mHealth in hyper-connected Hong Kong: examining attitudes and access to mobile devices and health information among older Chinese residents

Margo L. Turnbull[1], Ying Jin[1], Alice H. Y. Yau[2], Maggie S. Y. Lai[1], Meryl Y. C. Cheung[1], Wing Yau W. Kwan[1], Bernadette M. Watson[1]

[1]International Research Centre for the Advancement of Health Communication, The Hong Kong Polytechnic University, Hong Kong, China; [2]The Centre for Applied English Studies, The University of Hong Kong, Hong Kong, China

Contributions: (I) Conception and design: ML Turnbull, AHY Yau, BM Watson; (II) Administrative support: ML Turnbull, Y Jin; (III) Provision of study materials or patients: All authors; (IV) Collection and assembly of data: AHY Yau, MYC Cheung, MSY Lai, WYW Kwan; (V) Data analysis and interpretation: All authors; (VI) Manuscript writing: All authors; (VII) Final approval of manuscript: All authors.

Correspondence to: Margo L. Turnbull. International Research Centre for the Advancement of Health Communication, The Hong Kong Polytechnic University, Hung Hom, Hong Kong, China. Email: margo.turnbull@polyu.edu.hk.

Background: Hong Kong Special Administrative Region is one of the most technologically advanced and interconnected cities in the world in terms of ownership of internet-enabled mobile devices. mHealth programs that make use of mobile devices such as smart phones and tablets to maximise access to health information, have been identified as having great potential for ageing communities for the management of health and social care needs. This paper reports the findings of a two-stage exploratory research project which examined the experiences and perceptions of Hong Kong residents aged over 60 years in relation to mHealth technologies and health literacy.

Methods: This study collected data from older Hong Kong residents at a community centre. Data were collected at two stages in July and August 2019. Stage one involved a one-on-one interview at Centre A with each research participant. The self-report surveys included seven questions about mobile phone ownership and a 16-item gerontechnology survey previously used in Hong Kong. Stage two of the data collection involved three discussion groups with the research participants that were run over a 3-week period.

Results: (I) Providing health information via digital devices was considered promising and acceptable by most of our participants. (II) Major concerns that impeded the elders' use of digital devices were their lack of the necessary skills to use these gadgets and their loss of memory. (III) Many participants stated their concern that they found it difficult to recall information immediately after being taught. (IV) Most participants had problems in reading because of low literacy levels or some age-related eye-diseases. (V) Video instructions were preferred by participants as audio and visual input is more useful than rather than static written information with heavy reading requirements.

Conclusions: Participants were interested in using mHealth technologies. Education and ongoing support in their use is necessary.

Keywords: mHealth; elderly; Hong Kong; health promotion; health literacy

Introduction

Hong Kong Special Administrative Region is one of the most technologically advanced and interconnected cities in the world (1,2). Per capita ownership of mobile, internet-enabled devices is high, and residents have access to well-developed infrastructure and relatively cheap data (3). Hong Kong is also one of the most rapidly ageing regions in the world. Hong Kong Census and Statistics Department (CSD) reported in 2017 that average male and female life expectancy is now 81.3 and 87.3 years respectively (4). This report also predicted that the population aged over 65 years will increase from 15% in 2014 to 34% in 2064. Based on these predictions, by 2065 approximately 2.8 million Hong Kong residents will be aged over 65—an increase from 1.1 million in 2015. mHealth programs that make use of mobile devices such as smart phones and tablets to maximise access to health information, have been identified as having great potential for ageing communities in terms of health promotion activities as well as the management of health and social care needs (5). The utility of mHealth technologies has been researched from the perspective of their use in the management of specific medical conditions such as diabetes and chronic obstructive pulmonary disease (5). The use of these technologies in modifying lifestyle factors that affect health such as smoking, and weight loss have also been demonstrated (1,5). There is also an emerging interest in the use of mHealth technologies in health promotion activities that distribute general health-related information to targeted populations. For example, recent studies in Asia have investigated the role of mobile phone instant messaging in promoting physical activity and smoking cessation programs (5,6) as well as the benefits for people with low-level awareness and use of technology. A recent study in Hong Kong (1) found that instant messaging showed great potential as a way to reach and impact upon the health behaviours of underserved groups who may have limited access to health promotion information and/or low literacy skills. The cost effectiveness of mHealth technologies such as instant messaging has been demonstrated but further research is needed (5) to understand more about its potential efficacy for older and underserved populations (7) as well as the patterns of uptake (1).

