attention to message framing of automated feedback health sensors during the message design process can address the limited capacity for empathy displays and the patronizing delivery of messages. Message framing theory explores how individuals' perceptions and reactions to a message are influenced by the way it is presented. Research indicates that people respond differently to identical information depending on whether it is framed in terms of potential benefits or drawbacks, and on the emotional tone of the message (Kahneman, 2011, as cited in Gier et al., 2023; *Framing Health Care Quality Scores as Positive or Negative*, 2016; Tversky & Kahneman, 1981). Adequate framing enhances understanding and influences the perception of provided information (Davie, 2014; and Sunday, 2017). However, relying solely on this definition of message framing is limiting and insufficient, as it fails to account for the complexity of human emotions and suffering.

Compassion is defined as “a deep awareness of the suffering of another coupled with the wish to relieve it” or the act of perceiving someone suffering, a motivation or action to alleviate this suffering, and showing empathetic concern, which is the most extended understanding of compassion in literature (Strauss et al., 2016). Gilbert's definition encompassed six attributes: sensitivity, sympathy, empathy, motivation/caring, distress tolerance, and non-judgement. This empathetic concern mentioned by Gilbert implies adopting the other person's perspective and imagining or feeling their condition, as well as an emotional resonance to it, but it is not enough by itself in order to decrease this distress. Until now, empathy has been found to be more used to describe technology than compassion itself (Van Lotringen et al., 2022), since it takes into consideration the emotional state of patients during message framing. Although empathy has shown to be a strong predictor of therapeutic alliance, which translates to increased engagement in technology use and trust (Hauser-Ulrich et al., 2020), it alone is insufficient to reduce distress. Conversely, compassion focuses on distress and implies a motivation or action to alleviate any perceived suffering, while empathy can be felt for any emotional display and does not compel any action

As for now, sensor-made feedback has been found to be mostly task-focused, with little attention paid to message framing. Instead of addressing emotions, motivations or well-being, it provides with performance-based information for task completion or

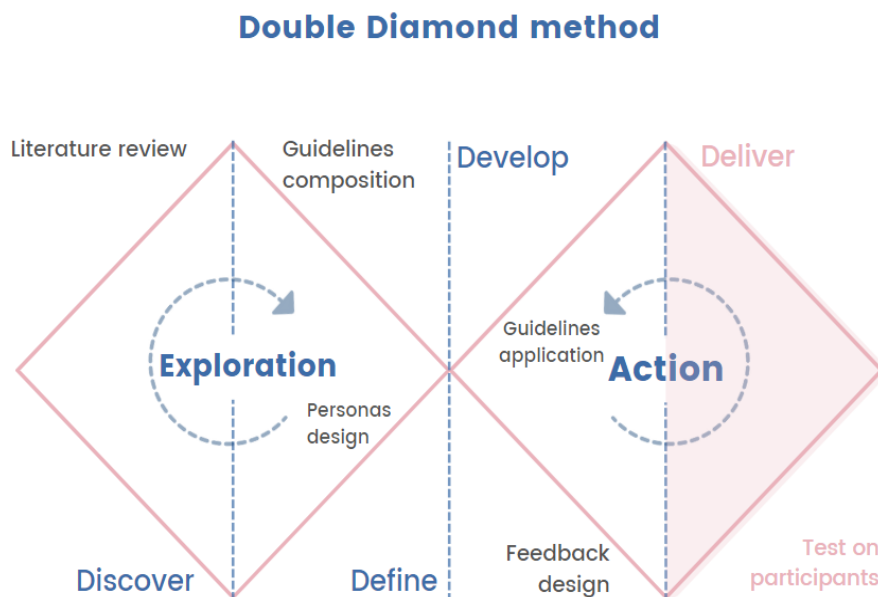
improvement. Designing automated feedback messages with a compassionate framing for automated feedback giving health sensors is crucial for improving automated care. Despite the existence of numerous studies that assess automated feedback in multiple formats, none of them assesses the design process of the feedback given by their automated agents. Since the effectiveness of compassionate framed feedback depends not only on its content but also on how it is structured and delivered, it is essential to first establish clear design guidelines before evaluating its impact through experimental research. Therefore, this study aims to conduct a literature review to better understand the current state of the field and to gather the necessary data to start the design process for compassionate feedback guidelines. The ultimate goal is to provide future researchers and projects focused on compassionate automated feedback with a structured approach to designing such feedback. Therefore, the research question is: *How can compassionate focused automated feedback for home-based healthcare be designed?*

