Satisfying Product Features of a Dementia Care Support Smartphone App and Potential Users' Willingness to Pay: Web-Based Survey Among Older Adults

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Abstract. Dementia is a large economic, social and health concern with the aging population. One of the best ways to care for people living with dementia is to keep them at home in a familiar environment. Smartphone applications may provide assistance to patients and caregivers. An open web-based survey was answered by 104 individuals older than 50 years. Participants rated eight features of a potential dementia care support app according to the Kano technique. Out of the eight product features investigated, six were positively associated with an application (wandering detection, weather and other threat detection, notifications and voice prompts, location sharing, emergency services contact, and medical records). The median for the amount people were willing to pay per month was 25$ (CanD) with a third quartile of 50$ (CanD). The results show which features should be included in an application to have maximum acceptance and usability and how much potential users are willing to pay on a monthly basis a dementia care support smartphone app.

Keywords: Health · Dementia · Kano technique · Willingness to pay · Older adults

1 Introduction

Dementia is a rapidly growing problem with senior citizens. It has been found that 1 in 3 individuals over the age of 65 will die having some symptoms of chronic mental decline that interfere with their daily lives (i.e. Dementia). Once dementia is present, one major concern is wandering. This is when patients will aimlessly walk or move around which leads to them getting lost or confused. Strategies for managing this vary from providing reminders and directions to head home, to contacting a caregiver or emergency services [1].

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Improvements in smartphone technology and a growing accessibility to smartphone devices has led to a possible aid for individuals with diagnosed or developing dementia. A smartphone application that supports caregivers as well as prolong the time seniors with dementia could live comfortably in their homes makes sense both financially and socially. As of now there are two main branches of apps available, ones that are preventative, aimed at people who are at risk of developing chronic mental decline, and others that track and maintain the safety of people already experiencing dementia [2–5].

This research investigates which features a dementia care support smartphone application aiming at wandering patients should have. On top of that, it was also assessed what the cost is that individuals would be willing to pay for this product.

2 Method

2.1 Design

An open, self-selected, Web-based survey was created to provide a potential answer to the research goal. The survey was designed in English and provided for English-speaking older adults within the area of Alberta, Canada. The medium of a Web-based survey was used, as it is a convenient and valid method to obtain individuals with particular characteristics without any limitations on physical space [6].

The goal of the survey was to gather information and data that pertains to the expectations surrounding a dementia support application. This was measured using the Kano technique [7].

2.2 Investigated Product Features of a Dementia Support App

To decide on the features, literature and market research were reviewed to determine the products that are currently on the market and which technologies would be beneficial to dementia patients and their caregivers. Instead of broadening the survey to include memory exercises and dementia prevention, the focus is being spent on reducing caregiver time and easing the experience of dementia patients wandering by offering features addressing this phenomenon (see Table 1).

Table 1. Features investigated in to determine product scope

F1	24/7 Tracking of users location
F2	Navigation services for users
F3	Wandering detection
F4	Weather information and alert
F5	Voice based notifications instead of text based ones
F6	Location sharing with family and/or caregiver
F7	Automated emergency service
F8	Storing medical records within the app

24/7 tracking of the location and daily activities of a person with dementia would be collected to be able to provide other services related to wandering. Project Lifesaver is one of several companies producing wearable tracking devices aimed at people with dementia [8].

Map and navigation services are tools available for a person with dementia to use. The app would provide clear and concise directions to ensure their safe arrival at work, home or other locations. This service is recommended by studies as an important tool to aid in dementia care [1, 9].

Automatic wandering detection would have access to GPS tracking data of the person with dementia. The app would gather information regarding their routine and regular schedule and monitor their displacements for irregularities. If found, these irregularities would be analyzed to determine whether or not they are wandering. Other features of the app could then act accordingly to minimize the associated risks such as getting lost or stranded. This is as feature outlined in the paper by Sporaso and an app named iWander [2].

The weather feature is designed to keep a person with dementia out of immediate danger. The app would access local weather information and remind them to take the necessary articles of clothing when leaving their home. There would be warnings about violent weather and recommendations to stay at home. In extreme weather conditions, the app could respond more quickly to an incident where a person with dementia is lost [2].

