

Uses of Internet and Mobile Technology in Health Systems for the Elderly

A Case Study of Hong Kong

[doi:10.3991/ijim.v4i2.1175](https://doi.org/10.3991/ijim.v4i2.1175)

S. Lam¹, W. Chung²

¹Oxford University, Oxford, UK

²Tung Wah Eastern Hospital, Hong Kong

Abstract—To investigate the impact of training the elderly to use the Internet and mobile computer devices in order to become more active in their health care. This study utilized semi-structured interviews and surveys. Five themes emerged from the interviews that described participants' motivations and barriers they experienced when using the mobile devices and Internet. Survey data revealed that levels of computer anxiety decreased and levels of efficacy increasing after training. **Conclusion:** Training the elderly to use the Internet lowered levels of computer anxiety. In addition, participants used the information retrieved from the Internet to become more active in their own health care.

Index Terms—Mobile device, elderly, Health system, Hong Kong

I. INTRODUCTION

The Internet provides an opportunity to the public and healthcare professionals to access medical and health information, improve the efficiency and effective, timely healthcare. The rise of mobile systems and the widespread adoption of the cell phone mean that mobile applications are an exciting and rapidly expanding domain for such applications. Many new offerings are being developed through digital appliances, computer terminals and mobile devices. Yet important empirical questions remain to be answered at every level about how effective these systems are, what their different effects are on various socio-demographic sectors, and whether their expense justifies the efforts involved. Important too are issues of how quickly and in what format they should be created, who should bear the costs of development and dissemination, how to ensure their dependability and sustainability, and what their immediate and longer term social implications might be.

We have observed that (1) there has been substantial resource commitment, resulting in the creation of many useful centralized services (some commercial, some governmental); (2) however, despite their utility, perceived and actual inadequacies of these services have stimulated disparate groups to organize their own compensatory, decentralized and local networks of health information resources. These include Internet listservs, “blogs” (that is, online interactive diaries or “Weblogs”) and local telephone circles. As new communication technologies are developed, they are also explored for novel e-health uses. Serious problems have raised from the elderly users. Old people are not a homogeneous group and we must find

solutions that take into account the diversities and respect the wishes from individuals.

In our analysis, we perceived a dialectical process: each of the above analytical themes stems from an original, perceived problem, which in turn gives rise to specific forms of Internet use. From these there arise new contradictions, which suggest potential, often novel, solutions. So advancement in effective Internet and mobile healthcare systems require not only empirical data on the specific reception of each system by its users, but also a larger framework that understands the logic of self-interest and cultural moorings that affect each system in a larger setting. Issues for the elderly users can be more complicated. For instance, analysts need to consider ways in which elderly people try to use the Internet and mobile computer devices to serve their own needs, and how, when doing so, they become enmeshed in, or seek to subvert, the inherent logic and vested interests of health institutions and information systems.

Assessment of these problems involves issues that go beyond good intentions and laudable aims (or other motives) of providers. They should include consideration of the inherent bureaucratic logic of one-way information flow. This logic governs traditional relations of healthcare organizations with their clients, even as these operations are extended into digital domains and widespread access. Further, as this process unfolds, it often includes within it a market logic of packaging information for return on investment, and at the very least some concern about program efficiency. These inherent logics sometimes lead to confusion on the user's part since the user may not understand the deeper motivations and rationales. Organizations, if they are to have a continued existence and reap the rewards of sunk costs and prior efforts, must also attend to their vested interests.

As ageing is already strongly influencing the needs for care and ‘lifelong participation’ in society and the ICT literacy of the above-65 age group will improve significantly in the next decade, service markets for well-being products and services will be created. Citizens have increasing expectations in terms of full inclusion in society and economy, quality of life and exercising of rights. Elderly people and people with functional limitations are increasingly recognised as posing the most challenging requirements also for mainstream usage.

As more and more elderly people stay in their own homes larger efforts on health- and social care is needed. To get better health and elderly care services for the indi-

vidual and the community the perspective is changing from organisational to a patient perspective. To meet the demands and to maintain an acceptable level of services in health and homecare, implementation and use of ICT as support for caring work, are increasing. The assumption is that technology will give rise to a large number of improvements, such as effectiveness and ability to follow up and evaluate the performance of the services provided. With an ageing population, there is an increased need for rehabilitation and care and a gap between resources and needs. The development and implementation of mobile information and communication technology (mICT) can somewhat balance this gap. ICT as technology can enable changes at many different levels; in the artefact itself (both the device and services), on working processes, in communication, coordination, and cooperation, knowledge exchange and concerning scope of action. Needs together with the solutions are deciding which ICT innovation that will be developed and designed in order to empower the users.

A. Previous studies

While the Internet has contributed to societal change, and provided opportunities to revolutionize health care [1-3] it may be said that for the elderly population, it is more of an 'evolution' than 'revolution'. In a survey by the University of Pittsburgh [4], it was discovered that 62% of the residents of Pittsburgh and surrounding Allegheny County had access to the Internet. However, the average older adult in Allegheny County, the second largest population of older adults in the nation [5], had the lowest levels of computer ownership and more limited access to the Internet than other county residents. Furthermore, these elderly adults, who make up 17.8% (228,416) of the county's 1,281,666 residents lacked the essential knowledge of how to use the Internet to locate health information. Nationally, research [6] shows that older Americans are in danger of being cut off from one of the most provocative communication mediums of the 21st century. In the United States, elderly adults make up 13% of the population with only 4% using the Internet. Overall, 56% of America is online and out of that percentage, only 15% age 65 and over have direct access to the Internet. [7]

