

YourWellness: Designing an Application to Support Positive Emotional Wellbeing in Older Adults

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Emotional wellbeing is an important indicator of overall health in adults over 65. For some older people, age-related declines to physical, cognitive or social wellbeing can negatively impact on their emotional wellbeing, as can the notion of growing older, the loss of a spouse, a loss of sense of purpose or general worries about coping, becoming ill and/or death. Yet, within the field of technology design for older adults to support independence, emotional wellbeing is often overlooked. In this paper we describe the design process of an application that supports older adults in monitoring their emotional wellbeing, as well as other parameters of wellbeing they consider important to their overall health. This application also provides informative and useful feedback to support the older person in managing their wellbeing, as well as clinically-based interventions if it is determined that some action or behaviour change is required on the part of the older person. We outline findings from a series of focus groups with older adults that have contributed to the design of the YourWellness application.

Emotional Wellbeing, Older Adults, Application Design, Feedback

1. INTRODUCTION

Population projections estimate a significant increase in the number of older adults in the near future (Hayutin, 2007). By 2050 an estimated 22% of the world's population, nearly 2 billion people, will be aged 60 or over (United Nations, 2007) and spending on pensions, health and longterm care is expected to triple by this time. Whilst ageing is wrought with challenges, it also offers many opportunities. Thus, improving the period of healthy ageing, by enabling older adults to manage their own health in the place of their choice, is an essential and pressing need. Technology can play a significant role in this (Jones, Windegarden & Rogers, 2009; Sainz-Salces et al. 2006). Emotional wellbeing is an important indicator of overall health in adults over 65 (Engel, Siewerdt & Jackson, 2011; NIMH, accessed 2012). Yet, within the field of technology design for older adults to support independence, emotional wellbeing is often overlooked, with research tending to focus on the three 'geriatric giants' of health and ageing - physical, cognitive and social health. A significant barrier to deliver technology solutions to support emotional wellbeing involves a lack of research into how to 'close the loop' in such applications i.e. what to do with a person's emotional wellbeing data once it has been collected and analysed, as well as unnecessarily complex interfaces and interaction techniques that make it difficult for older adults to benefit from such technology.

For some older people, age-related declines to physical, cognitive or social wellbeing can negatively impact on their emotional wellbeing, as can the notion of growing older, the loss of a spouse, a loss of sense of purpose or general worries about coping, becoming ill and/or death. However, the reverse is also true - poor emotional wellbeing can equally adversely affect one's overall health and wellbeing. Fair to poor emotional wellbeing has been shown to be significantly associated with poor appetite in older adults (Engel, Siewerdt & Jackson, 2011). Furthermore, many chronic health problems faced by older adults have a high rate of co-occurring depression. Up to 25% of people with cancer suffer depression, as do up to 27% of people who have had a stroke and 1 in 3 people who have suffered a heart attack (NIMH, accessed 2012). It is estimated that up to 5% of US citizens over the age of 65 living in the community have major depression compared with 13.5% of those who require home health care and 11.5% in nursing homes (Hybels & Blazer, 2003). However, a significantly larger number suffer depression that remains largely undiagnosed and thus untreated (Sable, Dunn & Zisook, 2000). Thus systems that can help older adults to monitor and self-manage their emotional wellbeing by providing feedback and interventions can be used to promote positive emotional wellbeing and perhaps, more significantly, might increase overall wellbeing.

The purpose of our research is to design and implement a tightly-knit, closed-loop feedback mechanism to deliver wellbeing interventions to the older population, that include support for emotional

wellbeing. By closed-loop we mean not only monitoring emotional wellbeing and mood over time, but detecting declines in positive wellbeing, assessing why wellbeing has declined and ultimately providing interventions to promote increased positive emotional wellbeing. To this end, we are designing an application - YourWellness - that supports older people in self-reporting on their wellbeing through interactive questionnaires. More critically for the older person, the application also provides them with informative feedback on their wellbeing over time and supports interventions to promote positive emotional wellbeing. YourWellness has currently been designed for use on an iPad but will also be made available as a web-based application. The focus of this paper is on the design process of the YourWellness application.