Older Hong Kong residents present with unique social and literacy needs that affect their ability to access health promotion information (1,8). In addition to facing the social and physical challenges commonly associated with ageing, older Hong Kong residents often live in densely populated high-rise buildings and are exposed to environmental factors such as air pollution and high summer temperatures which can influence ageing (9).

This paper reports the findings of a two-stage exploratory research project which examined the experiences and perceptions of Hong Kong residents aged over 60 years in relation to mHealth technologies and health literacy. Although people over 60 years of age make up a significant proportion of Hong Kong's population, a majority of research focusing on the health literacy of this group has been done with residents of hospitals or care homes. In contrast, we focused on people who resided in their own homes. The overarching research objective was to develop an empirically-based understanding of older people's experience of, and interest in, using digital devices to access health-related information. Supplementary research objectives related to exploring: (I) individual's access to, and experience, of using digital devices; (II) preferences and opinions about the different modalities of information presentation (i.e., digital versus print modalities); (III) awareness of the benefits of digital devices; and (IV) perceived challenges in relation to the use of digital devices. The topics of 'safety in the home' and 'good nutrition' were used in research activities for illustrative purposes. Data were collected through interviews, self-report surveys and group discussions. We present the following article in accordance with the MDAR reporting checklist (available at http://dx. doi. org/10. 21037/mhealth-20-123).

Methods

Research setting

This study collected data from older Hong Kong residents at a community centre (referred to as Centre A). Hong Kong has a well-developed network of community-based centres which are often partially funded by the government and/or charitable organisations. These centres offer a variety of services including community support and health education and are usually located within public housing complexes. Centre A was located within a housing complex built in the 1990s that consisted of 30 tower blocks housing approximately 30,000 residents. Centre A managers were approached by a member of the research team (AHYY) to be in the study.

The Ethics Review Board of The Hong Kong Polytechnic University (institutional ethics approval code:

HSEARS20190418002) approved the study and Centre A management gave their approval after documentation was reviewed. The study was conducted in accordance with the Declaration of Helsinki (as revised in 2013). Centre A kindly agreed to let the research team use centre-owned tablet computers (Apple iPads©) during research activities. All research materials and research activities were presented in Cantonese by native speakers and members of the research team (AHYY, MSYL, MYCC and WYWK).

Potential research participants received written and verbal information about the study from MSYL and MYCC and provided informed, written consent prior to participating. Research participants were advised they could withdraw from the study at any time and that the recordings of the interviews would be de-identified prior to transcription. No personal details of research participants were retained by the research team. At the conclusion of the research activities participants were given a selection of healthy foods such as noodles and fresh fruit (valued at less than US$5 per person) as a small token of thanks for their time and involvement.

Research participants

Centre A staff assisted with the recruitment of participants. Centre staff made people aware of the research opportunity and facilitated participation by giving reminders about attendance. Inclusion criteria for research participants were as follows:

(I)   Aged over 60 years (this age was chosen as since 2015 60 years of age has been the minimum retirement age for civil servants in Hong Kong, available online https://www.csb.gov.hk/english/admin/retirement/183.html);
(II)   Regular attendee at Centre A;
(III)   Able to give informed, written consent prior to participation in research activities;
(IV)   Hong Kong resident and native speaker of Cantonese.

Initial interviews were conducted by MSYL and MYCC in a small office at Centre A. The follow-up discussion groups were facilitated by MSYL, MYCC, AHYY and WYWK in a large meeting room also at Centre A.

Seventeen people participated in the research study and completed the initial interview. Fourteen participants attended at least two of the three follow-up discussion groups. Participants were aged between 62 and 97 years with a majority (eight) of the sample aged between 75 and 84 years. Educational and socio-economic information reported by participants reflected census statistics published by the Hong Kong government and thus the sample, although small, is reflective of this subpopulation in some of these demographic measures (9,10). Most participants reported finishing primary school education (although three people described themselves as participating in only preprimary or informal schooling) and all participants reported their monthly income as less than HK$10,000 (approximately US$1,275 per month) which falls within the low income bracket (11). Demographic details of research participants are presented in *Table 1*.