Medical care in America has generally been regarded by many as the best and of the highest quality throughout the world. However, research [8] has shown that the deaths of over 98,000 people annually may be due to medical errors. The physician, once thought to be an oracle of medical knowledge, has been found to practice medicine based on a combination of their instinct, experience, and sometimes outdated education. This has created a system prone to mistakes due to the wide range of variability in practice, knowledge, and education. To perpetuate this illusion of the infallibility of the physician, tradition has taught the individual that their role in the health care process is one of passive recipient, i.e., "The Doctor knows best." Hospitals, physicians, and health care professionals purport to know what is best for their patients, thus the patient should allow the providers unrestrained ability to make the major decisions regarding the care that is given. Research, however, shows that the adoption of a passive role is a matter of blind faith [8-10] and can be counter-productive in diagnosis and treatment.

The majority of patients prefer to leave their medical decisions to their physicians. [11-12] Not only is this the

case for older and less educated patients [13-18], but physicians perpetuate this trend as their experience and education increases. [19-20] Over the years, studies have shown that patients over 60 years of age have a lower desire for control over their health care when compared to younger adults. [21-25] Moreover, older patients and men are more likely to let the physician make decisions regarding their treatment.[26] This suggests that the elderly tend to have an external locus of control when it comes to health beliefs [27], as opposed to an internal locus of control, over their health care. This phenomenon appears to exist across disease classifications [10, 12, 14, 16, 25]

Although the majority of patients prefer to let their physician make the decisions, the more a patient learns about their illness, the more likely they are to ask questions of their physician. [28-32] Studies have shown that patients who ask questions, elicit treatment options, express opinions, and state their preferences regarding treatment during office visits with their physicians have measurably better health outcomes than those who do not communicate. [8, 33-37] Therefore, this study explored the impact the Internet had on the elderly with regard to their participation in their own health care. Did they use the Internet to become more informed health consumers, and as a more informed consumer, did they assume a more active role in their own health care.

B. Digital divide in Hong Kong

While many countries are striving to bridge the gap between the information-rich and the information-poor, there are still great differences in access and usage, as well as social behaviour between developed and less developed countries, and within these countries. Reports show that while high-income industrialized countries (e.g., Germany, Norway, Sweden, and United States) comprise only fourteen percent of the world's population, they are home to seventy-nine percent of all Internet users. Organization for Economic Co-operation and Development (OECD) reports that when measuring PC penetration and Internet access rates by age groups among 30 relatively high-income countries, the usage is generally lower for elderly people than for younger people. Besides, usage has tended to grow faster in the younger age groups. The highest users appear to be the 34-45 years group.

This is quite similar in the case of Hong Kong. In 2005, the age group 10-14 has the highest rate of PC usage (90.8 percent), while the age group 15-24 has the highest rate of using Internet services (91.1 percent). In 2007, the PC and Internet usages rates of these age groups have jumped considerably. The age group 10-14 still has the highest rate of PC usage (96.8 percent), and the age group 15-24 has the highest Internet rate (91.9 percent). On the other hand, in 2005, the Internet usage and PC usage rates of the age group 55-64 are 6.0 percent and 8.8 percent respectively. The percentages are much lower for the age group 65+ with a 0.9% Internet usage rate and a 1.2% PC usage rate. In 2007, the Internet usage and PC usage rates of the age group 55-64 have doubled, which are 13.8 percent and 16.2 percent respectively. For the age group 65+, the Internet usage and PC usage rates are 1.8% and 2.2% respectively [51]. Even though the number of people aged 65 and above using PC and the Internet has increased, it is still relatively low. Judging from these statistics, we must raise both the awareness of ICTs in the elderly group and especially their abilities to use ICTs so to lower the barrier

ers of PC usage and Internet access in this particular socially disadvantaged group. However, where are the barriers come from? Why are the elderly so hesitated to use ICTs? What are the obstacles they are now facing? First of all, there are the stereotypes about the ability and willingness of the elderly to learn intellectually challenging tasks in our society. With such impression, the elderly might fear that they are incapable of learning computing-related skills and hence dare not to do so. Shapiro (1995) indicates that with suitable applications and training, the elderly can also be energetic and enthusiastic computer users like the younger generation. Second of all, for elderly with limited income, cost of ICTs equipment and online access are considered as the luxury items. Thus, the financial situation of older people is a key and practical constraint when examining their barriers in accessing ICTs. Thirdly, especially in Hong Kong, language and literacy are the hurdles. Many services and the language used in computer are English, prohibiting elderly with low educational background from using ICTs. Lastly, lack of sufficient information may be another reason, which makes the elderly hesitant about using and purchasing ICTs despite the fact that they are economically capable to do so. Seniors need to be well informed about the benefits, including its usefulness of the new services [52].

II. OBJECTIVE

A concern about the interaction between professionals and patients/clients made our interested in the development and impact of ICT within health care and care and how especially mobile ICT could support self-understanding and understanding between all stakeholders in health care and rehabilitation in Hong Kong. How could mobile ICT serve as a tool for empowerment of elderly people in home healthcare and rehabilitation meaning that the elderly person's voice would be listened to and the process of ageing well would be supported?

In this paper, the authors focus on delineating some recent developments in the use of the Internet and related technologies for healthcare.

