Purpose:

Spatial disorientation as a form of cognitive impairment is common in older people with dementia. People with spatial disorientation sometimes experience wayfinding difficulties even in a familiar environment. People with early dementia (PWeD) without significant physical impairment still retain the will-to-mobility (i.e. navigate and experience things en route) and reaching desired destination on a daily basis is a basic human need. However, safety is a concern and getting lost could lead to significant harm and death although it is a low-frequency event. Getting lost can lead to risk of accidents and negative emotional responses in both the PWD and their caregivers. It can also contribute to a person’s decision to avoid leaving home.

In order to prevent getting lost, there are many global positioning system (GPS) installed devices available to track the location of the PWD. Caregivers can know the position of the client. This may minimize the risk of injuries and provide caregivers peace of mind and reduced anxiety when the PWD get lost. However, these devices do not resolve their wayfinding difficulties in PWeD or promote their independence. The cost of these devices may add extra financial burden to the caregivers.

Smartphone is being increasingly common to be used highly accepted by older people. Smartphone-based wayfinding application by employing the GPS and voice commanding recognition technology is very common and helpful for people to navigate in outdoor settings. The cost of using these applications is usually low and even most of them are free of charge. However, knowledge about the use of the smartphone-based applications to assist wayfinding in older PWeD is scarce. Therefore, the aim of this study is to explore the feasibility and acceptability of using of smartphone to assist outdoor wayfinding in older PWeD.

Methods:

This study aimed at recruiting 60 participants with or without dementia in 1:1 ratio by convenience sampling. Participants with dementia were recruited from a dementia day center. They all had dementia diagnosis documented on their medical record with MMSE score between 20 and 25. Participants without dementia (n=30) were recruited from another elderly service organization. They had showed no diagnosis of dementia shown on the medical record with MMSE score above 25. Participants also had fulfilled the following eligibility criteria to be recruited: 1) age ≥ 65 years, 2) good mobility function as determined by the Modified Functional Ambulation Classification (MFAC) at the level of independent outdoor walker (i.e. category VI of MFAC), 3) normal walking speed as defined by being able to walk more than four meters in five seconds, and 4) no implanted electrical devices such as cardiac pacemaker.

All participants attended in the same smartphone-based wayfinding (SBW) protocol. Apple iPhone 7 Plus, which has incorporated GPS and voice-commanding functions, was used as the smartphone for testing. Two applications namely Siri and Maps were used in the SBW protocol. Siri is a voice-commanding application to allow participants to operate the smartphone by their voice. Maps is a navigating application to allow participants to go places by giving them audiovisual cues on a real-time map continuously updated by GPS. The first part of the SBW protocol was a 30-minute training workshop, which taught the participants the basic commanding skills. This workshop also aimed at making sure that all participants’ voice command could be recognized by the smartphone and they could understand the needed voice and visual commands given by the smartphone. The second part of the SBW protocol was another 20-minute outdoor navigation test. This test required the participants to walk an untold journey in a city. This journal
was fully directed by the interaction between the smartphone and participants. All participants were invited to start from the same elderly center. In order to ensure that the participants need to use smartphone to find way, the participants were instructed to navigate to a place which they had never visited. A few standardized destination options were provided. The journeys between the starting point and destinations were all approximately 300 meters with three planned turns en route. To start the test, the participants were asked to simply activate the Siri by pressing the Home button, followed by telling the smartphone where they want to go. In order to ensure safety, one research assistant and one elderly center staff member accompanied the participants. After the test had started, the accompanying people could not give any hints to the participants unless the research assistants observed that the participants were unable to complete or the time needed exceeded the planned 20 minutes.

Before the implementation of the SBW protocol, demographic (e.g. age and gender) and clinical data (e.g. mobility and cognitive function) were collected. To examine the feasibility, “successful pass of training workshop”, “successful arrival of destination”, “time needed to complete”, and “successful completions within the planned three turns” were collected. Qualitatively, non-participatory observations were conducted by the research assistants when they walked with the participants throughout the journey. The observation aimed at identifying barriers hindering the participants to complete the SBW protocol. Descriptive field notes were taken in the observation process. To examine the acceptability, Senior Technology Acceptance (STAM) questionnaire was used to inquire participants’ acceptance on the use of smartphone to solve their living problems.

Quantitative data were compared between older people with and without dementia by using Mann-Witney U test for continuous data and Fisher’s Exact test for categorical data. Level of significance was 0.05. Content analysis was conducted to analyze the descriptive data of the field notes. Ethical approval was obtained at the Human Subject Ethics Sub-committee, The Hong Kong Polytechnic University.