2. RELATED WORK

There has been a recent increase in the design of technology-based wellness applications that support people in actively monitoring their wellbeing, largely due to the wide availability of smart phones embedded with powerful sensors. Such applications promote wellbeing by providing the individual with some level of feedback based on the data collected. One of the issues with such applications tends to be a narrow focus, in terms of only monitoring one or two parameters of health. Furthermore, while there has been a recent increase in smartphone applications to monitor mood (MoodPanda: www.moodpanda.com; MoodJam: www.moodjam.com), we are not aware of an appropriate tool that provides clinically-based feedback to support older people in managing their emotional wellbeing.

UbiFit is an application that uses on-body sensing and activity inference to encourage and promote physical activity (Consolvo & Landay, 2009). However, it only looks at this single parameter of wellbeing. BeWell is a smartphone application to monitor, model and promote wellbeing across three parameters - quantity of sleep, physical activity and social interactions (Lane et al., 2011). All sensing is done through the smartphone, for example levels of social interaction are determined by microphone measurement of ambient conversations and duration of sleep is inferred by examining phone usage patterns. Both BeWell and UbiFit are targeted at the general population rather than older adults. MindBloom is an application that supports people in improving their quality of life by focusing them on what aspects of their life are important to them and motivating them to improve these areas (www.mindbloom.com). The Nokia Wellness Diary is a tool for Nokia mobile phones that supports users in setting health and wellness goals and aims to help the user in reaching these goals

(<http://europe.nokia.com/wellnessdiary>). Each of these applications provides feedback on various aspects of wellness, but don't explicitly support emotional wellbeing.

Some research efforts have begun to appear in the space of supporting mental wellbeing. Monarca is a persuasive monitoring and feedback system for mental illness and is an excellent example of a closed feedback loop to patients (Marcu, Bardram & Gabrielli, 2011). Furthermore, it has been designed based on a Patient-Clinician-Designer framework to overcome the unique challenges in designing for mental health patients. As such, Monarca acts as an exemplary reference point for any wellbeing application being delivered to patients. Doherty et al. describe a set of guidelines for the design and evaluation of mental health technologies (Doherty, Coyle & Matthews, 2010). These include guidelines relating to the design process, design factors related to the development of such technologies and guidelines for conducting evaluations of mental health technologies and constraints that exist (Doherty, Coyle & Matthews, 2010). While our work benefits from previous research such as that by Doherty et al. and the Monarca system, it differs in focus and intended cohort. Thus, the following section discusses design issues relevant to our specific research.

3. DESIGNING YOURWELLNESS

In designing the YourWellness application, we held three focus groups. Each focus group lasted approximately 90 minutes. Focus group 1 had 5 participants consisting of 2 men and 3 women aged between 61 and 82; focus group 2 had 2 men and 4 women aged between 64 and 86; focus group 3 had 5 participants, 2 men and 3 women, aged between 61 and 78. Participants were recruited from local ageing groups and within each focus group, participants knew each other. The aim of the focus groups were to explore values and attitudes to self reporting on health and wellbeing as well as to discuss design issues surrounding inputting such information as well as receiving feedback. This followed from previous work that involved interviews with older adults to explore attitudes to self-management of one's health (Doyle et al., 2011).

All focus group data collected was qualitative. Transcription of responses yielded data for content analysis. Two coders identified important themes based on the frequency and intensity of participant responses. Three major themes emerged which are outlined in the following subsections. Two smaller themes around motivation and compliance also emerged. A detailed discussion on these issues is outside the scope of this paper, but they are considered in our work. Section 4 describes our

current prototype application that has been designed based on these findings.

3.1 Important measures of wellbeing

Each focus group began by asking participants what they felt were the most important aspects of wellbeing as they age. A common theme across all 3 focus groups was the importance of social interaction. One participant noted: "That's, I'd say as essential to us as breathing and eating and stuff like that, we are social beings." What was interesting were the types of interactions that people found important. We would have considered 'quality' interactions - those with friends or family - to be most important to older people, with potentially more frequent but less quality interactions such as those with a shopkeeper or bank official not carrying much importance. However, many participants commented on the importance of these latter types of interactions, particularly for those without close family or friends. For some older adults, a quick chat with the postman or shopkeeper can be satisfying. Other research has found that quality of social relationships is a strong predictor of wellbeing in older adults (Pinquart & Sorenson, 2000). Thus, assessing an older adult's satisfaction with their social interactions is potentially an important component of a wellbeing application for this cohort.