III. METHOD

To facilitate the training of the elderly, a large Hong Kong NGO specializing in elderly service agreed to sponsor a series of mobile Internet device training seminars and make their resources available to the research team. These resources included a meeting room and use of mobile Internet accessible computers. The decision to use an elderly center as the setting for the training was made based on the fact that this is where most of the elderly would access the Internet. [4] The training sessions were advertised in two local newspapers. Flyers were also placed in the elderly center where the training was to take place. A sign-up sheet was made available for three time slots during the week (Mondays, Wednesdays, and Fridays). The sessions were five weeks in length, meeting once a week for two hours for a total of 10 hours of instruction. Each session began with an overview of the day's topic, followed by hands-on instruction and practice.

The sessions used constructivist teaching techniques (citation) and self-directed learning. Each lesson was presented using a different method for engaging the participant to find medical information that was relevant to their individual needs. For example, many seniors are interested

in finding out more about the medications they are taking. A short presentation was made using a laptop, LCD projector and related mobile technology devices. Seniors were shown how to search several web sites containing pharmaceutical information, and then given a chance to practice searching those sites using a mobile computer device connected to the Internet. Small groups made individual attention possible for the hands-on portion of each session. Toward the end of the five weeks, as the participants skill level increased, they began to work cooperatively, helping other participants navigate to web sites of interest, or finding information pertaining to their own health problem. To facilitate learning a course workbook was provided to the participants to serve as a reference for future use.

A. Subject

All subjects (n=28) were aged 65 and older. Eight of the participants were male, and twenty were female. The majority of participants had used a computer before attending the seminar, either at home, the public library, or an elderly community center. Thirty nine percent reported having a college degree, while 28% had some form of post-graduate training. Eighty two percent were retired.

B. Survey (Pre-Post)

Surveys were distributed at the beginning and end of the five-week training session. The surveys were designed to capture baseline information about the participants, their experience using mobile computer devices, and experience searching the Internet. To measure anxiety, the Computer Anxiety Subscale of the Computer Attitude Scale [38,39] along with Busch's [40] computer efficacy scale were administered. The rationale for using these measures was to determine if levels of anxiety toward mobile computer devices and feelings of self efficacy influenced participants use of the Internet to locate health related information. It was hoped that training older adults to use the Internet to find medical information would lower levels of anxiety, while increasing levels of efficacy and the desire to participate in one's health care.

C. mobile devices Usage

In the fourth week of the seminar, a short questionnaire was administered which measured the frequency rate at which participants used the mobile devices outside of class to search for medical information.

D. Evaluation

A final questionnaire was sent to participants forty five days from the conclusion of the seminar. Each participant was asked to record how often they had used mobile computer devices and the Internet to locate health information and body condition checking and whether the seminar changed the role they played in their own health care.

E. Interviews

A stratified sample was used to interview eight people at the conclusion of the training. These subjects were chosen due to the variation in their behavior during the training, i.e., some people had more trouble than others in learning the mobile computer device in general, others were comfortable with it, and others were inquisitive about how they could use the Internet to help them manage their own care. Questions were tailored to elicit as

much information as possible regarding the outcome and satisfaction of the Internet training the subjects received. These included questions such as, “Before the seminar, what were your feelings toward the Internet”, “What are the barriers you have experienced in using the mobile computer device”, and “How do you think you can use the Internet to manage your health care?” Each interview was tape recorded and lasted approximately one hour.

IV. RESULTS

A. Surveys

Four surveys were completed by participants during this case study. A pre and post survey asking participants about their attitudes toward mobile computer devices and Internet use was used at the beginning and end of the five week seminar. An Internet usage survey was completed at the beginning of the fourth week, and a final survey was sent out to participants forty-five days after they completed the seminar. Results from each questionnaire are discussed below.

B. Pre and Post Surveys

These surveys were used to measure participants levels of anxiety toward mobile computer devices and their levels of efficacy in terms of using a mobile computer device to locate medical information found on the Internet (N=28). The Computer Anxiety Subscale of the Computer Attitude Scale [38,39] was used to measure participants level of anxiety. Busch's [40] computer efficacy scale was used to measure a person's efficacy when using a computer to perform certain tasks, such as using the Internet to locate health information.

Comparison of group pre and post scores indicated that instructing elderly adults how to use mobile computer devices to find medical information lead to a reduction in anxiety levels and increased feelings of efficacy. See Table I.

Participants feelings in their ability to find information on the Internet, rose from 59% to 80%. When it came to their confidence in finding information about their own health, the feeling of being confident rose from 51% to 69%. Finally, when asked about their confidence in using the Internet to manage their personal health care, the feeling of being confident rose from 29%-46%. See Table II.

TABLE I.
COMPUTER ANXIETY SCALE

FEELING TOWARD THE MOBILE COMPUTER DEVICE	PRE	POST
FEAR OF THE MOBILE DEVICE	39%	20%
MOBILE DEVICE MAKES ME NERVOUS	22%	0.08%
MOBILE DEVICE MAKES ME UNCOMFORTABLE	37%	11%
MOBILE DEVICE DOSE NOT MAKE ME FEEL UNEASY AND CONFUSED	38%	57%

TABLE II.
LEVELS OF EFFICACY IN FINDING INTERNET INFORMATION

LEVELS OF CONFIDENCE	PRE	POST
CONFIDENCE – I CAN FIND INFO ON THE INTERNET	59%	80%
CONFIDENCE – I CAN FIND INFO ON THE INTERNET REGARDING MY OWN HEALTH	51%	69%
CONFIDENCE – I CAN USE THE INTERNET TO MANAGE MY OWN HEALTH CARE	29%	46%

In addition to anxiety and efficacy levels, the pre and post questionnaires elicited information regarding participants' feelings toward using the mobile devices as a tool for locating health care information. At the conclusion of the seminar, 100% of the participants indicated they felt the mobile devices could be used to manage their health care, an increase of 25% from the pre-questionnaire. On the post questionnaire, 81% percent responded that they would be more comfortable taking a collaborative role in their health care. However, 48% indicated that they would use the Internet to manage their health care, while 44% stated that they did not know.

