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Technology Devices for Older Adults to Aid Self Management of Chronic Health Conditions

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Abstract: The overall purpose of this study is the enhancement of devices and visualisations used by older adults as part of a telecare system for the self-management of health conditions. The opinions and feelings towards devices that could be used as part of a telecare system were gathered from a range of older people. This was done through the use of technology evaluation workshops, and the subsequent analysis of the collected data using grounded theory and thematic coding methodologies. Presenting healthcare data to an older person with chronic health issues may be an appropriate way to help that person to better manage their condition, if the data can be understood by them.

Keywords: Older adults, self-management of health, telecare, visualisations, assistive care, assistive technology.

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1. INTRODUCTION

There is an increasing proportion of older people in modern society. Furthermore, many now live well into their eighties and nineties due to longer life expectancy. The proportion of the working population in society is also shrinking. As a result, a greater amount of stress is being placed on health and social care services for older people in countries around the world.

There is an increasing number of the UK population over 65 years of age (15% now compared to 11% in 1951 and 5% in 1911 [4]). The proportion increase in Scotland is even greater, with 17.9% of the total population in 1998 and an increase to 24% predicted for 2036 [1]. In the US, life expectancy has improved by a quarter of a year every year since 1840, and the number of adults aged 65 years and over rose by a factor of 11 during the 20th century [14]. With the percentage of the working population getting smaller, there will be a lack of skilled health and social care professionals with the required knowledge to manage those with chronic conditions. Using current methods, this will cause a strain on resources. Furthermore, this will increase the pressure and raise the demand on informal carers (family, friends or neighbours of a patient) to help with their care. There is therefore a need to change the way in which health and social care is delivered. In particular, it is important to help all patients self-manage their health.

Around the world, there are currently a number of telecare studies that aim to model and understand a person's daily activities, or activities of daily living (ADLs), to help carers manage care. Two such studies that the School of Computing in the University of Dundee is involved in are the Smart and Aware Pervasive Healthcare Environment (SAPHE) project [12] and Mobilising Advanced Technologies for Care at Home (MATCH) project [10]. In practice, most projects will concentrate on the technology to capture data about a patient, and the data processing required to make this data relevant. Most studies focus mainly on the formal carers, and will rarely consider informal carers or outputs for the patient. In appropriate situations, formatting data for use by an older patient in a suitable manner, possibly using technology devices, could help older people to self-manage their health conditions.

The main questions that are investigated in this paper are:

- What kind of display device is preferred for the output of health data for older adults?
- What is an appropriate amount of health data for an older adult to be exposed to, and in what form should this data be represented?
- Are there any concerns about older adults having access to their real-time health data?

2. BACKGROUND

2.1 Generations of Telecare

Telecare Aware defines the term 'telecare' as "the continuous, automatic and remote monitoring of real time emergencies and lifestyle changes over time in order to manage risks associated with independent living" [13]. In general, telecare gives the service user (the person whose home the system is installed in) care in their own home through the use of a range of communications technology. It aims to help the user stay independent, while still enjoying a good quality lifestyle.

There are three generations of telecare that have been defined [6]. The first generation consists of very basic systems, dependent on the service user to trigger an alarm and alert the carer of the need for assistance. They are often referred to as Personal and Emergency Response systems. Telecommunication links are used to send the alarm to the carer. These first generation systems are still the most commonly used as they are cheaper and easier to install and use than newer generation systems.

Being so heavily reliant on the service user triggering an alarm however is not ideal. Many older people will refrain from sounding an alarm when they perceive a problem not to be critical as they don't want to put the carer to any trouble in dealing with the alarm. This will often lead to what the older user sees as a minor problem escalating to a much greater problem and put them at more of a health risk. Other older users, particularly those with dementia and related conditions, often continuously trigger alarms for the slightest needs or just to 'find out what it does'.

Second generation systems introduced sensors to provide continuous monitoring and raise alarms. This takes the reliance away from the service user having to trigger an alarm. Examples of such alarms are flood sensor alarms and temperature sensor alarms. These alarms will in general be triggered when a threshold condition is reached, e.g. if the flood sensor records a certain level of water or if the temperature sensor detects a low temperature in the dwelling. While these sensors reduce the reliance on users to flag alerts, they still do not provide a carer much information about the health condition of the service user.