In the event that a person with dementia is wandering, simple voice prompts or reminders are proven to minimize the risk of getting lost by notifying the person with dementia of a break from their routine. The app could automatically help them return to a safe and familiar location if they deem it necessary. This feature is the first line of defence against getting lost or stranded [1, 2].

Sharing the location of a person with dementia with their family and/or a caregiver can give everyone peace of mind. If something goes wrong, it is easy to communicate and connect through the app to keep a person with dementia safe [1]. This feature is designed to ensure the safety of a person with dementia if the previous strategies have failed to mitigate the risk of getting lost. If the app continues to detect irregularities in their displacements that indicate they are at risk, emergency services will be contacted automatically. They will then provide the needed support. The products on the market that have 24/7 tracking also have access to emergency services. This includes the line of Project Lifesaver products [8].

Providing access to medical records of a person with dementia, the app can make better decisions regarding how to handle their personal situation. This information would need to be filled out with a certified doctor to be implemented within the app's database. The information provided would be medication being taken as well as ailment history. This information could be passed on to emergency services if needed to accelerate emergency response decisions. Such wearable devices already exist. Medic Alert bracelets are the most popular device that has information regarding medical history [8].

2.3 Kano Technique

Described product features were investigated by the Kano technique [7]. With this technique, potential product features are classified according six different categories: attractive, one-dimensional, must-be, indifferent, reverse and questionable. To classify the potential product features according to Kano, pairs of questions are asked. Each feature is asked with one positively worded question (feature is included in the product) and a negatively worded one (feature is not included in the product). Both questions have the same set of answers available to select. To ease confusion and make the choices more clear, the adapted version of answers for the Kano technique, created by Robert Blauthe [10], were chosen. To ensure valid classification two different decision rules were applied. The first decision rule is called total and category strength [11]. In case this decision rule results in unclear classification Fong Test was applied [12].

Along with the categorical placement of each feature, two-sided customer satisfaction (CS+) and customer dissatisfaction (CS−) coefficients were calculated [10]. If these scores are higher than 0.5 in magnitude, corresponding features are determined to be of significant importance to increase or decrease customer satisfaction in case of implementation [10].

2.4 Willingness to Pay

It has been suggested that to gain the most use and generate revenue apps should be free of charge, but then operate with a subscription fee business plan (Freemium Business Model) [13]. Willingness to pay was measured as a monthly fee that potential users of the app would pay. This topic was addressed after participants rated the eight product features. They were then allowed to enter a value that was limited to four characters in Canadian dollars (CanD) (Lin et al. 2013).

2.5 Demographics

The first section on the questionnaire contained questions regarding the population demographics. Including questions on age, gender, ownership of smartphone, length of time having a smartphone, use of health related apps, health literacy and experience with dementia. Determining the sample of percentage of people most likely to be affected by dementia that own a smartphone is a crucial part of realizing the feasibility of using a smartphone as the aid platform. All of the smartphone related questions were used to gage the technical affinity of the sample tested.

2.6 Health Literacy

Getting an idea of the health literacy of the sample will help gauge the validity of the study, as it shows whether the surveyed individuals are aware and understand what dementia is and how it could affect them. This will be done using the HLS-EU16 questionnaire [14]. This questionnaire includes 16 items that pertain to health awareness and prevention and are evaluated on a 4-point Likert scale (1=not correct and 4=fully correct). Subsequently, a final score was calculated according to Röthlin et al. [14].

The final score ranges between 0 points and 16 points, whereas 13 to 16 points represents a good health literacy, 9 to 12 points a concerning health literacy and 0 to 8 points describe a problematic health literacy [14].

2.7 Questionnaire

The survey began with a short description of the study, followed by a section about demographics. Health literacy was then self-assessed by the participant. Participants then read a short description of a product feature and then answered questions according to the Kano technique. This was the way it was structured for all eight features. Next was a question regarding the participant's willingness to pay. Finally, there was a section where participants could give qualitative feedback for the app and project. In total there were 14 pages with 42 questions.

2.8 Data Collection

Data collection started on June 14, 2018 and ended on June 21, 2018. The questionnaire was created using the Web service Unipark (Questback GmbH).

All participants were informed about the duration of the survey, data storage, and the leading investigator. Each participant decided to take part in this survey voluntarily by following the designated link to the survey. A monetary incentive was not offered for participation.