Methods

This is a design research project conducted following the double diamond approach, which was developed by the British Design Council (Design Council, n.d.). This method comprises four phases: discover, define, develop, and deliver; of which the current study encompasses the first three (see Figure 1). The first diamond stands for the exploration phase, and the second one stands for the action phase.

The goal of this design research was to design compassionate feedback guidelines for automated feedback agents in a healthcare context. This was done by means of:

- A literature review, which entails the discovery phase of the double diamond method, aimed to find relevant studies about automated feedback applied to the health care field. This provided the necessary background and understanding of the problem to develop the guidelines for the desired compassionate-focused feedback.
- During the definition phase, two personas were profiled after patients with long-term or chronic diseases, which later on would be used to provide context for the resulting guidelines.
- Finally, the development phase entailed the construction of the guidelines, based on an analysis of Gilbert's (2009) definition of compassion, and the aforementioned literature review. Example feedback messages were created with the personas as target audience for these guideline's illustration and piloting.

Figure 1*Double Diamond Method Diagram***Discovery phase: Literature review**

The aim of this literature review was to review articles reporting on automated feedback in health-related contexts, understand how other researchers have designed their own feedback, learn about users' experiences with this feedback, and, in general, provide the necessary background to build compassionate automated feedback guidelines. Articles analysing the use of automated feedback were included, as well as articles that described the feedback design process and showed users' opinions about the received feedback. As no articles were found working on compassionate focused automated feedback, these types of articles were the closest in relevance to this research. The articles were obtained from the electronic databases PubMed and Google Scholar and through a snowball sampling of reference lists. The search terms used were "automated feedback", "healthcare sensor feedback", "compassionate feedback", "chatbot feedback", "digital health", "text-based feedback", "feedback design process in healthcare" and "message design process in healthcare" in different combinations.

Inclusion and exclusion criteria

Eligibility criteria were: 1) focus on automated feedback for health maintenance or improvement, 2) describe the feedback design process and/or provide user's evaluation of the feedback, 3) studies written in the English language; 4) less than 25 years old.

The eligibility criteria were screened in 2 rounds. The first round involved a screening of the titles and the second one of the abstract and keywords.

For data extraction, the articles from Tables 1 and 2 were thoroughly read, with a focus on finding and understanding users' feedback and the shared characteristics of the agents that had or seemed to have a positive impact on the users' satisfaction levels and the effectiveness of the intervention that was relevant to compassion.

The results of the literature review can be seen in Tables 1 and 2. The low number of articles (n= 9) is explained by the limited availability of articles that meet the eligibility criteria. One article (Mennicken et al. (2016) does not fully meet the criteria since it is not aimed at health improvement but was included anyway because it provides relevant information about the user's thoughts about technology-driven communication.

Table 1

Compassionate feedback guidelines literature review: Overview of studies

Study	Study design	Target group	Kind of technology
Chung et al., 2021	Design Research. Text-mining and Contextual Usability Testing.	People enduring pregnancy preparation.	Chatbot (Dr. Joy). Mobile phone.
Fitzpatrick et al., 2017	Randomised controlled trial. Information only control group.	US university community students that self-identified as experiencing symptoms of depression and anxiety.	Chatbot (Woebot).
Hauser-Ulrich et al., (2020)	Randomised controlled trial. Control group: weekly motivational messages. No SELMA.	Anyone suffering from ongoing pain.	Chatbot (SELMA). Smartphone-based CBT.
Mennicken et al. (2016)	Two-group post-test randomized experiment.	Authors social networks and university mailing list.	Smart home.
Morris et al. (2018)	Randomised controlled trial. Control condition: peer responses. Experimental condition: peer responses as chatbot responses.	Anonymous population.	Chatbot (Koko).