The third and most recent generation of telecare aims to predict care needs by anticipating changes that could lead to loss of well being before they occur or result in long term damage. It aims to provide more contextualized information about the occupant for a carer. Health data is collected using a range of sensors that monitor the occupant continuously. The sensor data is then taken and, through the use of complex algorithms, converted into meaningful output. The sensors that are used can vary from system to system, but many will focus on collecting data related to the users ADLs and data important to the medical condition(s) suffered by the service user. A carer can use this information to learn more about the occupant's status and manage their care more efficiently. A service user could also use this information to self-manage their condition better.

2.2 Self-Management of Health

Self-management of chronic health conditions can be understood as the means by which a patient makes an effort to alter aspects of their activities of daily living to benefit their condition. Factors that influence the self-management of health conditions can be age, level of informal support available, length of time since diagnosis, severity of condition and level of education [5]. Not all people can self-manage their conditions. Some simply don't want to, and some apparently can't.

In the United States, 70% of healthcare spending is attributed to chronic diseases [9]. By the year 2020, chronic diseases may become the main cause of disability and death throughout the world [8]. If patients are involved in their own health care, the care provided can be delivered more effectively and efficiently. This will in turn have the effect of reducing the need for the patient to require medical treatment, as well as experiencing reduced symptoms and improving their physical activity [9]. This should result in an improved lifestyle and less dependency (therefore reducing the cost) on healthcare.

Those who are open to self-management need first to be able to understand their condition. This information has to be provided by the health and social care professionals. The patient may be directed towards useful websites or leaflets about their condition and what they can do to help. With an understanding of their condition, giving a patient information about their readings, in a way appropriate to them, could greatly aid the self-management of their condition.

2.3 Technology Design for Older Users

Technology now has to be designed with older users in mind. This can be seen in mobile phone design [11]. Different design concepts, such as 'universal design' or 'inclusive design' are required and have been investigated [7]. These approaches aim to cater for as many users as possible and incorporate diverse user requirements [11].

3. DEVICES FOR RESEARCH

3.1 Technology Device Research

One of the main aims of this study is to investigate what available graphical display devices could be used to output health data to older adults. The devices chosen for this study were done so with a view to them being considered as part of a telecare system that is also used by health and social care professionals.

3.2 Chosen Devices

The chosen devices were all pieces of technology that would not normally be associated with being used by older adults. This has much to do with their lifestyle and the time in which they grew up. Most of the devices used in this study are relatively new to the consumer market. These were the Apple iPod Touch, the Samsung Q1 7" tablet PC, the Nokia N95 mobile phone, Nokia 6100 mobile phone, HP IPAQ Personal Digital Assistant (PDA), a

7" and an 8" digital wireless photo-frame as well as a 15" touch screen connected to a PC. These devices were chosen as they all offered some form of Internet access amongst their features. Each device had a different screen size and resolution and different user interface types. The size of each device and its portability was also taken into consideration when it was chosen.

The other devices chosen were specific to the SAPHE project. A set-top box with remote controls and mobile data hub developed by Philips and an eAR sensor developed by Imperial College London were used. The eAR sensor is a device worn on the ear of a user and collects activity and pulse data from the user. The mobile hub is used to store the data from the eAR sensor, and relays this to the set-top box when a connection between the devices can be made. The set-top box sends the data it receives from all SAPHE sensors to a database. It can also be used to display the data gathered when connected to a television set.

4. WORKSHOP PROCEDURE

4.1 Target User Group

A group of older adults were invited to attend a workshop in the School of Computing at the University of Dundee. Members of the group had varying degrees of computing skills, some with basic computing skills and some with none at all. They were of pensionable age, and were spread over the age range of 60-80 years. The group all came from different educational and working backgrounds. There were several who had experience of working in a professional office environment, others who had worked in education, a number of manual workers and one ex-nurse. There were also several who had not worked. This gave the study a wide range of people from the target group. The health conditions of group members were not considered in the scope of this workshop, although many of the group referred to their health during discussions.

4.2 Workshop Structure

The workshop was split into two sessions over the course of a day. The morning session was used to introduce the group to each of the commercially-available technology devices, most of which they had not used and some of which they had not seen before. Each device was set up to show how it can be used and to demonstrate the features of the device. This was done by sampling video and audio files on the iPod Touch, Samsung Q1, Nokia N95, HP IPAQ and the 15" touch screen as well as showing the Internet features of each device. The Global Positioning System (GPS) capability of the Nokia N95 and the HP IPAQ was also demonstrated. Any device specific features were also demonstrated.