C. Internet Usage Survey

This survey was used to gather information regarding participants (N=28) use of the Internet to search for medical information outside of the seminar. Overall, 66% used the Internet to locate medical information an average of 2-3 times since the start of the seminar. Of that 66%, 25% had computers in their homes. 20% made use of computers located in a public library and the majority (55%) preferred to use their mobile device in a free way (i.e. wherever they want). It is important to note that individuals with computers in free way used the Internet 2 more times than the fixed way (i.e. at home and elderly center) to locate health related information. The key message here is that a more flexible approach in term of time and venue is more suitable for the elderly users. The authors believe the following factors / reasons for the elderly users' flexible approach by using mobile technology device –

1. Peer support
2. Informal and casual environment
3. Similar age cohort
4. Elderly users tend to be self-directing - they only use when they need it.

TABLE III.
INTERNET USAGE

USE INTERNET			DIDN'T USE INTERNET
66%			44%
AT HOME	ELDERLY CENTER	FREE (EVERYWHERE)	
25%	20%	55%	

D. Final Survey

This survey was completed by the participants (N=26) forty five days after completing the Internet seminar. Results showed that during that time, 58% (N=15) had used the mobile devices to look up health related information. Many of the participants used the mobile devices to look up information on topics as broad ranging as: colitis, thyroid, mental illness, drug information, prevention, hearing aids, cancer treatment, clinical trials, vitamins and heart conditions. Sixty-five percent of the participants reported having been to a health care professional since taking part in the Internet seminar. From that 65%, 59% engaged in activities that can be interpreted as having a more participatory or active role in their own health care. Participatory, defined as the elderly adult using the mobile devices to seek more information regarding their health problem, to discover alternative treatments, or to locate information to generate questions that were directed to their primary care physician. For example, one participant described

how her use of the mobile devices made her more confident in asking questions of her health care provider. These questions ultimately lead to a change in her prescription drug medication. Another participant reported that he now takes more questions to his doctor based on the information found on the Internet.

TABLE IV
FINAL SURVEY

USED MOBILE DEVICES TO LOCATE HEALTH RELATED INFO	VISITED HEALTH PROFESSIONAL	PERCENT THAT VISITED HEALTH PROFESSIONAL AND ENGAGED IN PARTICIPATORY ACTIVITIES
58%	65%	59%

The primary reason for not engaging in participatory activities was *access* to a computer. For instance, one participant developed a balance problem along with a gastrointestinal disorder. Because he found that physical barrier is the top reason, his illness inhibited him from driving to a fixed terminal to research his problem. Two other participants, (a husband and wife team) developed health problems concurrently. The husband was already suffering from the effects of a stroke and was dependent on his wife to go to the elderly center. When the wife broke her leg, both became house bound and where unable to reach the library to use the Internet to research their problems.

Interestingly, just because an elderly adult is confined to their home without Internet access, does not mean that they cannot get to medical information found on the Internet. One enterprising participant who was suffering from a severe bout of colitis sent an emissary to the library to locate information for her. This example speaks to the growing determination of many elderly to use the Internet to locate health information.

E. Interviews

Each interview was transcribed by the authors. To evaluate the interviews, transcripts of each interview was read and evaluated by three separate readers. From the evaluation process a codebook was developed which classified participant responses into twelve areas. These were then broken down into five specific themes. Those themes included: digital disparity, barriers, health beliefs, enticers and future potential.

F. Digital Disparity

This theme was characterized by the incongruity among participant emotions and feelings toward the mobile devices and the Internet. Participant responses were overwhelmingly positive, but qualified by negative comments, “Yes, I enjoy using the mobile computer device about three times a day.” Only one participant stated that they did not enjoy using the mobile computer device, because it was “a great time waster.” This sentiment was echoed by another participant who although they liked using the mobile computer device, felt that one of the things that they “resented” was the amount of time it takes from doing other activities. The participant described how she could sit down at the mobile device at 1:00 o’ clock and before long it was 3:00 o’ clock, and she would feel that she got nothing accomplished.

G. Barriers

This theme was characterized by responses that referred to any physical or cognitive obstacle which prevented or hindered the participant's ability or desire to learn the mobile computer device and the Internet to locate health information. Overall, a majority of the respondents felt they lacked the “technical skills” to use a mobile computer device, while a quarter of them felt that various technical problems, “you have to watch what key you hit... I hit the control key and it kind of froze everything,” prevented them from using the mobile device optimally, and another others felt that they lacked adequate software skills, “I am always making little errors—like www. and then maybe I will have one letter too much or have the wrong colon.” Participants also cited lack of time, lack of resources, and certain cognitive skills (memory and organization) as significant barriers. “Fear... Primarily, as I mentioned before—eh—fear that I couldn’t absorb the information and it was beyond my comprehension...”

Half of the participants stated that prior to taking the seminar, they did not know what kind of information was available on the Internet, while the remaining participants cited fear, de-socialization, anomie, and questions regarding authenticity of information as their primary emotions regarding Internet use.