**Results:**

This study screened 31 participants in the elderly center without dementia with one participants screened out because of use of pacemaker. There were 30 participants with known dementia were screened for eligibility with subjects screened out because of having pacemaker (n=1), too cognitively impaired (MMSE< 20, n=5), refused to participate (n=8), and unable to complete training workshop (n=1). Finally, there were only 16 participants completed the study.

The age of the participants with dementia (median=79.0, range=23.0) are significantly higher than those without dementia (median=66.5, range=19.0). Participants with dementia (median MMSE=24, range=20-25) have significantly poorer cognitive function than those without dementia (median MMSE=29, range=26-30).

To examine the acceptability by comparing the STAM scores between people with and without dementia, the participants with dementia perceived that only “physical function” as a more significant reason that will affect their acceptance upon using technology to solve their living problems compared with the participants without dementia. There was no significant difference between groups on other factors, such as “attitude towards use”, “perceived usefulness”, and “perceived ease of use”.

To examine the feasibility by comparing the frequency of “successful arrival of destination” and “successful completions within the planned three turns”, there was no significant difference between groups of participants with or without dementia. Over 80% of participants in both groups could arrive the destination within 20 minutes (mean time=8.1 min, SD=3.4) and the planned three turns. However, the group participants with dementia needed significantly longer time to complete the SBW protocol (mean difference=3.28 min, p=0.014) and have significantly fewer people passed the training workshop (p<0.001) compared with the group without dementia.
To explore the feasibility by analysis the field notes, it was observed that participants’ sensory functions (visual and auditory function), cognitive functions (attention, executive function, memory, and comprehension) hindered their use of the smartphone to do wayfinding. Also, some technical problems related to networks signal detection and software design also hindered their use.

Conclusion:

Dementia was observed to be a reason hindering older people participating in using smartphone to do wayfinding, as one third of the eligible participants with dementia refused to join the study. However, there is still a large portion of older people with dementia in this study were interested to use smartphone to assist wayfinding. Although PWD need longer time to complete the SBW, early dementia is not a significant factor hindering older people to successfully find their way using smartphone. Older people with dementia were observed to have more difficulties to learn and use the smartphone. In order to overcome the barriers for the PWeD to use smartphone for wayfinding, modification of the smartphone and application should focus on compensating specifically on their sensory and cognitive function impairment, as well as the technical problems.

Title:
The Use of Smartphone in Older People With Early Dementia for Outdoor Way-Finding: Pilot Study

Keywords:
Dementia, Smartphone and Wayfinding

References:


Abstract Summary:
This study is about the use of smartphone in older people with early dementia (PWeD) for outdoor wayfinding. After attending this session, participants are expected to understand the feasibility issues and acceptability of using smartphone to assist outdoor navigation, hopefully to resolve way-finding difficulties and promote independence in PWeD.

Content Outline:
Introduction

A. The impact of cognitive impairment on outdoor way-finding in people with early dementia

B. The purpose of this study is to explore the feasibility and acceptability of using a smartphone application to assist way-finding in people with early dementia

Body

A. Study design

1) Sampling: convenience sampling

2. Sample and sample size estimation: 60 participants

a) Older people with early dementia = 30

b) Older people without dementia = 30

3. Setting:

a) Dementia care center

b) Elderly center

4. Eligibility criteria

a) Older people (age ≥ 60 years)

b) No physical impairment limiting their mobility

c) No implantable electrical devices (e.g. pacemaker)

5. Testing protocol materials: a smartphone-based way-finding protocol

a) Apple iPhone 7 Plus

b) Siri

c) Maps

6. Testing protocol procedures

a) 30-minute training workshop

b) 20-minute outdoor navigation test

7. Quantitative measurement

a) Demographics and clinical data
b) Feasibility and feasibility variables

8. Qualitative measurement

a) non-participatory observation

b) recorded by descriptive field notes

9. Data analysis

10. Ethics

11. Result

Conclusion

A. Smartphone-based way-finding is feasible and acceptable in most of the people with early dementia in the study.

B. Sensory decline related to ageing, cognitive impairment related to dementia, and technological designs contribute to hinder the use of the smartphone for people with early dementia to resolve their way-finding problems.

C. Further technological modifications may enhance its feasibility and acceptability

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Author Summary: My teaching research focuses on the care of older people, specifically in dementia care, frailty, and gerontechnology. For the research methodological knowledge, I am specialized in non-pharmacological intervention development and randomized controlled trial. For teaching methodological knowledge, I am specialized flipped classroom and online teaching.