Data collection

Data were collected at two stages in July and August 2019. Stage one involved a one-on-one interview at Centre A with each research participant. During this interview demographic details were collected and brief self-report surveys were completed with the interviewers (MSYL and MYCC). The self-report surveys included seven questions about mobile phone ownership and a 16-item gerontechnology survey previously used in Hong Kong (8) that was adapted for use with our particular sample. These self-report measures were completed through discussion with the interviewers to support the participation of individuals with visual impairments and/or low literacy levels (12). Survey tools were translated from English to Cantonese by AHYY, MSYL and MYCC through a process of backward-forward translation until agreement was reached following conventions within qualitative research (13). Interviews lasted between 11 and 45 minutes.

Stage two of the data collection involved three discussion groups with the research participants that were run over a 3-week period. There were two to five participants in each group and discussions lasted between 20 and 30 minutes. The purpose of these discussion groups was to show the research participants a selection of Cantonese health promotion materials related to the topics of 'safety in the home' and 'good nutrition' in a variety of presentation modalities. Information was initially presented in a conventional format of posters and brochures with both text and pictures. Similar information was then shown in a selection of videos presented on iPads owned by Centre A. Discussion was structured around questions of:

(I)   Mode of presentation (written versus video formats).
(II)   Interest in using iPads to access this information.

Table 1 Demographics (n=17)

Domain	Number	Percentage (%)
Age		
60–64	2	12
65–74	3	18
75–84	8	47
>85	4	23
Gender		
Female	15	88
Male	2	12
Living arrangements		
With others	9	53
Alone	8	47
Education		
Informal/pre-primary	3	18
Primary	13	76
Secondary	1	6
Work status		
Retired	16	94
Never worked	1	6
Monthly household income		
< HKD$10,000	17	100

Previous employment: factory worker [3], farmer [3], food seller (hawker), restaurant worker, cleaner, lorry driver.

(III) Perception of skills and ability to access health related information in iPads and other mobile devices.

Data analysis

(Please note that all analysis was done on untranslated, Cantonese data. Illustrative examples have been translated into English in this article).

Responses to the three self-report survey tools were collated quantitatively and qualitatively. Results of the technology usage survey are presented in *Table 2*.

Discussion groups were audio-recorded when possible (due to occasional background noise and soft voices of the research participants this was not always possible). Researchers facilitating the focus groups took notes, reviewed audio files, transcribed recordings and integrated these sources to produce coherent data sets and the transcripts that were subsequently analysed. Illustrative extracts have been translated into English for publication.

Transcripts from the discussion groups were exported into PDF documents and then uploaded to Nvivo 11 Pro for manual coding. An inductive approached to data analysis was undertaken following Braun and Clarke's (14) seven step guide. Researchers read the transcripts several times and generated initial codes which were reviewed by the research team. The unit of analysis and coding was the utterance which was defined as the smallest unit of speech with a complete semantic meaning. While coding, we considered the context of the utterance to capture the speaker's purpose (15). The codes were then modified to avoid semantic overlap and to limit ambiguity. It is acknowledged that exclusiveness of codes is not possible in a strict sense since any utterance could be multi-functional and semantic meaning is often connotative. However, reliability and validity of coding is optimized by taking the context into consideration and focusing on the primary function of an utterance [for further discussion on context, thematic analysis and coding, see (14)]. As this was a qualitative and exploratory study the objective of data analysis was to reflect the research participants' experiences and opinions rather than to produce quantitative analysis. Based on kappa coefficient inter-rater reliability of the codes was high ($0.95 < K \leq 1$). Disagreements were discussed by the coders (YJ and MLT) and resolved. Refer to *Figure 1* for the Nvivo Node Tree generated through this analysis.

Results

Stage one: self-report surveys on mobile phone ownership and technology usage

Mobile phone ownership

One hundred percent of participants reported that they owned a mobile phone. Fifty percent of participants described their phone as a smart phone and said that they had received these as gifts from other people (usually family members). Ten people reported that they only use their mobile phone for making or receiving phone calls; four of these people said that they use apps on the phone such as WhatsApp or WeChat to communicate with others. Only one person said that he uses the phone to search for information on the Internet.