H. Health Beliefs

This theme refers to the participant's belief about the control they have over their health care. Participant health care beliefs could lie somewhere between an internal and external locus of control. For example, a participant with a paternalistic Primary Care Provider (PCP), in most cases, had an external locus of control, where they were willing to give complete control of their health care to some external source. Interview data suggest that patient/physician relationships varied widely, including patients who question their doctors, but ultimately follow their doctors' directions; and patients who react to their doctors' decisions by going online and investigating diagnoses, conditions and treatments. Two other types of relationships encountered identified patients who would only deal with physicians who agreed with their beliefs, “I try to choose doctors that I know agree with me”, and patients who had physicians receptive to a more open, participatory relationship.

When asked how their relationship with their primary care provider might change after being exposed to the mobile computer device, most of the respondents believed that their behavior would change because they would be more willing to look up information before making a decision about their health care, “now when I am going to the doctor . . . I am going to research why I am seeing him in the first place.” Furthermore, participants believed that use of the mobile device to find health related information allowed them to ask their physician more intelligent questions, therefore, putting them on a higher level of understanding in terms of their illness and the ramifications associated with different treatment options. This, participants believed, would allow them to have a “more detailed important discussion with their physician.”

There are also matters that pertain to mobile services and functionality of mobile systems.

Services, which need authentication and other protection of sensitive information, such as, medical informa-

tion, or other personal records, are becoming more numerous. Increase of protection makes systems more difficult to use, for instance, because of changing passwords.

I. Enticers

This theme is typified by the Internet sites that participants experienced as interesting and useful. Participants expressed interest in further exploring the Internet as an information tool, "*it's amazing how much information is available if you have the know how.*"

Overall, the participants enjoyed using the mobile computer device and the Internet to stay in touch with other people, perform research, and use as a tool to look up news items or medical information. For non-health related topics, participants used various Internet sources to locate information on theater tickets, legal information, investment research, genealogy and recipes.

J. Future Potential

Participants discussed how they planned on using the mobile computer device and Internet to manage their health care in the near future. Overall, participants felt the Internet was a good resource because it provided them with alternatives for their health care, enabled them to critique the qualifications of their provider, obtain important and factual information, and use as a source for quick up-dates to information on a health related topic. One participant went as far as to describe the sources available on the Internet as today's 800 numbers:

I think of web sites as the new 800 numbers. Before the Internet was big you would call an 800 number to get information about a disease or organization. Now everybody, every organization and disease has a web site that you can get the homepage and you see the linkage—you know you can go through the links and see what is available that way.

All of the participants responded that they would use the mobile computer device with Internet to find information on physicians, health conditions, complications, treatments and medications. As a corollary, participants felt that the Internet provided them with the means to become a better, more informed patient who could ask their provider better questions. And asking better questions, they believed, would lead to better health outcomes.

K. Expected Benefits of mobile devices and services

The benefit of using mobile computer devices and services turned out to be one of the most salient factors in every interview. Elderly people accept and take new technical solutions in use, if they bring relief in daily life, for example, by facilitating living in own apartment or by enhancing security. The benefits are valued differently by different people. One obvious reason or benefit for acquiring a mobile device and using services is the need to communicate with other parties.

Demand and usage of mobile computer devices might increase, if there were more utility services available. For instance, in some cases, both public and private dental clinics send a SMS to inform a customer about new possible appointments. For some hospitals in Hong Kong, some of the interviewees were recommending and using themselves the mobile tickets of one interviewee said that many patients, including elderly people, are happy to re-

ceive the results of blood tests from their physician, when the results do not call for any further action.

Elderly people suffering severe memory problems, like dementia or Alzheimer's disease, tend to wander and get lost. Cell-based positioning by mobile devices is a technique, which can be used to locate and find persons, but only with limited accuracy. When the new generation of mobile phones equipped with Global Positioning System (GPS) becomes more common, service providers have an opportunity to generate new location based services.

Mobile technology devices can also provide the relatives of an elderly person with some peace of mind. For example, with an electronic medication dispenser, the family of an elderly can ensure that the elderly takes his or her medication. Hong Kong Hospital Authority is piloting with an electronic dispenser, which uses GSM technology. The dispenser reminds the customer to take his or her medication. If the medication is not removed from the dispenser, first an automatic voice reminder call is made to the mobile device of the customer, and then, if needed, an alarm goes through a patient portal, which forwards a message to a nurse's cell phone. After that, a nurse goes and checks up on the customer.

V. DISCUSSION

Results gathered from the questionnaires and interviews allowed for the generation of three conclusions.

First, the adoption of constructivist, self-directed techniques to teach older adults how to locate medical information using the mobile computer device helped them to overcome some of the barriers (technical, navigational, and recall) they encountered when learning to use a mobile device. For example, participants would get easily confused regarding where to type a URL to navigate to a new web site. The instruction helped to clear up this kind of confusion by requiring participants to repeat the same skills over and over again. Furthermore, providing older adults with a safe learning environment, where they can freely make mistakes, and then learn from those mistakes empowered them to overcome their feelings of anxiety toward the computer; to master navigational issues of the Internet software, and to feel confident in their abilities to effectively use the computer. [41-47]

Feelings of anxiety and efficacy can be related to the themes of digital disparity and barriers, which were identified during the analysis of the interviews conducted with individual participants. By providing instruction to older adults on how to use a mobile computer device to locate health information on the Internet, negative feelings toward the use of the computer along with barriers such as the lack of technical and software skills may be reduced, which can lead to lower feelings of anxiety and higher feelings of efficacy.