The survey was pretested properly by a total of eleven people. Feedback and concerns were recorded and taken into consideration before sending out a final version of the survey. The Alzheimer's Society of Alberta reviewed the survey to make the wording more appropriate for the target community. For example, "patients" was changed to "people living with dementia". Technical problems, including the amount of numbers that could be inserted in the questionnaire for your year of birth were solved. The final version was sent out after proper revision.

2.9 Recruitment

The survey was sent via email to a personal network of people in Alberta and was then distributed by word of mouth to other participants. Initially the network included two primary groups of people, from Rotary or from the Alberta Teacher's Association (ATA). By using this method, the goal was to reach a large sample of diverse people. A letter was sent out explaining the goal of the research project as well as the target demographic. By using the IP address of the individuals computer or electronic device, the survey software from Unipark (Questback GmbH, Germany) ensured that all responses were from unique individuals.

In total, 218 followed the link to the survey. Of the 218, 75.69% (165 individuals) started the survey. Only 64.68% (141 individuals) completed the survey. Thus participation rate is 75.69% and a completion rate of 64.68% was achieved. The mean completion time was 12 min 28 s with a median of 10 min 8 s.

2.10 Statistical Analysis

Any individual below the age of 50 that had no experience in being a caregiver was excluded from the data. Also, any individual that missed answering a question (excluding individuals who incorrectly inserted the willing to pay data) or was not from Canada was excluded from the data. Remaining data from the Unipark Web-service (Questback GmbH) was exported to SPSS 23 (IBM, USA) for analysis. Microsoft Excel 2010 (Microsoft, USA) was also used to make analysis more efficient. Data was analyzed according to the Kano technique, including total and category strengths calculations, Fong-Test and customer satisfaction coefficients. After general examination of the results more detailed analysis was performed based on grouped comparison by means of dementia experience, age, and HLS-EU scores.

3 Results

3.1 Participants

In total, 104 participants took part in this study. The mean age of the sample was 63.16 years with a standard deviation of 10.84 years. Female participants numbered 63 (60.58%) while males accounted for 40 individuals (38.46%). One person selected "other" as a gender option (0.96%). 94 individuals (90.38%) reported owning a smartphone, while 10 did not (9.62%). Of those who reported owning a smartphone the mean length of time that they have owned one is 7.97 years with a standard deviation of 4.86 years. The number of people that use a health related app on their smartphone is 37 out of 94 smartphone users (39.36%). The sample contains one person (0.96%) who experiences symptoms of dementia while 56 (53.85%) declare that they have experience with someone who has dementia.

3.2 Health Literacy

For the 104 individual sample, the mean health literacy according to the HLS-EU16 was 11.26 with a standard deviation of 3.97. Health literacy is measured on a scale from 0 to 16, and there are 3 classifications based on the numeric answers [14]. From 0 to 8 is considered inadequate, 9 to 12 is considered problematic and 13 to 16 is good. The mean of the 104 person-sample is within the problematic range. The maximum an individual scored was 16 and the minimum was 2.

3.3 Classified Product Features According to Kano Technique

The Kano classifications are shown in Table 2. The features were all categorized using the full Kano model, including strength and Fong tests. In every case, there is a significant classification with the Fong test only having to be used for one feature.

Table 2. Kano classification of features.

		Classification
F1	24/7 Tracking	Indifferent feature
F2	Navigation services	Indifferent feature
F3	Wandering detection	One-dimensional feature
F4	Weather	Attractive feature
F5	Notifications	One-dimensional feature
F6	Location sharing	One-dimensional feature
F7	Emergency services	One-dimensional feature
F8	Medical records	One-dimensional feature

The customer satisfaction coefficients (CS) values are shown in Fig. 1. Four of the eight features are considered to have relevant values for at least one of the two sides of the value (>0.5).