Sleep was extensively discussed in each focus group. The majority of participants spoke of their poor sleep patterns and how it can negatively affect them the following day. It emerged that quality of sleep was more important than the number of hours slept, and in particular how rested you feel the next day. One participant stated: "I'd rather have four hours where I slept well than 12 hours in bed, but with regular waking up." This is consistent with research by Pilcher, Ginter and Sadowsky (1997) who found that sleep quality was better related to health, affect balance, satisfaction with life and feelings of tension, depression, anger, fatigue and confusion than sleep quantity.

Interestingly, none of the participants mentioned emotional or mental wellbeing as important to their overall wellbeing. However, once the facilitator introduced this topic, participants began to discuss the role it plays in one's health – "I think sadness would drag you right down. And the consequence of that would be, ultimately, bad health. 'Cos if you're depressed or down you neglect yourself and you stop doing the things you liked to do." Maintaining a good social life was considered important to ensuring positive emotional wellbeing – "A good social life is a tonic. It is, isn't it?" Thus, emotional wellbeing isn't necessarily something that older people think about as being immediately relevant to their overall wellbeing. While

participants spoke about actively trying to improve their physical wellbeing or their social interactions, emotional wellbeing was not something they actively thought about improving. Thus, including this topic in the YourWellness application has the potential to help people become more aware of their emotional wellbeing and to 'look after it' as they do other aspects of their wellbeing.

3.2. Design: Input, Feedback and Interventions

Two important aspects of designing YourWellness are the content (both the questions being asked and the feedback being returned) as well as how this content is visualised, ensuring both are easily interpretable and beneficial. The second half of each focus group concentrated on aspects of design relating to participants' preferences for methods of inputting information on their wellbeing as well as on their preference for and ability to interpret different types of feedback. Methods of input included presenting questions as text with buttons or a slider for input, smiley faces with words relating to feelings associated with them and images of a body where you might touch a certain area to indicate pain or a problem. Overall the textual questions were preferred. Most participants felt the smiley faces trivialised the issue of emotional wellbeing: "I find that a bit kindergarten or something, isn't it?" Another participant commented: "You know, I'd find those a little bit patronizing, the kind of thing you would give to a child."

What became apparent across each of the focus groups was that feedback is critical in a wellness application, for the obvious reason of requiring feedback to help you improve your wellness. Thus we focus more on the design of feedback (than input mechanisms) in this paper as the ability to interpret and benefit from feedback is essential if the goal is to support behaviour change and improved wellness. It was pointed out that people would not be motivated to answer a daily questionnaire if they were not receiving beneficial feedback on it. While regular, updated feedback through the technology is important, participants felt it equally important to have some human feedback. "I kind of like the idea that maybe someone would come and talk to you maybe once every... like have a review." Another participant commented "It's the idea that there's somebody keeping an eye on you that's very valuable for older people."

Similar to discussing methods of inputting wellbeing information, participants were shown a number of visualisations that could be used to provide informative feedback to users of the YourWellness application. Relevant literature and commercial applications that provide wellbeing feedback were reviewed in deciding what visualisations to show

participants. Some of these can be seen in Figure 1. The least preferred type of visualisation was the metaphor. We showed participants the garden image from Figure 1 explaining that concept of the metaphor. We also showed the UbiFit garden metaphor (Consolvo & Landay, 2009) and the BeWell aquarium metaphor (Lane et al., 2011). Not one of the participants liked the idea of a metaphor as feedback. For many, this was because they felt it was confusing and would require too much effort to interpret: "A bit vague, isn't it?" One participant commented: "I don't know what the relevance of those pictures (the metaphors) is at all. I mean it doesn't do anything for me." Another replied: "Or me. But well, I'm not very visual anyhow, but that makes no sense to me at all." This is in contrast to reported feedback from other studies that use metaphors for wellness feedback (Consolvo & Landay, 2009; Lane et al., 2011). Participants evaluating the UbiFit Garden felt that the garden metaphor, or some metaphor, was an essential form of feedback (Consolvo & Landay, 2009). There may be a number of reasons for these differences. Firstly, the UbiFit garden is displayed as the wallpaper of a mobile phone and thus abstracting the data into a metaphor that only the user of the application can interpret yields a level of privacy. A metaphor is potentially not as important for an application such as YourWellness that is not 'always-on'. Furthermore, password protecting the application can prevent someone other than the owner of the application viewing private data. UbiFit and BeWell were not evaluated with older adults, thus it may be that metaphors are more acceptable to a younger population. However, we realise that long-term use of a metaphor visualisation may result in it becoming easy to interpret. A more detailed study may therefore be necessary to determine the effectiveness of metaphors as wellbeing feedback mechanisms to older adults.

they wanted more detailed information they could click into an individual category. Participants stated they would be particularly interested in seeing their trends over time.