Table 2 Technology usage

Items	1 (never heard of or used the item), % [n]	2 (heard of but not used the item), % [n]	3 (have used the item in the last 12 months), % [n]
Items used in the home and daily activities (shopping, transport)			
Cooking devices	0	12% [2]	88% [15]
Remote controls	0	12% [2]	88% [15]
Credit cards for purchasing items	18% [3]	76% [13]	6% [1]
Cash withdrawal machines and services	12% [2]	70% [12]	18% [3]
Octopus card (the Hong Kong transport smartcard)	0	0	100% [17]
Communication items			
Mobile phones	0	0	100% [17]
Email	29% [5]	71% [12]	0
Computers or internet	0	76% [13]	24% [4]
Health related items			
Exercise equipment	0	47% [8]	53% [9]
Telecare services for interaction with doctors or nurses	25% [4]	12% [2]	63% [10]
Electronic devices for measuring blood sugar or blood pressure	0	6% [1]	94% [16]
Personal security devices (e.g., alarms, help buttons)	0	53% [9]	47% [8]
Recreational activities			
Dictionaries	47% [8]	53% [9]	0
Items for playing movies or television programs	12% [2]	82% [14]	6% [1]
Music players	12% [2]	82% [14]	6% [1]
Digital cameras	0	59% [10]	41% [7]

Technology usage

Drawing on the previous work of Chen and Chan (8) and adapting it for our particular research participants, we investigated people's familiarity and/or reported use of different electronic devices in the previous 12 months. Items are categorized in to groupings of those associated with the home and activities of daily living such as shopping and transport, communication, health and educational/recreational technology (8). Research participant responses are detailed in *Table 2*.

Stage two: discussion groups

After coding the transcripts from the discussion groups, four broad themes were identified. As shown in *Figure 1*, these broad themes (level one codes—bold, underlined)

were further analysed into level two (italicized in *Figure 1*) and level three sub-themes. Level two and level three codes and their translated example quotes are shown in *Table 3*.

Broad level one themes related to the following:

(I) iPad use;
(II) Conventional source (i.e., presentation of health-related information in print format);
(III) Phone use;
(IV) Video instructions (i.e., presentation of health-related information in video format using an iPad).

Discussion

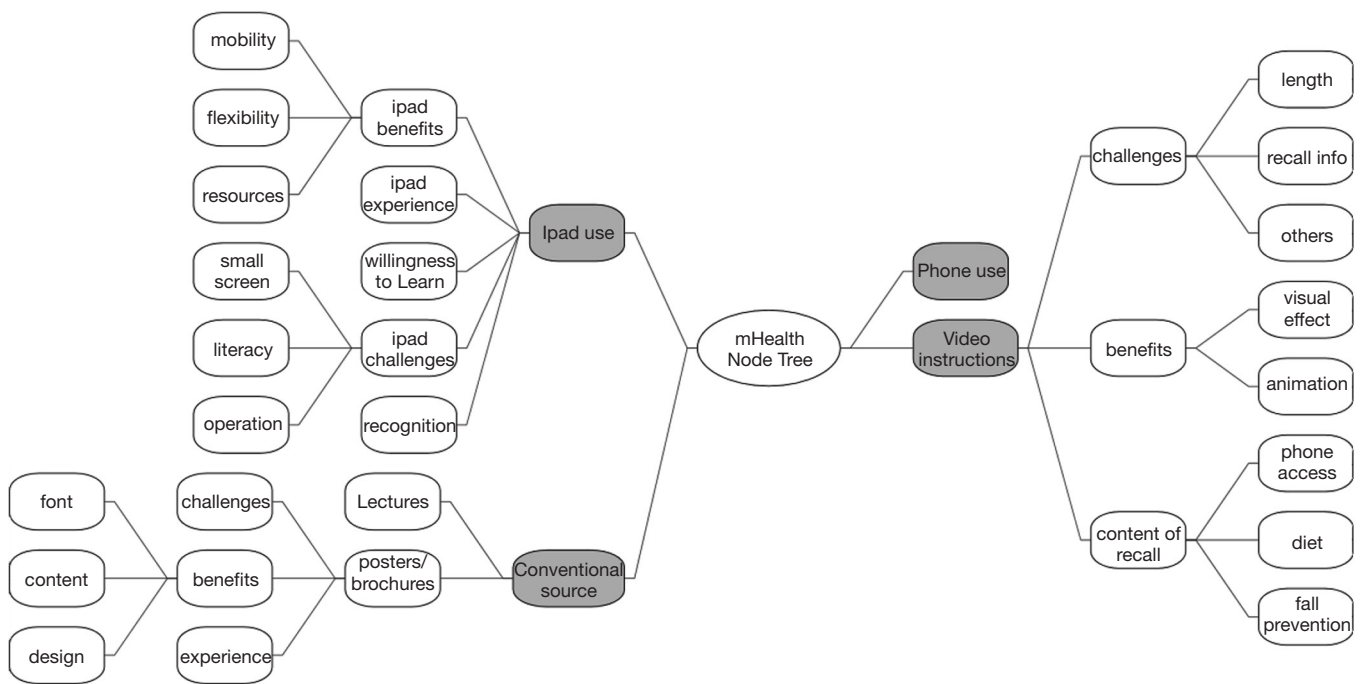Results from the stage one self-report surveys indicate a