Study	Study design	Target group	Kind of technology
Nieboer et al. (2021)	Qualitative research design with semi-structured interviews.	Stroke survivors.	Walking performance sensors. Smarthphone Android Mortotola Moto G 3 rd gen.
Odisho et al. (2023)	Design research	Patients of lung transplantation.	Chatbot.
Orsama et al. (2013)	Randomized controlled trial. Control condition: standard care Experimental condition: mobile telephone-based remote patient reporting and automated telephone feedback	Type 2 diabetes individuals.	Mobile telephone technology (remote patient reporting and automated feedback system)
Potts et al. 2023	Prep-post intervention study. Intervention: Use of Chatbot.	Participants from rural NPA* areas of Europe.	Chatbot (ChatPal)

Table 2*Compassionate feedback guidelines literature review: Elements of Compassionate Feedback*

Study	Kind of feedback	Aim of the feedback	Frequency and prompt	Example of kind of feedback	Users' evaluation
Chung et al., 2021	Text-based conversation. Instant messenger. Q&A based.	Deliver pregnancy health related information.	On user demand.	<i>"At first, you do not probably know what to do. When it is not easy to go somewhere right away, it is a good idea to practice mindfulness meditation"</i>	Appreciation for inclusion of personal details in their questions (close friend feeling). Utilitarian and hedonic value. Valuable information. Chatbot does not cover all relevant matter.
Fitzpatrick et al., 2017	Text-based conversation. Instant messenger. Empathic.	Deliver a self-help program.	F and P: On demand + daily push up notifications and weekly reports.	<i>"What's going on in your world right now?"</i> <i>"I'm so sorry you're feeling lonely. I guess we all feel a little lonely sometimes"</i>	Positive about accountability, empathy, bot's personality, learning. Negative about process violations, technical and content problems.
Hauser-Ulrich et al., (2020)	Text-based. Psychoeducational. Empathic.	Promote self-management of chronic pain	F and P: Seven daily messages.	<i>"Welcome back dear [nickname]. How did you manage the exercise,</i>	Mostly positive feedback (fun, helpful, optimism, empathy/bond).

Study	Kind of feedback	Aim of the feedback	Frequency and prompt	Example of kind of feedback	Users' evaluation
				<i>perhaps you can repeat it before the next time we meet?</i>	Negative: lack of free text answers, static flow interaction.
Mennicken et al. (2016)	Voiced. Assistance.	Everyday assistance.	F: depends on users' habits and needs. P: facial expression, time, interactions with the house...	<i>EC home: Extroverted and cheerful.</i> <i>CKC Home: Kind, Calm, Conscientious.</i>	Questions to confirm proposed actions, caring and stable mood deemed positive. Dislike for recommendations or directions (patronizing).
Morris et al. (2018)	Text-based feedback pre-written by peers. Chatbot gathers existing responses that fit the context.	Teach cognitive reappraisal skills and facilitate peer-to-peer interactions.	F and P: On demand.	<i>"I definitely understand how stressful that can be, and I'm sorry you're feeling this way"</i>	Peer responses rated more positively than chatbot generated. Chatbot ones mostly acceptable.
Nieboer et al. (2021)	Real time audio-feedback about walking performance (Stappy). Encouraging/Corrective.	Improve gait rehabilitation performance.	F: whenever rehabilitation takes place. P: performance.	<i>"Very good, try to continue in this way", "Pay attention to your walking"</i>	Positive as: active reminder, awareness of importance of being physically active, encouraging. STappy reminded them about their physiotherapist.