Knox [48] stated that adults expect that they will be proficient in using the necessary skills to be a productive citizen. When there is a discrepancy between an adult's current level and desired levels of proficiency, they may be motivated to acquire the skills needed to become proficient in a deficient area. As computer use proliferates and the Internet becomes a standard method of acquiring medical information, many older adults will be less than proficient using these new technologies, and may be motivated to learn the required skills. Use of constructivist [49] and self-directed teaching methods help develop these

skills by placing the older adult in learning environments that require them to solve problems that are directly related to finding relevant medical information using the mobile computer device. These methods help the older adult become proficient at using the mobile computer devices and the Internet, but more importantly, they help the participant become a self directed learner when finding medical information related to their own health.

Second, teaching older adults how to look up high quality health information lead to a feeling or desire to become more participatory in the process of their health care. Recent research [7] shows that as older adults go online, a majority (53%) of them will use the Internet to locate health related information. As older adults continue to use the Internet, it is highly probable that they will use this information to take a more active role in their health care. The Pew Internet & Life [1] project reported that seven million people search the Internet each day to locate health related information. This information helps individuals understand their illnesses, verify diagnoses, investigate treatment options, check physicians' credentials and learn more about current medications. As health consumers become more informed, research [28-32] shows that many of them will ask more questions and demand more information from their PCP. These facts correspond directly with the themes of *Health Beliefs*, *Enticers* and *Future Potential*. With their responses on the questionnaires and through the subsequent interviews, participants acknowledged that the Internet can be used to locate health related information that allows them to take a more active role in their own health care, and work collaboratively with their PCP. These facts also underscore the hypothesis that by lessening participants level of anxiety toward the mobile computer devices, and heightening their levels of efficacy, elderly adults develop a greater desire to participate in their own health care.

This case study showed that when instructed how to use the mobile computer device to access health related information, older adults report a greater desire to participate in their own health care. However, these data and the current literature on how older adults use the Internet is based on self report and not verifiable evidence.

Third, access continues to be a barrier for those who don't have a home computer with Internet access. Research [50, 7] has shown that one of the major reasons older adults lag behind other populations in mobile computer device and Internet use is that the computer is not interwoven into their everyday lives. Younger populations make use of computers in school or at work, while older adults contact with computers is limited to the public library or via children, grandchildren or close relatives. Because of this trend, of the 56% of the Hong Kong population currently online, only 15%, which is 65 or older, have direct access to the Internet. Because of their physical impairment, it is difficult for the elderly traveling to library for Internet. And this is why a mobile device is rather important for this particular cohort. This validates the findings detailed above that describe how older adults who become ill or house bound where unable to use the Internet to locate health information because they lacked access in their home, thus, they were unable to get to a facility that had Internet accessible computers. This also highlights the need to include caregivers and family members who are charged with monitoring, maintaining, and providing health related services in the training programs

designed to teach older adults how to use the Internet to locate health related information. This will insure that individuals who lack direct access can benefit from the health information found on the Internet by using mobile devices.

VI. FUTURE RESEARCH

To substantiate the findings of this study and show that older adults are actually taking a more active role in their own health care due to Internet training, carefully designed studies must be created that document how Internet savvy older adults interact with health professionals and what activities they engage in that allow them to participate in their health care. Manuals and written instructions from device or service provider are often said to have been "written from an engineer to another". Instructions should be simple enough for everyone to understand. The authors would like to suggest that mobile computer device retailers could, as a service, pre-set the device of an elderly customer with basic settings. If the use of mobile devices is learned before serious memory problems, the required skills may endure longer.

Finally, as part of this research agenda, measurements need to be adopted that document changes in older adults' locus of control. One important question that will emerge from this line of research is whether training the elderly to use the Internet changes their locus of control from an external to an internal orientation, and whether an internal orientation manifests itself by older adults becoming more participatory in their own health care.

REFERENCES

- [1] Fox S, Rainie L. The online health care revolution: how the Web helps americans take better care of themselves. Washington, D.C.: The Pew Internet & American Life Project, 26 November 2000, <http://www.pewinternet.org/reports/toc.asp?Report=26> Accessed April 12 2001.
- [2] Campbell JD, Harris KD, Hodge, R. Introducing telemedicine technology to rural physicians and settings. *The Journal of Family Practice*. 2001; 50(f): 419-424.
- [3] Ferguson T. Online patient-helpers and physicians working together: a new partnership for high quality health care. *BMJ* 2000; 321(7269): 1129-32. (doi:10.1136/bmj.321.7269.1129)
- [4] Consumer health information in Allegheny County. An environmental scan. The Graduate School of Public and International Affairs University of Pittsburgh 2000.
- [5] Rostein G. Allegheny still second oldest big county in United States. *Pittsburgh Post-Gazette*. May 24, 2001. Available at: <http://www.post-gazette.com/headlines/20010524.census4.asp>. Accessed September 24, 2001.
- [6] Brodie M, Flournoy RE, Altman DE, et. al. Health information, the Internet, and the digital divide. *Health Affairs* 2000; 19(6):255-65. (doi:10.1377/hlthaff.19.6.255)
- [7] Fox S. Wired seniors: a fervent few, inspired by family ties. Washington, D.C.: The Pew Internet and Life Project, 9 September 2001. Available at: <http://www.pewinternet.org/reports/toc.asp?Report=40>. Accessed October 31, 2001.
- [8] Kohn LT, Corrigan JM, Donaldson MS, (Eds). *To err is human: building a safer health system*. Washington, DC: National Academy Press; 2000.
- [9] Institute of Medicine, (Ed). *Crossing the quality chasm: a new health system for the 21st century*. Washington, DC: National Academy Press; 2001.
- [10] Millenson ML. *Demanding medical excellence: doctors and accountability in the information age: With a New Afterword*. Pbk ed. Chicago: The University of Chicago Press; 1999.
- [11] Kaplan SH, Greenfield S, Gandek B, et. al. Characteristics of physicians with participatory decision-making styles. *Ann Intern Med*. 1996;124:497-504.