Figure 1 Node tree.

pattern of mobile phone ownership and usage that has been reported elsewhere (1,8). These patterns imply that these research participants owned mobile phones and primarily used the device for communication purposes such as making and receiving calls. It is interesting to note that all smart phones were given to these participants as gifts. In relation to technology usage, they were most familiar with items that were part of their everyday life such as transport smart cards, cooking and household items and mobile phones. Participants also had a high level of familiarity with medical devices used for measuring blood sugar and blood pressure. These devices are often available for health monitoring in community centres.

Themes from discussion group analysis indicate certain patterns and attitudes towards the different presentation modalities of health promotion information that can influence development of resources in future work. Key themes were grouped around: access to and experience of using mobile devices; preferences in relation to presentation of information; awareness of benefits of mobile devices, and challenges associated with using these devices. Each theme is discussed in detail below. (In the following extracts from the discussion groups FP stands for female participant and MP stands for male participant).

Access to and experience of using mobile digital devices (subthemes: phone use, tablet experience, tablet recognition)

Research participants indicated that they had access to digital devices in the form of smart phones and/or iPads either at home or at Centre A. Individuals described these devices being primarily used for entertainment (e.g., playing games) and for basic communication such as making and receiving calls. Limited comments referred to using messaging services such as WhatsApp. For example:

Researcher: Do you have a smart phone?/Have any of you used these iPads before?

FP3: I only use it for making and receiving calls.

FP1&2: I use it for playing games.

MP1: I watch football games with it. (Referring to the iPad).

Two people said they did not recognize the digital devices (iPads) which may indicate a lack of experience or exposure to the technology.

These responses correlate with findings of other research into the use of mobile technologies by older people in Hong Kong and elsewhere (refer to previous discussion). That is, they may own or possess a device like a smart phone but not use its additional capacities. It is of note that a majority of the research participants who owned a smart phone said it

Table 3 Illustrative quotes associated with codes

Level 2 codes/sub-themes	Level 3 codes	Quotes
iPad benefits	Mobility	For iPad, you can move it around and watch it wherever you want
	Flexibility	For iPad, you can select whatever you want by pressing any buttons on the screen
	Resources	I know we can use iPad to surf the Internet and watch videos. I watch videos about cooking and doing exercises
Willingness to learn	–	I would like to learn using iPad. I will know how to use it after learning it
iPad experience	–	I watch football games with it
iPad challenges	Small screen	The screen on the TVs are bigger. Once you press a button, everything will be shown clearly
	Literacy	Only people who know how to read and write can use iPad. But I don't know
	Operation	I don't know how to use it
iPad recognition	–	Computer? (when I asked them if they know what this gadget is)
Lectures	–	when someone comes to the centre to give a talk, I will attend it with others
Posters	Benefits	The font size is big and clear enough
	challenges	Posters are less interesting and the font size is too small
	Experience	Yes, I will attend the workshop in the centre whenever there is one
Video instruction benefits	Visual effect	It would be clearer if there are more contrasting colours in the video
	Animation	I like it! I can watch and listen to the video
Video instruction challenges	Length	it would be great if the video could be shorter as it is quite demanding for the elderly to listen for that long period of time
	Recall info	I forgot what the video has said
	Others	I could understand better when you explain the video
Video instruction Content	Phone access	always keep the phone close to us
	Diet	less salt, less oil and less sugar
	Fall prevention	We need to hold on to the handrails when we go up and down the stairs