The participants, separated into smaller groups with a facilitator, were shown each device. This gave each person an opportunity to experience each of the devices first hand, get a feel for the dimensions of the device and gain a greater understanding for what each could do. They were also able to discuss each device with their group members. Once each group had seen each device, a session was held in a lecture theatre where the group as a whole further discussed each device and further elaborated on their comments. A facilitator was also used during this session.

The afternoon session focused specifically on healthcare, and how each device, including the SAPHE technology, could be used in a telecare system to aid self-management of medical conditions. Sample web-pages were created and optimised for each device. These web-pages showed health indicators and, where possible, graphs of health trends. It should be noted that the content of the web-pages and their design was completely abstract, and was used only to demonstrate how healthcare readings could be displayed on each device, and to show the difference in capabilities between each device. This session was held in a lecture theatre. Each device was given to the group and discussed as they used them and put them on where appropriate. A facilitator was used to manage these discussions.

4.3 Workshop Focus

The role of the facilitator throughout the workshop was to control the flow of discussion while not influencing participants' comments. To achieve this, a list of open-ended discussion topics was compiled prior to the workshop for the facilitator to use.

4.3.1 Discussion Topics

In the morning session, the aim was to understand what the group thought about each device, and if they would consider it as an everyday useful device. The discussion topics were therefore focused around the usability of each device. Questions were asked about the size and portability of each device, as well as how the group felt about the user interface and its navigation. There was also discussion about the situations in which the device could be used, and who the group perceived the device to be most useful for.

The discussions in the afternoon session were to focus on health and telecare. The group was asked to comment on how they would feel if they were to view their health statistics on each device, taking into account how the device is set up and used. Following on from the morning session, and getting a basic understanding of the capabilities of each of the devices, the group would be asked to comment on what health information they would like to see on each device, and how the information could be displayed. Finally, it was questioned whether the possibility of the device displaying their health statistics would mean they would be more likely to use the device.

5. DATA COLLECTION

Data were collected throughout the workshop by several methods. Initially, each participant was given a notepad to write down their comments. These comments were transferred to a flipchart pad along with other comments from the group noted by the facilitator. During the sessions in the lecture theatre, concept maps of the group discussion were developed and projected back to the audience in real time. Two High Definition (HD) video recorders were also used for data capture, with one focused on the facilitator on stage and the other focused on the audience. Identities of participants have not been revealed in this paper.

This process of data collection ensured that all the groups' comments were captured in one of the formats. Use of the live concept map allowed everybody in the group to keep up with the course of discussions taking place, and encouraged the group to continue with discussions. The video recordings were useful in the analysis of the event as the session could be replayed and important discussions and comments could be understood better.

6. METHODOLOGY

A Grounded Theory and Thematic Coding approach was used throughout the analysis of workshop materials. These two methodologies have a clear link between them. Grounded Theory analysis involves finding the concepts behind actualities. This is done by looking for codes, then concepts and categories in the gathered data [2]. This method is commonly used on transcribed interviews, but for this research it was used on data collected in the flipchart pads, concept maps and videos. Thematic analysis is used to find patterns (themes) in the gathered data that can then be analysed further [3]. Categories are created in relation to the data, with similar terms being grouped together upon further analysis. This is the 'coding' aspect of the method.

7. ANALYSIS AND RESULTS

7.1 Data Analysis

The video recordings taken in the lecture theatre of the large group discussion were converted into QuickTime movie files for analysis. Analysis software was used to synchronise the two recordings and place discussion markers and content codes to the video as part of the above methodologies. The codes were derived from the content of the concept maps and flipchart pads, as well as throughout the recorded discussion.

It was apparent throughout the workshop that the group felt it easiest to relate to their own circumstances and experiences to best comment on each device. This showed that the functional aspects of the device were being considered and applied to real-life experiences, with the result being an honest opinion of each device.