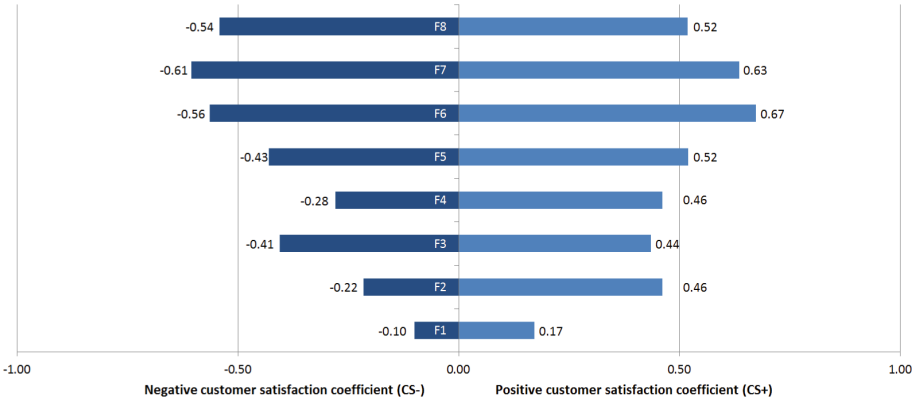

Fig. 1. Customer satisfaction coefficients

3.4 Willingness to Pay

Of the 104 person-sample, 96 individuals inserted a monetary value for the amount they would be willing to pay per month. Values ranged from 0$ to 500$ (CanD) with a mean value of 48.79$ (CanD) and a standard deviation of 8.18$ (CanD). Since there seems to be outliers, the median represents a better resistance to outliers. The median of the sample is 25$ (CanD).

3.5 Qualitative Results of Open-Ended Questions

Of all the participants, 41 responded (39.3%) to the qualitative question section. Most comments were split into three categories: privacy, feasibility and familiarity. There were 16 comments about the feasibility, four each of both privacy and familiarity, two on WTP, six concerns regarding to survey format, five general comments providing

support for the project, two about their results of the Kano model, and three that stated that they had no comments. Concerns regarding privacy were that it was imperative to protect both the person living with dementia and their caregiver's data and information. There were numerous people questioning the feasibility of the app. Their main concern was centered around if a person with dementia could use such an app in the designed manner. Anxiety stemmed from interactions with elderly people and technology. Suggestions for having the application programmed individually for each patient were mentioned. Most were ideas for having a loved one be the programmed voice for notifications and voice prompts.

3.6 Kano Feature Groupings

The 104 individual sample was split into different groupings that were investigated for difference. The group having experience with dementia thought that wandering detection was an attractive feature, while the non-dementia group found the feature to be indifferent. Revealed is also that the aged less than 64 years old group and the non-health literate group (less than 13 points on the HLS scale) classified the navigation services as an attractive feature. The health literate group and the less than 64 year old group both categorized medical records as indifferent. The 64+ year old group found wandering detection to be an attractive feature and the less than 64 year old group found weather information and alert as an indifferent feature.

4 Discussion

4.1 Primary Results

In this exploratory study, product features were ranked as to the amount in which they could influence a user's use of a dementia support app. The Kano technique classified eight product features that belonged to two categories: data privacy and remote tracking. Furthermore, the strength and Fong tests revealed that all product features were classified with significance. There were five one-dimensional product features (wandering detection, notifications, location sharing, emergency services and medical records), one attractive feature (weather), and two indifferent features (24/7 tracking and navigation services). Grouping participants by demographic information resulted in little deviation in the Kano classifications.

4.2 Features

For six of the eight features analyzed, the result is that the features are desired in an application regarding dementia. The one-dimensional features that are particularly strong (>0.5) categories if referred to the CS+ values are notifications, location sharing, emergency services and medical records. This shows that these features cause great satisfaction when present. The CS− values are also significant in these categories meaning that the sampled population found these products very important to the application. Wandering detection was still a one-dimensional feature but did not breach

the threshold of 0.5 to be overly significant. The one attractive feature was weather. As this is a feature added to the survey as a sort of add on to wandering detection and 24/7 tracking, this classification seems reasonable. 24/7 tracking and navigation services are classified as indifferent and therefore could be put in with no concern to a negative reaction. On the other hand, they cause no satisfaction either. Tracking devices in the market currently are generally accepted and the benefits of tracking outweigh the privacy and other concerns [15]. The 24/7 tracking is used for many of the other features; therefore even if the feature is by itself indifferent, it must be used for other features. The grouping results show that there is little variance between groups, and the small changes have potential explanations for them. Wandering detection became an attractive feature for the dementia experience group while it became an indifferent feature for the group with no dementia experience. This might show that with experience and more knowledge of wandering, you see automatic detection as a real big help and therefore find the feature to be attractive. On the other hand having no dementia experience could cause you to be indifferent about wandering detection. All in all, the groupings overturned no polarizing result which indicates a certain validity to the classifications found.