has been given to them as a gift by family members.

Presentation of health-related information: preferences of conventional or digital formats (subthemes: video instructions benefits/challenges, conventional source benefits/challenges)

Preferences about the types of health information resources varied among our participants. While digital devices are accessible, conventional resources of health information such as lectures, brochures, and posters are still more commonly used and provided to the participants. A majority of respondents said that they access health related information through workshops held at the centre and that these include distribution of written material. While some

people were satisfied with receiving information in that way, others with lower literacy levels, poor memory skills and/or visual impairments felt that videos presented on the iPads were easier to understand and promoted a more in-depth understanding of the content presented. Auditory and visual input (as in listening and watching a video) can promote multi-modal learning. For example:

Researcher: Posters are different to videos. What sort of differences can you see? Do you like this video?

Everyone: There are some demonstrations in those short clips.

FP5: There are vivid scenes, so I can follow the videos to do the exercise. But I find booklet difficult to follow as there're only pictures in it. Watching videos makes me easier to remember the health information and learn it

more deeply.

FP2: Posters are less interesting and the font size is too small.

It is noteworthy that the people who commented on the strengths of the information presented in brochures and posters highlighted the importance of accessibility of the font size, colour and the picture-assisted design of the materials:

Researcher: What do you think about getting information about your health in posters, brochures, etc.

FP4: It's easier to read when the words are of different colours and the font size is bigger

FP5: The content is easy to understand, with attractive colours and clear fonts.

FP2: The pictures help us understand the content.

Awareness of the benefits of digital devices (subtheme: benefits of the mobile device)

Participants perceived digital devices to be convenient in terms of mobility, flexibility, and diversity of resources. Many participants expressed their appreciation of the freedom to select sources or content online rather than being predetermined as in the conventional resources:

Researcher: Do you think using an iPad is different from watching TV?

FP6: iPad We have more freedoms in iPad. We can choose to watch whatever we like.

FP7: The programs on TV were predetermined, but with iPad, I can do whatever I want.

Some participants also like the fact that gadgets such as phones and iPads are portable and thus allow them to move around and watch programs wherever they want.

Challenges of using digital devices (subthemes: device challenges, willingness to learn)

Some participants indicated that they felt they lacked the underlying skills and abilities to operate and use the digital devices effectively. For example:

Researcher: Do you have a smart phone? Do you want to use iPads? What do you think about using iPads to learn about health-related information? What do you think you need to know to use an iPad?

FP3: I don't know how to use it.

FP8: With an iPad, you can choose whatever you like to watch but just that I don't know how to switch it on.

Research participants often said in both discussion groups and survey responses that either centre staff or younger family members taught them how to use digital devices. While tutorials on how the use devices were provided in the community centre, these reportedly had a long interval between sessions. This interval was not helpful for those with memory difficulties. Learning from family members tended to focus on using smart phones for making and receiving calls. This is illustrated in the examples below:

Researcher: Do you own a smart phone? Do you know how to use iPads? Has anyone taught you how to use?

FP 1: The staff in the center has taught us how to use it, but I don't think the classes were run for more than once in a month.

FP3: My children gave their old smartphone to me and I only use it for calling. They don't teach me how to use the other functions.

Small screens and general literacy emerged as other concerns in addition to operating and using digital devices. For example, some participants raised the point that people need to be minimally literate to use the tablet computers. Furthermore, the screen was considered to be much smaller than conventional sources such as the television.

Some participants demonstrated interest and initiative in learning how to access health information via digital devices while others declined. For those who were willing to learn, their concern was mainly their cognitive abilities and their access to people who could assist them in learning the requisite skills.