7.2 Morning Session Analysis and Results

7.2.1 Device Discussion Overview

The derived codes from the final analysis of the morning session data were: device portability/size; device display size/resolution; health/physical user limitations; device icons/display design; interaction/navigation issues;

learning issues; older people using device; device target group; other device features and other device comments. In all, 92 discussion points were highlighted in the video and organised to best fit into these code headings. It should be noted that some of the discussion points overlapped into two different code headings.

A recurring issue that was aimed at most of the devices was the display, and problems in viewing it. The main reason given for this was a combination of depreciating eyesight quality of older users and small display and icon sizes.

The interaction an older user had with a device, and how they navigated the device, was evident in discussions for all the devices. This often started discussion about older users adapting to and learning how to use the technology. Learning to use the touch screen technologies was compared to learning how to use a mouse in many cases.

With the portable and "fashionable" devices, the comments often related to what group the device would be mostly aimed at, and lifestyle comparisons were sometimes made between older and younger people.

7.2.2 15" Touch Screen

The 15" touch screen was the first to be discussed and even with it being the largest display, the icon sizes were described as being too small. This of course can be corrected by altering the icon size settings, and, on a device such as this, would not cause a great problem on the overall display in terms of clutter. However, a greater problem identified was the calibration of the screen itself. One of the group members commented:

> "The angle affected how you would use it; at different angles the point to select an icon wasn't the same. This made it difficult to navigate."

The group agreed as a whole that this was made easier by using a pen as a pointing device as it was more accurate. This is true of most touch screen technologies.

Another main issue with this specific device was the force that was required to select an icon. This was a problem because of the health conditions that may be apparent in some users, such as arthritis or a tremor. However, when compared to using a mouse, the use of a touch screen was deemed easier for those suffering from conditions where they had "shaky hands". The discussion then led to how easy it would be to learn to use a touch screen over a mouse. Another of the group members commented:

> "The majority of older people won't know how to use a mouse."

This would mean that they would be learning without any preconceptions and would essentially be a 'blank canvas' to work with.

Learning how to use the device was highlighted as a problem by one of the group:

> "There is a need for a simple sequence of events in order to perform tasks. This process would have to become automatic, just like using a telephone at home. If someone becomes agitated when needing to use it, they might forget a complicated sequence."

The group agreed however that this was an issue with all technology.

7.2.3 Digital Wireless Photo-frame

Initial comments regarding the digital wireless photo-frame revealed that the group saw this as an interesting device that would be:

> "Nice to receive as a gift."

The facilitator was required to describe how this device could be used in slightly more detail than others. This created discussion as to the advantages there were to using this method of displaying photographs compared to having them developed as is traditional. The group was interested in the concept of receiving photographs from family members direct to their frame with little effort or physical interaction. The group also looked on the fact that this method of displaying photographs saved a great amount of space compared to a set of photo albums as an

advantage. The digital photo-frame was therefore seen as a useful device for an older user and one participant thought:

> "It would brighten up a room, and would be good for morale"

The group felt that this type of photo-frame would also be good for keeping in touch with family members such as grandchildren.

7.2.4 iPod Touch

The iPod Touch was the technology device that provoked the greatest amount of discussion amongst the group. It was seen as:

> "It's fun, thought of it more as a toy, something to it was amusing and you could play with it. It's a gadget. In many ways it's a visual delight, but I don't know how much I'd use it for."

Some of the group didn't feel that it would be very useful to an older person. However, because of the vast range of its features and "how clever it was" many of the group said that they would like to own one.

The iPod Touch was considered to be targeted at younger people, but this was as much to do with the different lifestyle trends younger people had to older people. One group member commented about how their lifestyle was affected by the time period in which they grew up, and how older people were struggling to adapt to the concept of technologies like this. They felt that a younger person was more likely to be "seduced by the attractiveness" of the iPod and buy it, while the older generation considered practical usage and cost first.

The usage aspects that dominated the discussion were the screen and icon sizes and the eyesight of older people, though this is a problem with most small, portable devices. Using the multi-touch display, by zooming close to items, the group felt they had no problems in navigating the screens. To improve this further, one group member suggested:

> "It depends how far you would be able to lock in a particular size of icon as accidentally someone could hit the wrong button and it would go back to its original settings and in a panic they wouldn't know how to make it big again. You would always want a program that would lock in these things so if you were giving this to a person with eyesight problems, they would not be able themselves to muck it up, you know, it would be idiot proof in that sense."