Study	Kind of feedback	Aim of the feedback	Frequency and prompt	Example of kind of feedback	Users' evaluation
Odisho et al. (2023)	Text-based automated feedback.	Monitor for complications of lung transplantation	F: Once per week, unless user's needs differ. P: No prompt.	<i>"Your FEV1 is about 36% less than your baseline of 3.75. We'd like you to take another FEV1 reading now [...]"</i> .	Net Promotor Score System used as evaluation tool with a result of 64% promoters, 25% neutrals and 11% detractors. No specific feedback.
Orsama et al. (2013)	Automated feedback related to personal health records. Encouraging/Instructive.	Improve self-management and health status.	F: twice per day. P: delivery of health parameters.	<i>"Your blood sugar levels were above the target levels of 8 mmol/L [...] Please, pay attention to [...] to avoid excessive variation in your blood sugar levels."</i>	Improved HbA1c and weight levels. No specific user feedback, only results. Considerable user experience satisfaction is mentioned.
Potts et al. 2023	Text-based automated feedback. Followed the PERMA/H model (positive emotions, engagement, relationships, meaning, accomplishment, and health).	Improvement of well-being.	F and P: Not specified.	<i>Hi! It's great that you want to go through some exercises with me. Please just press the button to choose the exercise *Display of options*."</i>	Complaints about the chatbot were related to the technical issues. Positive about exercises offered.

* Northern Periphery and Arctic

Definition phase: Personas design

Two personas (see Figures 2 and 3) profiled after potential end users of automated feedback health sensors were designed to help envision, tailor, and contextualize the application of the feedback guidelines (Jansen et al., 2017; and Salminen et al., 2022). These personas exemplified the application of the guidelines to two specific scenarios and served as a test for their usability. These scenarios were presented with both compassionate focused feedback and task-focused feedback, facilitating a clear identification of the differences between them. For their design, the goals of the personas were held in mind, which serves as the ground for the feedback design.

Both personas currently live in smart homes equipped with health sensors that measure vital constants such as heart and breathing rates, cortisol levels, and skin conductance. When they detect distress signals, these sensors provide feedback on these vitals, aiming to alleviate their suffering. The first persona has been inspired by Kaye (2018), a case study from the Society of Clinical Psychology. This case was modified to meet the needs of this study. The second one has been built using the advice of a mental health professional specializing in oncological patients.