- [12] Arora NK, McHorney CA. Patient preferences for medical decision making: who really wants to participate? *Medical Care* 2000;38(3):335-341. ([doi:10.1097/00005650-200003000-00010](https://doi.org/10.1097/00005650-200003000-00010))
- [13] Ende J, Kazis L, Ash A, et. al. Measuring patients' desire for autonomy: decision making and information-seeking preferences among medical patients. *Journal of General Internal Medicine* 1989;4(1):23-30. ([doi:10.1007/BF02596485](https://doi.org/10.1007/BF02596485))
- [14] Frosh D, Kaplan RM. Shared decision making in clinical medicine: past research and future directions. *Am J Prev Med* 1999;17(4):285-294. ([doi:10.1016/S0749-3797\(99\)00097-5](https://doi.org/10.1016/S0749-3797(99)00097-5))
- [15] Benbassat J, Pilpel D, Tidhar M. Patients preferences for participation in clinical decision making: a review of published surveys. *Behav Med* 1998;24(2):81-88. ([doi:10.1080/08964289809596384](https://doi.org/10.1080/08964289809596384))
- [16] Bilodeau BA, Degner LF. Information needs, sources of information, and decisional roles in women with breast cancer. *Oncology Nursing Forum* 1996;23(4):691-6.
- [17] Kaplan SH, Gandek B, Greenfield S, et. al. Patient and visit characteristics related to physicians' participatory decision-making style. *Medical Care* 1995;33(12):1176-1187. ([doi:10.1097/00005650-199512000-00002](https://doi.org/10.1097/00005650-199512000-00002))
- [18] Beisecker AE. Aging and the desire for information and input in medical decisions: patient consumerism in medical encounters. *The Gerontologist* 1988;28(3):330-335.
- [19] Beisecker AE, Murden RA, Moore WP, et. al. Attitudes of medical students and primary care physicians regarding input of older and younger patients in medical decisions. *Medical Care* 1996;34(2):126-137. ([doi:10.1097/00005650-199602000-00005](https://doi.org/10.1097/00005650-199602000-00005))
- [20] Paterson, B. Myth of empowerment in chronic illness. *Journal of Advanced Nursing* 2001;34(5):574-581. ([doi:10.1046/j.1365-2648.2001.01786.x](https://doi.org/10.1046/j.1365-2648.2001.01786.x))
- [21] Smith RA, Woodward NJ, Wallston BS, et. al. Health care implications of desire and expectancy for control in elderly adults. *Journal of Gerontology* 1988;43(1):1-7.
- [22] Woodward NJ, Wallston BS. Age and health care beliefs: self efficacy as a mediator of low desire for control. *Psychology and Aging* 1987;2(1):3-8. ([doi:10.1037/0882-7974.2.1.3](https://doi.org/10.1037/0882-7974.2.1.3))
- [23] Haug, M. Doctor-patient relationships and the older patient. *Journal of Gerontology* 1979;34:853-860.
- [24] Cassileth BR, Zupkis RV, Sutton-Smith K, et. al. Information and participation preferences among cancer patients. *Ann Intern Med* 1980;92:832-836.
- [25] Stiggelbout AM, Kiebert GM. Patient preferences regarding information and participation in clinical decision-making. *Can Med Assoc J* 1997;157(4):383-389.
- [26] Broomhaar B, Visser APH, Kleunen JGVM. Perceptions and behavior among elderly hospital patients: description and explanation of age differences in satisfaction, knowledge, emotions, and behavior. *Soc Sci Med* 1990;31(12):1377-1385. ([doi:10.1016/0277-9536\(90\)90076-5](https://doi.org/10.1016/0277-9536(90)90076-5))
- [27] Caress AL. Patient roles in decision-making. *Nursing Times* 1997;93(31):45-48.
- [28] Frederikson LG, Bull PE. Evaluation of a patient education leaflet designed to improve communication in medical consultations. *Pat Educ Couns* 1995;25:51-57. ([doi:10.1016/0738-3991\(94\)00696-J](https://doi.org/10.1016/0738-3991(94)00696-J))
- [29] Mullen PD, Mains DA, Velez R. A meta-analysis of controlled trials of cardiac patient education. *Pat Educ Couns* 1992;19(2):143-62. ([doi:10.1016/0738-3991\(92\)90194-N](https://doi.org/10.1016/0738-3991(92)90194-N))
- [30] Sharf BF. Teaching patients to speak up: past and future trends. *Pat Educ Couns* 1988;11:95-108. ([doi:10.1016/0738-3991\(88\)90042-0](https://doi.org/10.1016/0738-3991(88)90042-0))
- [31] Mullen PD, Green LW, Persinger GS. Clinical trials of patient education for chronic conditions: a comparative meta-analysis of intervention types. *Preventive Medicine* 1985;14(6):753-81. ([doi:10.1016/0091-7435\(85\)90070-2](https://doi.org/10.1016/0091-7435(85)90070-2))
- [32] Kaplan SH, Greenfield S, Ware JE Jr. Assessing the effects of physician-patient interactions on the outcomes of chronic disease. *Med Care* 1989(3 Suppl):S110-27. ([doi:10.1097/00005650-198903001-00010](https://doi.org/10.1097/00005650-198903001-00010))