Researcher: What do you think about using iPads to learn about health-related information?

FP8: I want to use iPads to learn about health-related information. But we don't know how to use it. It'd be great if somebody could teach us.

The data and analysis described in this article can be summarized in the following key messages:

(I)   Providing health information via digital devices is considered as promising and acceptable by most of our participants;

(II)   Major concerns that impeded the elders' use of digital devices are their lack of the necessary skills to use these gadgets and their loss of memory;

(III)   Many participants stated their concern that they found it difficult to recall information immediately after being taught;

(IV)   Most participants had problems in reading either because that they have low literacy levels or some age-related eye-diseases;

(V)   Video instructions are preferred by participants

as the audio and visual input is more useful than static written information with heavy reading requirements;

(VI) Digital health promotion materials may be most effective in terms of impacting on lifestyle choices if they are combined with written information and repeated teaching by other people;

(VII) Owing to age-related loss of memory among the elders, personalized care and teaching that allows for the consolidation of new knowledge should be provided to remind the elders about what has been taught and to improve their confidence in accessing information via technologies;

(VIII) Some participants were keen to be active learners of such 'new' skills and to access these digital sources;

(IX) Awareness of the convenience of accessing digital health information (e.g., access to animated instructions) and the mobility and flexibility of phones and tablet computers increased their motivation to learn how to use these devices.

Conclusions

In this study, research participants responded to the potential use of digital devices in accessing health related information with interest but raised concerns related to their perceived skills and abilities to use the digital devices. All participants had access to digital devices either in terms of smart phones or through the tablet computers available at the elderly centre. Most individuals reported having had some instructions on how to use these devices but did not necessarily utilize these skills independently. That is, people have access to devices and the potential to develop skills in their use, but there remains a reluctance to utilize the devices in ways that can enhance health literacy. This is significant when looking at how mHealth can be used to improve the health literacy of underserved populations. This is particularly relevant to older people who may have variable literacy levels as well as declining visual and cognitive skills. These particular subpopulations would benefit from learning about the more intuitive nature of digital devices (compared to desk top computers for example) as well as being made aware of how visual and auditory supports can be utilized to address literacy, visual and cognitive difficulties. Access to training in how to use mobile devices may be an important learning opportunity for many older people who have easy access to digital devices. Future research could examine if combining such skill development with exposure to health-related information offers unique opportunities for novel cognitive engagement and continued learning. It is also important to note that as many community-based centres in Hong Kong and elsewhere have easy access to digital devices, the development of health promotion materials that can be used through those devices is timely. These findings correlate with studies undertaken in other regions which have also highlighted the potential of mHealth technologies but emphasized the need to consider person-related and contextual barriers affecting older people's use of these devices (16,17).

There are several limitations associated with this study. Firstly, our findings were not analysed by age group but were rather collected from people aged between 62 and 97 and thus encompass a wide age range and diverse life experiences. Secondly, the findings from this small-scale exploratory study cannot be generalized to a larger population group. These limitations, however, do not detract from the significance of the findings. As in many regions, older people in low socio-economic groups are rarely engaged in academic research and thus their views and experiences continue to be under-represented within the literature. Engaging with underserved populations is important in capturing their views and experiences in relation to the development and use of mHealth technologies. Future research into the use of mHealth technologies by residents in care homes and other institutions would give further insights into the needs of this population.

Footnote

Reporting Checklist: The authors have completed the MDAR reporting checklist. Available at http://dx. doi. org/10. 21037/mhealth-20-123

Data Sharing Statement: Available at http://dx. doi. org/10. 21037/mhealth-20-123

Conflicts of Interest: All authors have completed the ICMJE uniform disclosure form (available at http://dx. doi. org/10. 21037/mhealth-20-123). The authors have no conflicts of interest to declare.

Ethical Statement: The authors are accountable for all aspects of the work in ensuring that questions related to the accuracy or integrity of any part of the work are appropriately investigated and resolved. The study was conducted in accordance with the Declaration of Helsinki (as revised in 2013). The study was approved by institutional ethics board of The Hong Kong Polytechnic University (ethics approval code: HSEARS20190418002) and informed consent was taken from all the participants.

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