3.3. Sharing Wellbeing Information

Across all 3 focus groups it was felt that information should be given back to the person in the first place. i.e. the person whose data is being monitored, unless the person doesn't have the capacity to deal with the information him/herself: "It depends on that person's ability to absorb information and be able to interpret it." All participants stated they would have no problem sharing their information with a health professional, but most said they would not necessarily share with a family member. One participant noted: "The person might not want to feed it back to anyone else." Another said: "I think families would worry unnecessarily." Sharing with a professional was felt to be important. However, there were mixed feelings on whether it should be left to the person to decide whether they contact their clinician, or whether a friendly phone call from a clinician should be initiated if a problem is detected. One person pointed out a potential problem with leaving this decision to the older person: "Here we're talking about moods and emotional wellbeing, a person in that state might not be in the mood or able to ring someone for help 'cos they are kinda lethargic and that." Thus, any feedback provided must be appropriate to the type of wellness being monitored.

4. DISCUSSION

We have decided to initially monitor emotional wellbeing, quality of sleep and social interactions. The latter two topics constituted much of the discussion around important parameters of wellbeing for older adults and it became evident that making older adults more aware of their emotional wellbeing would be beneficial. In determining the sets of questions we will ask that will yield clinically valid measures, we collaborated with a number of clinicians who specialise in these areas of wellbeing, including two geriatricians and a clinical psychologist. We have also integrated capturing and feedback of physiological measures including blood pressure and weight into the app, using the Withings blood pressure cuff and smart weight scale to provide a more complete picture of the person's wellbeing.

When the user opens the YourWellness application they are presented with the option of completing their daily survey or viewing feedback. If they choose to fill in the survey, they are presented with a series of questions asking them to reflect on and report how they are feeling. This information is

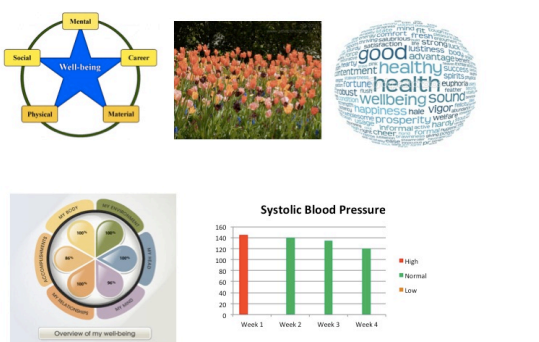


Figure 1: Some of the feedback visualisations shown to focus group participants

Participants particularly liked the two visualisations that show various categories of wellbeing. They felt that ideally, something like this could be used to give a quick overview of their wellbeing, and then if

analysed, a wellness score is calculated for each category of wellbeing and this information is returned to the person as visual feedback. Key aspects of the design of feedback in YourWellness can be seen in Figures 2-4 (though it should be noted that these are in an early prototype stage). At the highest level, feedback is provided as a quick-glance overview of wellbeing. Based on feedback from participants, we have designed a feedback wheel to support this (Fig 2). The wheel is divided into categories, based on what parameters of wellness are being monitored. The interior part of the segment is coloured green if the individual is considered healthy, meaning they don't need to take any action regarding behaviour change for that parameter of wellbeing. If the individual is scoring relatively low in a particular area of wellbeing, the segment is coloured amber - indicating an orange alert and that some action should be undertaken to address this. A red segment means immediate action is required, and the individual will be alerted.

The colour of the segment is based on the person's past 7 days of data. In collaboration with clinical specialists and taking into account existing guidelines such as the NHS NICE guidelines (<http://www.nice.org.uk/> including 'Treating Depression in Adults' and 'Mental Wellbeing and Older Adults'), we have determined a scoring algorithm that calculates a wellness score for determining whether a green, orange or red alert should be provided. This wellness score takes into account deviations from the individual's norm. For example, to set a baseline for blood pressure, we currently take two weeks of data from the person and then look at certain deviations away from their average or norm that may indicate abnormal bp (orange alert) or critical bp (red alert).