Figure 2

Personas' charts

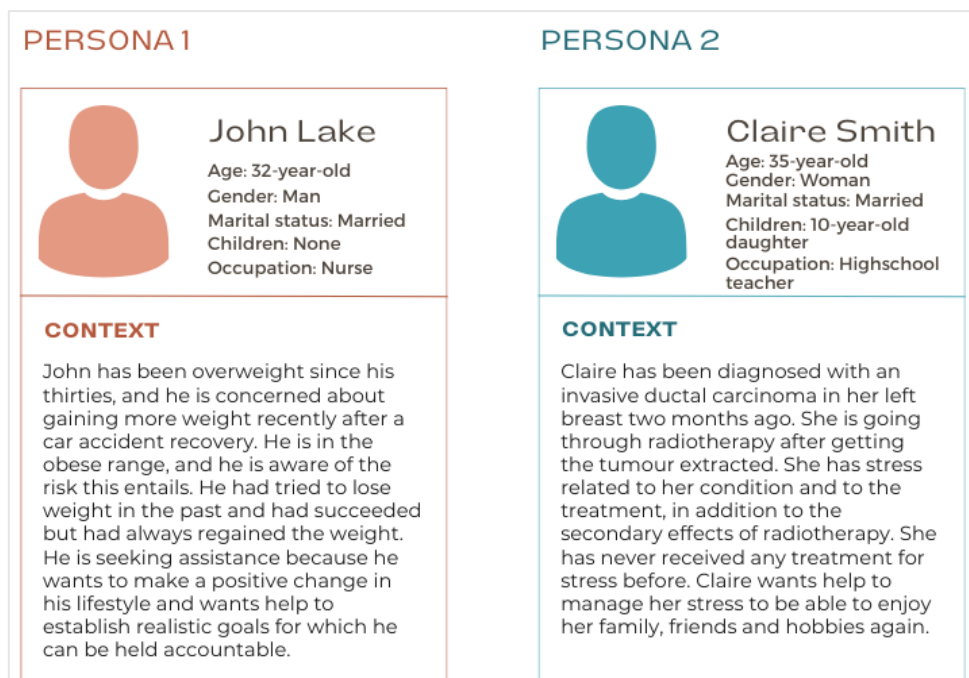




Figure 3*Personas' situations*

PERSONA 1	PERSONA 2
 John Lake	 Claire Smith
SITUATION 1 <p>John is doing exercise at home. He starts very strong, trying to surpass his limits, and his heart rate starts going very fast. Breathing becomes hard and he feels like he is lacking air. He gets a bit scared and stops. His heart rate keeps being in tachycardia, which makes him nervous. His breathing is not easing either. That makes him more anxious, which feeds back the situation. Starting very strong and finding himself in such a stressful situation might be one of the reasons why he could not reach his weight loss goals in the past.</p>	SITUATION 2 <p>Claire is home cooking dinner for her family. She is very tired from today's radiotherapy session, and the stitches from the tumour removal were especially itchy. Her husband insisted on her staying resting at home, but she did not want to stay there and "do nothing". She wants to do things as normal as possible for her daughter. While cooking, she was worrying about her hair falling soon, since she had been taking radiotherapy for a couple of weeks already. At that moment, her daughter approaches her to ask when dinner is going to be ready. Claire snaps at her and makes her leave the kitchen without further explanation. Claire starts feeling guilty about her reaction and her stress increases.</p>

Results

Development phase: Feedback design guidelines

These guidelines are based on an analysis of Gilbert's (2009) definition of compassion and the literature review seen in Tables 1 and 2. As no existing framework to design any kind of automated feedback was found, the guidelines for compassionate feedback design have been developed based on the compassionate literature and the users' feedback on the design literature (Table 2). These guidelines will provide a basis for the design of compassionate automated feedback.

Compassionate literature findings

To recap, based on Gilbert's (2009) definition of compassion this feedback needs to recognize the suffering of the user and attempt to alleviate it. The nature of this definition, which entails the use of different attributes (sensitivity, sympathy, empathy, motivation/caring, distress tolerance and non-judgement), allows for tailoring to a specific context, as it depends on the needs of different situations which attributes of compassion support the recognition and alleviation of suffering. This is especially relevant for automated feedback design, as it suggests a need for *personalised* feedback for every user and situation, involving different elements of compassion for each of them. This can also mean including other attributes or methods that are not mentioned, since taking different actions depending on the context can be compassionate or not. Sensitivity involves noticing other people's suffering, which makes the individual develop sympathy, understood as showing concern for the other person's suffering, and empathy, which entails adopting the other person's perspective emotionally or cognitively, which is a motivator for taking action to alleviate it. Distress tolerance is the capacity to deal with difficult emotions consequence of dealing with someone else's suffering without getting overwhelmed. Obviously, a sensor cannot resonate emotionally with someone or feel anything, but it is possible to provide feedback that evokes this feeling. As for this, the distress tolerance attribute does not need to be considered. Non-judgement is the ability to remain accepting of another person even when their condition, or response to it, arises difficult feelings in oneself. It is crucial to consider this last attribute when designing compassionate feedback to ensure it does not pass judgment on the user. This will allow the feedback to better adjust to every user. One of the most relevant attributes is "empathy", which would be the human motivator for acting into alleviating the suffering

of the user. This empathy could suggest a feeling of caring for the users, which would humanize the sensor.

Design literature findings

The findings and inferences from the design-related literature have been based on the users' feedback and authors reflections from the studies in the literature review, whose results can be consulted in Tables 1 and 2.

The users from both Fitzpatrick et al. (2017) and Hauser-Ulrich et al. (2020) indicated as a positive feature of their respective bots (Woebot and SELMA) the displays of empathy that the bots showed. According to Nieboer et al. (2021), users tend to show resistance to the agent's empathetic responses, even when they are similar to those given by other peers. Nevertheless, despite the users being more open to other users' answers, the agent's answers were well accepted and pointed out as a positive feature of the chatbots. This suggests that integrating empathy into automated feedback systems can contribute to a more engaging and well-received user experience.