This also suggests that there is an element of fear that the group members associated with experimenting with the iPod and other devices as they didn't want to break it. This was also evident in the way many of the group members handled each of the devices throughout the workshop. They felt that as they learnt more about the device, the "fear of breaking it" that they have may gradually subside.

Overall, the group realised that there was a balance between the display size of the iPod Touch and its features and portability. When the cost aspect was taken out of the equation, they saw the iPod Touch as a versatile device that they could use, given time and "step-by-step" instructions, but perhaps not to its full potential.

7.2.5 Mobile Phone Technology

The majority of the older people in attendance owned or had used a basic mobile phone regularly. They thought of them as being very useful, particularly in the case of an emergency. One group member said about text messaging (SMS):

> "It's all I use it for, I never phone with it at all."

Younger members within the group had also come to terms with extensively using the built-in address book to store important contact details:

> "It's also great for storage … of phone numbers, and any other details you want to put in … it's got the facility for code numbers and I've got my passport number in there for when I'm traveling and it's fantastic. I can even store who wants what presents brought back home!"

Other members of the group said how they used this to store bank card pin numbers as well. One of the participants had set up the speed dial facility on their partner's phone to allow them to use it with greater ease, and to keep the functionality simple for them. There was a general agreement that mobile phones had to be "idiot proof" to allow them to make phone calls and send text messages without any problems.

Text messaging was an area that brought up great debate in the group. While the majority did understand it and used it regularly, not many had an appreciation for "text-speak" or "text language" that most of the younger generations use. Some even considered:

> "It's a corruption of the English language."

However, they did understand that using this made creating text messages easier and sending them cheaper.

Not many of the group had used the extended features that were available on newer models of mobile phones, such as mp3 and mp4 players, Internet access, cameras and game applications. One of the participants commented:

> "It's just a phone, it's not to take photos or anything like that. This is just stuff that has been added on to it."

In spite of this, many of the group members weren't averse to the use of these features, but the problem again was the ability to learn how these features worked and could be used. The discussion then progressed to look into the pros and cons of user manuals that were supplied with many devices. It was felt that many user manuals were un-clear and confusing as users had to skip to different pages to find the information they want. One suggestion was:

> "Have a logical step-by-step guide as a starting point that leads you into it so you develop an understanding."

However, the "quick-start" guide was thought of as being a good piece of documentation, particularly those produced by the better-known companies.

An additional feature that was discussed was the GPS functionality, available on the HP IPAQ and the Nokia N95. The group collectively questioned if an older person needed it or why they would need it. One participant highlighted this:

> "I think it's wonderful, but having said that I'm not sure how many 80-year olds would need it or use it. It would be wonderful if old Mrs Smith went into (the town centre) and got lost, but I think if she was at the stage of getting lost in (the town centre) she would be at the stage of not taking her GPS with her and not being able to use it, if she had ever learned to use it."

7.2.6 Samsung Q1

The final device that was discussed in the morning session was the Samsung Q1 tablet PC. The group saw this type of device as a middle point between a normal PC and the iPod Touch. They felt that for a device to be used on the move, they would prefer the iPod Touch to the Samsung Q1, despite its smaller screen, as it was easier to carry around and offered them enough functionality. For other tasks they would rather use a laptop or desktop computer, as the screen size made the Q1 more difficult to use:

> "It seemed attractive until we saw the iPod, and then I thought no, from going from a computer (laptop or desktop machine), I would go to the smaller item."

7.3 Afternoon Session Analysis and Results

7.3.1 Healthcare Discussion Overview

The afternoon session gave the group the opportunity to discuss devices that they had experienced and used as part of their own health well-being treatments as well as comment on what devices they would like to see in place. Throughout this discussion, many references were made to the cost implications that introducing these possible devices would have and how this would be restricted by government spending. These points were taken on board, but were outside the scope of this study as the research was more concerned with what older people would like to see as part of a health care system, unrestricted by money issues.

The code headings that were derived from the final analysis of the afternoon session's data were: social issues; device design; health issues; data displays and interaction; health care technologies and learning issues.

Social issues and device design dominated the discussion throughout the session and, through initial analysis of these codes, it was apparent that there is a close connection between the design of a device and social issues that are associated with a device.