- [33] Greenfield S, Kaplan SH, Ware JE Jr, et. al. Patients' participation in medical care: effects on blood sugar control and quality of life in diabetes. *J Gen Intern Med* 1988;3:448-57. ([doi:10.1007/BF02595921](https://doi.org/10.1007/BF02595921))
- [34] Greenfield S, Kaplan S, Ware JE Jr. Expanding patient involvement in care. Effects on patient outcomes. *Ann Intern Med* 1985;102:520-8.
- [35] Barry MJ, Mulley AG Jr, Fowler FJ, et. al. Watchful waiting vs immediate transurethral resection for symptomatic prostatism. The importance of patient preferences. *JAMA* 1988;259:3010-7. ([doi:10.1001/jama.259.20.3010](https://doi.org/10.1001/jama.259.20.3010))
- [36] Rost KM, Flavin KS, Cole K, et. al. Change in metabolic control and functional status after hospitalization. Impact of patient activation intervention in diabetic patients. *Diabetes Care* 1991;14:881-9. ([doi:10.2337/diacare.14.10.881](https://doi.org/10.2337/diacare.14.10.881))
- [37] Mahler HIM, Kulik JA. Preferences for health care involvement, perceived control and surgical recovery: a prospective study. *Soc Sci Med* 1990;31(7):743-751. ([doi:10.1016/0277-9536\(90\)90169-S](https://doi.org/10.1016/0277-9536(90)90169-S))
- [38] Gressard CP, Loyd BH. Validation studies of a new computer attitude scale. *Association for Educational Data Systems Journal* 1986;18(4): 295-301.
- [39] Woodrow J. A Comparison of four computer attitude scales. *Journal of Educational Computing Research* 1991;7(2): 165-187.
- [40] Busch T. Gender, Group composition, cooperation, and self efficacy in computer studies. *Journal of Educational Computing Research* 1996;15(2): 125-135. ([doi:10.2190/KQJL-RTWI-VVUY-BHLG](https://doi.org/10.2190/KQJL-RTWI-VVUY-BHLG))
- [41] Lawhon T, Ennis, D, Lawhon DC. Senior adults and computers in the 1990's. *Educational Gerontology* 1996;22:193-201. ([doi:10.1080/0360127960220205](https://doi.org/10.1080/0360127960220205))
- [42] Echt KV, Morrell RW, Park DC. Effects of age and training formats on basic computer skill acquisition in older adults. *Educational Gerontology* 1998;23(3):3-25. ([doi:10.1080/0360127980240101](https://doi.org/10.1080/0360127980240101))
- [43] Jones BD, Bayen UJ. Teaching older adults to use computers: recommendations based on cognitive aging research. *Educational Gerontology* 1998;24:675-689. ([doi:10.1080/0360127980240705](https://doi.org/10.1080/0360127980240705))
- [44] Ratner J. Easing the learning curve for novice web users. In Forsythe C, Grose E, and Ratner, J, (Eds), *Human factors and web development*. Mahwah, NJ: Erlbaum, 1998.
- [45] Cahoon B. Teaching and learning Internet skills. In *New directions for adult and continuing education* 1998;78:5-13. ([doi:10.1002/ace.7801](https://doi.org/10.1002/ace.7801))
- [46] Cahoon B. Adult learning and the Internet: themes and things to come. In *New directions for adult and continuing education* 1998;78:71-76. ([doi:10.1002/ace.7808](https://doi.org/10.1002/ace.7808))
- [47] Kubeck JE, Miller-Albrecht SA, Murphy MD. Finding information on the World Wide Web: exploring older adults' exploration. *Education Gerontology* 1999;25:167-183. ([doi:10.1080/036012799267945](https://doi.org/10.1080/036012799267945))
- [48] Knox AB. Proficiency theory in adult learning. *Contemporary Educational Psychology* 1980;5:378-404. ([doi:10.1016/0361-476X\(80\)90059-4](https://doi.org/10.1016/0361-476X(80)90059-4))
- [49] Wilson BG, (Ed). *Constructivist learning environments: case studies in instructional design*. Englewood Cliffs, NJ: Educational Technology Publications; 1996.
- [50] Morrell RW, Rayhorn CB, Bennett J. Survey of World Wide Web use in middle-aged and older adults. *Human Factors* 2000;42(2):175-182. ([doi:10.1518/001872000779656444](https://doi.org/10.1518/001872000779656444))
- [51] The Internet Professionals Association (iProA) (2008), *Global ICT Summit – Country Paper Hong Kong*
- [52] Sin Chung Kai Cyber Office (2001). *Bridging the Digital Divide – A Vision to a Digital Inclusive Society*, Publication and Media, June 2001

AUTHORS

S. Lam was with New College, Oxford. He is now with the Social Sciences Division, Oxford University, UK (e-mail: sancheslam@gmail.com).

W. Chung is with the Social Work Department, Tung Wah Eastern Hospital, Hong Kong. (e-mail: winnie0903@hotmail.com).

Submitted December 18th, 2009. Published as resubmitted by the authors March 18th, 2010.