Secondly, upon reviewing users' feedback from the literature review, specifically from Hauser-Ulrich et al. (2020) and users' complaints about a lack of free answers and a static flow interaction, another point to be considered is the interactivity of the sensor, namely, the user can interact with the sensor and a small conversation would be possible. For the feedback to be considered compassionate, the users need to be able to interact with it, as it makes the sensor feel caring and empathetic. The sensor may make suggestions and theories, giving the user a sense of self-sufficiency, which is relevant to avoid a patronizing interaction between the sensor and the user (Mennicken et al., 2016). The interaction between them is necessary to properly attend to the needs of the user, similar to the way a health professional would. This would also contribute to the humanization of the sensor. Something else that has been mentioned and could support the humanization or anthropomorphizing of the sensor's feedback is the apparent personality of the agent (Fitzpatrick et al., 2017). Chung et al. (2020) showed that participants also enjoyed the interactions with the chatbot Dr. Joy and appreciated the inclusion of personal details, which was also mentioned in Fitzpatrick et al. (2017). This contributes to the adherence to the use of the agent and can potentially favour an increase in well-being. The use of greetings and names by the agent is generally used by all the

studies that apply to this research, and it is a reasonable addition for any human interaction, which favours the humanization of the sensor as well.

Compassionate feedback design guidelines

In Table 3 both the compassionate and design literature aspects that compose these compassionate feedback guidelines for health sensors can be found.

Table 3

Compassionate feedback design guidelines

Feedback design guidelines		
Compassionate literature	Recognition of suffering	Perception of the suffering.
	Attempt to alleviate suffering	Intent to act on the suffering to decrease it.
	Personalisation	Tailoring feedback to each user's circumstance making use of the different attributes ¹ and methods.
Design literature	Humanisation	Make the feedback feel human.
	Interactivity	Allow a back-and-forth dialogue
	Empathy	Recognition of emotions that evokes a feeling of caring when combined with attempt to alleviate suffering.

¹ See Gilbert's (2009) definition of compassion

Applied guidelines

Situation 1

Compassionate feedback:

Hello, John. This is your health sensor, Jose. I am sensing your heart and breathing rate have increased. Is there anything you need assistance with?

I was doing exercise and now my heart goes very fast, and I cannot breathe well. It is not stopping.

Of course, that must make you feel uneasy, doesn't it? An increase in heart and breathing rate is common when exercising, and it usually goes down again after a few minutes. It seems like you have been like this for some minutes already. I can guide you through a breathing exercise to help you regulate your breathing and your heart rate. Would you like that?

Is that all I need?

Given your physiological parameters, that should be enough to make you feel more at ease. If you are still in distress after the breathing exercise, I can give you more assistance.

Okay. I would like that.

Humanisation

- Greetings and name

Recognition of suffering

Attempt to alleviating suffering

Personalisation

- Sympathy
- Breathing exercise

Empathy

Interactivity (Suggestions, theories, and questions)

Task-focused feedback:

This is your sensor. Your heart and breathing rate are excessively above the normal parameters due to your high activity levels. It is necessary to get them back to normal. Here, you must do a breathing exercise to achieve that.

Situation 2

Compassionate feedback:

Hello, Claire. This is your health sensor, Jose. I can sense that your heart rate, blood pressure and cortisol levels have increased. Is there anything you need assistance with?

Everything is too much. I am tired, my head is filled with worries, and I cannot do anything well. And I just paid it with my daughter.

I am sorry to hear that, Claire. Is there anything in particular I can help you with?

I don't think you can help me. I was thinking about when my hair is going to fall. I think that is one of the things that are going to make the situation more real.

Losing your hair can be something scary, and it is a tough circumstance for most people suffering from cancer. Nevertheless, that is not something that needs to apply to you since you are getting a radiotherapy treatment localised on your chest area. This kind of treatment does not have hair loss as a secondary effect.

I did not know that.