7.3.2 Social and Design Issues

The main social issue with wearing or using healthcare devices was the social stigma that the group believes exists. Some group members felt that a device such as the eAR sensor, which is designed to be worn on the ear, brings unwanted attention to the user. A group member suggested:

> "It's too obvious for being out and about."

One participant compared the eAR sensor to wearing an early version of the hearing aid:

> "People just didn't admit to being deaf years ago because hearing aids were so bulky and they felt ashamed, they felt identified in the street for wearing a big thing attached to wires."

Another member of the group admitted:

> "I only wear my hearing aid when I'm sitting watching (television) on my own."

It was felt that, in its current form, a device such as the eAR sensor was not suitable for wearing for extended periods of time but only to take occasional readings.

This is an issue which could have an adverse affect on a person's willingness to self-manage health conditions, as they are too proud to accept their condition and don't want it to be known to others that they have a medical condition. This also highlights the fact that it can be difficult to get people to accept help for their condition before it is too late. A group member commented:

> "Some people get to the stage where they will accept a walking stick when they now need a frame to walk."

The design of these devices is seen by some of the group as being an integral part in whether or not they would be used as required by their condition.

The group spoke of the eAR sensor being made as small and discreet as possible to avoid any stigma. Also, it was felt that devices designed to be worn around the ear would be easier to "cover up" with longer hair if they were smaller. Other suggestions included:

> "If they were skin-toned (in colour) they might blend in a bit (better)."

> "It could be implanted (under the skin) so it can't be seen."

Several other group members suggested having the aesthetics of body-worn devices designed by major fashion labels to make them more attractive, similar to the way spectacles are now made by a range of designers. Disguising the devices as pieces of jewellery, in a ring or necklace, was also an option that the group liked and would make the device more acceptable to be worn.

The group thought of the mobile hub more positively. This was largely down to where it was worn and how discreet it was. The mobile hub has been designed to typically be worn around the waist, and the group felt that it could be easily "hidden" by clothing. Also, the fact that it could be made to look like a mobile phone being carried on a belt clip made the device look more attractive in the eyes of the group.

Another issue that concerned all the group members was that most of the devices being spoken of involved being worn or carried around. They felt that there was the possibility the user could end up with too many body-worn sensors:

> "The difficulty is you are trying to add too many objects and you would end up looking like a policeman carrying around all their equipment."

This is an issue that they felt would increase the stigma associated with healthcare devices.

In reference to the eAR sensor and the mobile hub, one of the group members commented:

> "Older people would be liable to mislay, forget or lose the devices."

This is another factor that will influence how useful these devices are. It would be appropriate to develop such devices in a way that would help a user to find it. One solution, described by a group member, was to have a "clapper" installed in the device. The user would clap their hands and the device would alert the user as to its whereabouts through sound output. A better solution however would be to prevent a user from forgetting the device to start off with. Users who can associate with their devices, in a similar manner to the way people associate with their favourite items of jewellery, such as rings or pin broaches, are less likely to forget to wear or carry these devices [15].

7.3.3 Health Care Devices and Visualisations

Most of the group participants had experience of wearing or using hospital devices to benefit health conditions. One group member spoke of using an automatic insulin dispenser to help control their diabetes:

> "This system took continuous blood sugar readings and would inject insulin through the attached needle to keep the readings constant. The machine could also be manually controlled should the need arise."

The group member was very appreciative of the device, as the readings gave them a clearer indication of when their blood sugar level reached its extremes, giving them a better understanding of their condition. A graphical printout of these readings, showing the "spikes", further helped with this. However, there was also evidence in the discussion that devices such as this can be misused. The participant acknowledged that there were cases in which others had done so:

> "I know somebody who used this full-time and turned on the glucose when they knew they were going to have a few beers."

Despite this, they felt that the device was useful to older people, as it minimised human error and was a relief to the user as they did not have to worry about controlling their glucose levels alone. They did find however that it was uncomfortable to wear and it could not be taken off without a health professional's help.

The concept of devices giving printouts of a user's readings was also seen as beneficial by the group in some circumstances. It was felt that the doctor/patient relationship would be altered, with positive outcomes. One group member said:

> "With the printouts you could produce "*hard information*" for their GP rather than just saying, "*I don't feel very well*.""

This would have the potential to help the doctor diagnose problems with greater ease. They also commented:

> "This makes a patient feel more involved in their care as they share information with the GP, rather than just listen and be dictated to."