4.3 User Groups

After splitting the 104 person sample in to groups of dementia experience, age and health literacy, there were no significant differences in the Kano results. The demographics information received had no significant correlation values. This shows a very homogenous sample in which all demographics are distributed evenly. This indicates that the needs and desires for a dementia support app might be universal and therefore the app might be the same for the entire population. This is further supported by the demographics of the sample. Around one half of the sample is experienced with dementia in some form and half are health literate. It shows a balanced sample. Development of an app with the features discussed would potentially not have to be tailored to specific groups.

The technical affinity and number of people that own a smartphone (94/104) potentially indicate that an application is a feasible option for a support medium, although survey participants stated their concerns about dementia patients using technology. It would seem like the smartphone medium would be valid and convenient for caregivers and the older adults sampled, but what is unclear is whether people living with dementia have the technical prowess to benefit from this app. One case study determined that it is possible for individuals with mild cognitive disorders to use smartphones with some teaching [16]. Furthermore, if current trends are maintained, the amount of older adults with smartphones should increase and therefore the feasibility and acceptance of an application would also increase. In Canada, 69% of people aged 55 to 64 year olds and 19% of people aged 75 and over owned a smartphone. This could indicate that in the future, this group of younger people who are at a risk of getting dementia are going to have phones and an application would then have a higher acceptance as a support medium.

4.4 Willingness to Pay

As a producer or developer of a dementia support app, you should not charge more than $25 (CanD) a month. As this is the median value, 50% of the sample is willing to pay this while 50% does not. 75% of respondents would be willing to pay up to $10 (CanD). As this is, to our knowledge, the first research study asking the willingness to pay for a dementia app, there is no real exact comparison to previous works. Compared with other dementia services and studies, the WTP value found is quite low. In France, caregivers are willing to pay 12.1 Euro an hour for informal care [17]. In the USA, they are willing to pay 144 British pounds a month for an hour per day reduction for informal caregivers [18]. As is shown, caregivers are willing to pay a significantly higher amount than what this paper found for informal care, even if they are not quite comparable. For a comparison to an Alzheimer's app that is used to prevent the disease, the WTP value is 155$ (USD) [19]. This provides us with a comparison to another app in the same field, but that is not for continuing care. Thus, a comparison is quite difficult, but if looked at them all as a whole, the WTP is significantly higher in other studies. This could be due to multiple reasons. One of the explanations is that since an app that provides the services of replacing some caregiving time and providing safety to dementia patients is not known that well, the sample population is unsure of how much it should cost. An alternative explanation might be that the sample population felt that this app would not be quite as valuable as an informal caregiver and, therefore, the price point should not be as high. A third consideration is that since health care is government subsidized in Canada, people are not willing to pay as much [20].

4.5 Limitations

There are some limitations of this study. Firstly, the survey distribution method was word of mouth from personal contacts. This might cause the sample to be too similar and possibly not represent the entire population. Since it was passed on by word of mouth, the demographic target of Rotary and the ATA might have been breached and overstepped. Also, since the survey was distributed online, there might be a misrepresentation of the technical affinity of the sample. The questions of smartphone use, health app use, and number of years a smartphone was used, were used to judge technical affinity, but there was no standardized test to measure this. The technical affinity that the survey did measure was very high, with the amount of people owning smartphones found to be large.

5 Conclusion

Dementia care is an ever growing concern. People living with dementia need care from an informal caregiver, which cause major economic and social stress on both patient and caregiver. As technology in smartphones improves, the more a dementia support app can offer. The target of the app is to ease pressure off of caregivers, while keeping a dementia patient independent and living in their own home for a longer period of time. The goal of the study was to determine the acceptability, features needed and willingness to pay for a dementia support application.

A study was conducted with the help of an online survey. Eight product features from reviewed literature were analyzed adhering to the Kano technique. From this technique, six features were found to have a positive correlation with an app while two were found to be indifferent. After completion of the study, the authors believe that an app that includes the eight features would be implemented successfully in the dementia community. Even though the app would probably be accepted, more research into the user-appropriate implementation of each feature needs to be conducted.

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