Humanisation

- Greetings and name

Recognition of suffering

Attempt to alleviating suffering

Personalisation

- Information

Empathy

Interactivity (Suggestions, theories, and questions)

Task-focused feedback:

Claire, this is your sensor. Your heart rate, blood pressure, and cortisol levels are above your usual range. To get them back to normal, I am sharing a breathing exercise that will help you reach them.

*Providing information to a patient may or may not be compassionate depending on the needs of the situation but considering that Claire's distress comes from her disinformation regarding her potential hair loss, covering this gap for her potentially contributes to her distress alleviation and makes it a compassionate measure.

Discussion

The goal of this study was providing future researchers with a structured approach to design compassionate-focused automated feedback, with the research question being: *How can compassionate focused automated feedback for home-based healthcare sensors be designed?* This work resulted in the first prototype of these compassionate feedback guidelines. The main results of the analysis of the literature suggests that for automated feedback to be compassion focused, it must have compassion-related aspects and elements of automated feedback. The compassion-related aspects include recognition of suffering, attempt to alleviate suffering, and personalisation, alongside the elements of automated feedback, namely humanisation, interactivity, and empathy.

The findings result of the compassionate literature emphasized the critical role of personalisation in the compassionate framing of the feedback. There are many definitions of compassion, but Gilbert's (2009) was chosen because it highlights personalisation, which is particularly fitting for this context. It also converges the essence of several other author's definitions with the recognition of suffering and the attempt to alleviate suffering. The importance of personalisation is further reinforced by Morrow et al. (2023), who proposes a reconceptualization of compassion, which involves six elements that address the need to understand the situation of each patient. This study supports the idea that interactivity and a caring approach are essential components of compassionate feedback. However, this suggests that not all the personalisation options have been covered in this research. This might imply, for example, that some patients might need a task-focused approach.

The design literature findings identify three important aspects to consider. Humanization is emphasized in the design literature findings and is supported by the other two components, interactivity and empathy. It has been seen that people already attribute human characteristics to artificial agents and that social norms are also applied to them (Nass et al., 1994). Users reported positive impressions from aspects of the agents related to human relations, such as personality (Fitzpatrick et al., 2017), empathy (Fitzpatrick et al., 2017; and Hause-Ulrich et al., 2020) and friendliness (Chung et al., 2021). Empathic emotion has also demonstrated a significant positive impact on users in areas beyond home-based healthcare, making the agent feel more likable, caring, trustworthy, and supportive (Brave et al., 2005). Empathy has also been found essential for humanisation

to have a positive effect, as it enhances perceived warmth and facilitates the willingness to trust it (Pelau et al., 2021). It would be interesting to analyse specifically which kind of impact compassion has on users and to what extent the available literature speaks about empathy when it is actually analysing compassion.

The therapeutic alliance, namely a trusting relationship with a health provider, is a big predictor of positive treatment outcomes, change, and adherence (Baier et al., 2020; Chue, 2006). Humanization is important for both short- and long-term therapeutic alliance agent-user interactions since it plays an important role in encouraging patients to interact with the sensor and to trust it (Fenwick & Molnar, 2022; and Hallqvist, 2021), as well as adherence. As previously discussed, interactivity plays a crucial role in offering better and more personalized attention to the users, as well as conveying empathy, humanness, and a sense of caring, which enables the therapeutic alliance as well.

Humanization is influenced not only by the framing and content of the messages, but also on other characteristics of the health sensor, such as the physical characteristics of the sensor, the method used to share the messages, voice or text (Fenwick & Molnar, 2022), the apparent personality of the agent (Fitzpatrick et al., 2017), and the interaction between them (Hamada et al., 2016). Additionally, it is essential for the agent to possess a social presence, which is defined as “the degree to which a person is perceived as a ‘real person’ in mediated communication” (Gunawardena, 1995). As Janson (2023) notes, a strong social presence enhances the human-like quality of the feedback. Future research could explore the impact of different personality archetypes presented by automated agents, as it would be wise to assume that different personalities will have different impacts on different users, and this might influence the therapeutic alliance between users and automated agents.