There was a discussion about what aspects of lifestyle could be monitored in the home and displayed to a user. Sleep quality wasn't considered to be a valuable statistic to one of the group members who said:

> "I know how I've slept."

However, as this discussion progressed, other group members thought that displaying such statistics could give the user a good indication as to the effects of medication that they are taking. One of the main issues that was discussed in giving someone, particularly an older adult, data in this way was the possibility that they would become obsessed with the readings, to the detriment of their health:

> "Maybe the user/patient is better not to know because they might get obsessive about whether they slept or whether they didn't sleep and this would mean that they suffer a greater lack of sleep as they worry more about the readings."

The group also saw how the data is displayed to a user as a problem, and considered that this could influence a user's care. Someone who reads data wrongly may panic when there is no need, or make other judgments based on what they believe the data to be saying. They were aware that the data had to be contextualised for each individual:

> "For some people it is enough to just see good or bad whereas others would want, or require, more information."

However, with backing from professional carers, the group felt:

> "A person would feel confident using such visualisations to help with the self-management of health."

Discussion also led to the issue of privacy. Many of the group questioned how telecare systems and devices would invade an individual's privacy. This was also associated with the stigma of having the display devices, such as the digital wireless photo frame. The group was aware that having such devices on view in their home would mean visitors could also see the data it displayed. They spoke of "locking the screens" and ensuring that the devices were somewhere where they would be able to see them, but also away from areas in the house where visitors would generally go. Others also commented on how they would allow close family member to access data on devices such as the set top box, and even give them any passwords to do so.

The set top box was considered as a useful device, although many of the group were more interested in the additional features that this could provide, such as digital television reception services. The ability of an individual to use a device such as this was also brought into question by the group. Issues again arose regarding its ease of use, and how it had to be easy to learn. They also felt that user input would be difficult for those with cognitive problems, as they would find a remote control, typically with small buttons, hard to use. However, the concept of seeing their health details on their television screen was thought of as being convenient.

Despite any issues that the group had with any of the devices, they were all mostly positive about using technology to help manage health conditions. Aesthetics and learning how to use devices were seen very much as a trivial aspect compared to helping out with their health. One group member who had suffered a heart attack previously and had bypass surgery highlighted this:

> "You can make it as big or small as you like, but if it's going to save a life then fine…if they (the doctors) told me to wear something or do something I would jump through hoops, I was delighted to do it."

8. CONCLUSIONS

This study has given much insight in how to progress with the development of technology devices as part of telecare systems to help older people who have chronic conditions self manage their state of health. With the correct amount of support and by working closely with health care professionals, such systems would be of great benefit to those who are willing to help with the management of their own health.

The devices developed must be done so with aesthetics as a high priority in the considerations of the design. The social stigma that many associate with wearing items that show they have medical problems is an issue that must be addressed for self-management of health conditions to be successful. If done in the correct manner, the introduction of technology devices to help with self-managing health may encourage more people do this.

Consideration must also be given to the usability of technology devices for older adults. Portable devices such as the iPod Touch give a great deal of functionality to a user. Given time with the device, the group felt that they may be able to adapt to using such a device. As many older adults now also have experience of using mobile phone technology, using a device such as the Apple iPhone could make this type of technology more appealing to these users as it integrates the functionality of the iPod Touch with that of a mobile phone. It is clear from the analysis however that older people would require time, and support, in order to learn how to use such devices, both for social and health related usage. This must also be done in an environment that will allow the user to experiment with the device, without the fear of breaking it. Also, older people, who tend to have worsening eyesight, require the display on devices to be clear with identifiable, large icons.

Ultimately, older adults aren't averse to technology being introduced into their lifestyles. Evidence in this study showing that many of the participant group use mobile phone technology highlights how they are willing to adapt. Using technology devices as part of a telecare system is also seen as an advantage to many from this group. As well as providing more information for healthcare professionals, users are made to feel more involved in the process, and, with contextualised data provided for them, they can gain a better understanding of their condition, and self-manage their health more efficiently.

Many older adults who suffer from chronic health conditions are willing to do anything that may improve or stabilise their condition, and are happy to accept technology devices as part of this. However, this is still heavily reliant on a user wanting to be involved in the self-management of their health.

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