An individual can also click a particular segment of the overview feedback wheel to get further information, including their trending/historical data presented as a graph, that will be made viewable as weekly or monthly data (Fig. 3). Educational and interventional content is also provided (Fig. 4). Such content has been defined for each type of alert in each category of wellbeing, in collaboration with clinicians and by examining existing guidelines. For example, if an individual is scoring in the orange zone for emotional wellbeing, feedback might include encouraging them to go for a regular walk. It might also involve asking additional questions to assess why the person is scoring low. The overall aim of such feedback is to help the individual to improve their wellbeing - to move from being in the red/orange zone to the green zone.

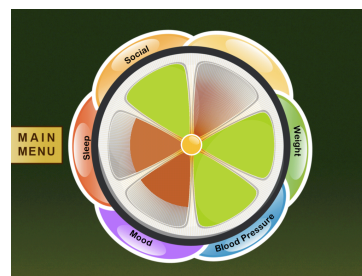


Figure 2. The feedback wheel with each segment representing a parameter of wellbeing

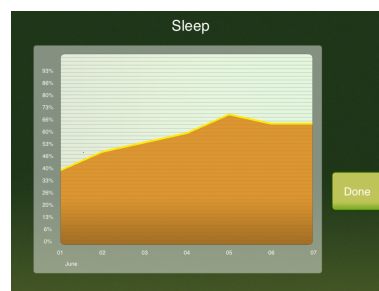


Figure 3. Weekly trend data for a person's self-reported quality of sleep

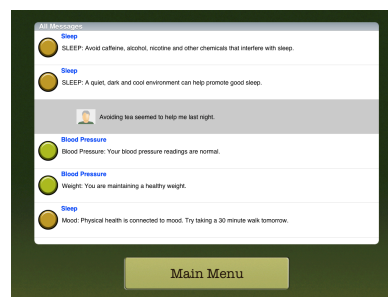


Figure 4. Examples of educational/interventional messages

Currently, we perceive two high level groups of users for this application - the worried-well who are interested in monitoring for self-awareness and to prevent illness occurring and those who are ill or frailer. The latter group might include individuals recently released from hospital into a home care package, and whose application data will be regularly monitored by their consultant, GP or carer. Thus, a care team can be defined for an individual, each of whom can monitor the data and contribute to providing feedback. The care team will monitor data daily and based on our findings around the sharing of information, the older adult should determine whether a family member can be part of the care team. In the case of a red alert, the individual is contacted directly by a member of the care team. In the case of an orange alert, a message is sent through YourWellness directly from a member of the care team, advising the individual on the action they should take. The backend architecture of the application supports a clinician or carer in adding additional sets of questions and also in scheduling the questions.

A smaller theme that arose related to motivation and compliance, with participants noting that it might get quite monotonous answering the same questions every day. Participants felt that receiving beneficial feedback would be a motivator to continue to fill in the survey. Another potential way of encouraging compliance might be to ask participants a multiple choice trivia question at the end of their wellbeing survey, but not provide them with the correct answer until they complete the next day's survey. A trivia quiz would also have the benefit of keeping the person cognitively active. Deployment of the application will allow us to examine and evaluate further motivational methods such as goal setting, virtual rewards, or a friendly leader-board for the trivia section.

5. CONCLUSION AND FUTURE WORK

This paper presented issues around the design of a wellness application for older adults that includes support for monitoring and managing emotional wellbeing. Emotional wellbeing is an important indicator of overall health in older adults, but despite this, it is not an area that older adults immediately see as being directly important to their overall wellbeing. Furthermore, it is often overlooked within the space of technology design for independent living. In designing this application, it was critical to involve older adults, to understand their attitudes towards wellness, as well as assessing the effectiveness of various types of input and feedback visualisations. The feedback we have gathered will help to ensure that the YourWellness application will assess appropriate aspects of wellbeing as well as deliver useful and beneficial feedback that is easy for the older adult to interpret.

In terms of on-going and future work, we are currently usability testing the application with older adults and plan to deploy the application as part of two field studies in coming months. One study will involve 16 older adults living in aware homes who will use the application over the course of one year. The second study will involve deployment of the application as part of a larger telehealth trial that will be deployed to over 100 homes around Ireland over a period of 3 months. During such longitudinal deployments, we will assess the effectiveness of YourWellness in helping older adults to manage and improve their wellbeing, as well as examining issues around motivation and compliance.

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