This study highlights compassion’s role in sensor technology use and automated feedback. Compassion is an adaptative prosocial feature that promotes caring behaviours steered by ethical values and social norms (Day et al., 2021; Gilbert, 2019 as seen in Morrow et al., 2023; and Goetz et al., 2010). Technology in health and social care is evolving and expanding, transforming interactions humans-machines interactions and incorporating affective and relational dimensions that are still being explored (De Togni et al., 2021). Design choices play a significant role in shaping this evolution and the values embedded within. For home-based care to be compassionate not only the framing

needs to be considered, but other aspects such as accessibility (Amin, 2019; as seen in Day, 2021). Considering that health technology has the potential to identify, alleviate, and prevent human suffering, as well as aggravating it, it is necessary to stress the importance of including compassion as a focus in technology design processes, as it has been done in this design research. By incorporating compassion into the user-agent relationship, these guidelines for compassionate automated feedback giving health sensors aim to enhance user experience, increase engagement, contribute to the humanization of automated feedback systems, and ultimately support patient well-being (Day, 2021; Van Lotringen et al., 2022).

Strengths and limitations

Gilbert's (2009) definition of compassion is one of the main strengths of this thesis, since it provides with a robust conceptual foundation ensuring that the guidelines for compassionate feedback are grounded in a comprehensive understanding of compassion. The use of personas in the feedback design process allows for more precise tailoring of feedback to various contexts and situations, enhancing the relevance and effectiveness of the feedback (Jansen et al., 2017; and Salminen et al., 2022).

The result of this project, the guidelines for the design of compassionate feedback, represents a novel addition to the current state of the art, addressing a previously unmet need for structured approaches in creating not only compassionate-framed feedback but for the transparency of feedback framing in general.

A key limitation was the scarcity of relevant literature, particularly on compassionate automated feedback-giving health sensors. As a result, conclusions had to be drawn from research on chatbots and health applications, rather than directly relevant studies. The lack of transparency in existing studies regarding their feedback design methods further challenged the research process, requiring a broader yet less precise approach. These gaps highlight the need for more research on compassionate technology, user perceptions, and compassionate message framing in feedback-giving health sensors.

Furthermore, while this study focused on message framing, other factors influencing user perception were not taken into consideration. Social presence and anthropomorphic elements can enhance or diminish engagement and satisfaction by making interactions feel more natural and human-like (Hamada et al., 2016). Future research should explore

their impact on compassionate focused automated feedback in health sensors. Finally, the absence of user evaluation inherently weakens the rest of the double diamond phases, since they all feedback on each other. However, this also presents an opportunity for future research to assess the efficacy of the current prototype.

Conclusion

This design research contributes to the current state of the literature by providing a set of guidelines for compassionate focused automated feedback for health sensors, highlighting the increasing need for more automated feedback services in healthcare, and addressing the lack of attention and transparency in the design of such feedback. This provides other researchers with a previously non-existent tool for designing compassionately focused automated feedback. This way, the research question “*How can compassionate focused automated feedback for home-based healthcare be designed?*” is answered.

The double diamond approach was used to design the guidelines. The discovery phase was done by means of a literature review to gather information about compassionate automated feedback design. During the definition and development phase, the guidelines were composed, and personas were developed to exemplify the use of these guidelines. These guidelines represent a prototype that requires further testing on users and refinement by professionals.

For future research, it would be pertinent to investigate the impact of different personality archetypes in automated agents, as varying personalities may influence user experience and the therapeutic alliance between users and automated systems. It would also be valuable to review existing literature for instances of mixed or incorrect use of compassion and empathy. More research is needed on compassionate technology, user perceptions, and compassionate message framing in feedback-giving health sensors. Finally, this study’s prototype presents an opportunity for future research to assess its efficacy and refine the guidelines based on empirical user evaluations.

Overall, the results of this master's thesis pave the way for a more compassionate home-based care by establishing guidelines that allow automated health sensors to provide more compassionate communication. This allows a stronger therapeutic relationship between the agent and the user, enhancing engagement and communication.

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