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BMJ Open Needs and views on healthy lifestyles for the prevention of dementia and the potential role for mobile health (mHealth) interventions in China: a qualitative study

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ABSTRACT

Objectives Over the coming decades, China is expected to face the largest worldwide increase in dementia incidence. Mobile health (mHealth) may improve the accessibility of dementia prevention strategies, targeting lifestyle-related risk factors. Our aim is to explore the needs and views of Chinese older adults regarding healthy lifestyles to prevent cardiovascular disease (CVD) and dementia through mHealth, supporting the Prevention of Dementia using Mobile Phone Applications (PRODEMOS) study.

Design Qualitative semi-structured interview study, using thematic analysis.

Setting Primary and secondary care in Beijing and Tai'an, China.

Participants Older adults aged 55 and over without dementia with an increased dementia risk, possessing a smartphone. Participants were recruited through seven hospitals participating in the PRODEMOS study, purposively sampled on age, sex, living area and history of CVD and diabetes.

Results We performed 26 interviews with participants aged 55–86 years. Three main themes were identified: valuing a healthy lifestyle, sociocultural expectations and need for guidance. First, following a healthy lifestyle was generally deemed important. In addition to generic healthy behaviours, participants regarded certain specific Chinese lifestyle practices as important to prevent disease. Second, the sociocultural context played a crucial role, as an important motive to avoid disease was to limit the care burden put on family members. However, time-consuming family obligations and other social values could also impede healthy behaviours such as regular physical activity. Finally, there seemed to be a need for reliable and personalised lifestyle advice and for guidance from a health professional.

Conclusions The Chinese older adults included in this study highly value a healthy lifestyle. They express a need for personalised lifestyle support in order to adopt

STRENGTHS AND LIMITATIONS OF THIS STUDY

- ⇒ This qualitative study builds on previous interview and focus group studies evaluating use of digital self-management applications and remote lifestyle coaching.
- ⇒ Through purposive sampling on medical history, living situation and educational level, we were able to provide an extensive overview of the potential attitudes, needs and preferences of Chinese older adults on healthy lifestyles to prevent dementia.
- ⇒ The scope of our study may be limited to urban Chinese older adults, as participants were largely recruited in the Beijing and Tai'an urban areas.

healthy behaviours. Potentially, the PRODEMOS mHealth intervention can meet these needs through blended lifestyle support to improve risk factors for dementia and CVD.

Trial registration number ISRCTN15986016; Pre-results.

INTRODUCTION

China has the largest population of people with dementia worldwide. The rapidly increasing incidence of dementia is expected to seriously challenge the Chinese public and healthcare system in the coming decades.^{1–3} Observational studies have shown an association of lifestyle-related risk factors with dementia in people aged 65 and over.⁴ An estimated 40% of dementia cases might be attributable to these risk factors,⁵ suggesting the potential to delay or even prevent dementia if these risk factors are successfully addressed.

For successful implementation in China, including its underserved rural areas, such

dementia prevention interventions should be inexpensive and easily accessible. Digital health interventions may meet these criteria, given the wide and increasing availability of internet.^{6,7} As in China, the internet is most frequently accessed through smartphones,⁸ digital health interventions offered as mobile health (mHealth) may be most feasible. The Prevention of Dementia using Mobile Phone Applications (PRODEMOS) study will assess the effectiveness and implementation of a coach-supported mHealth intervention to reduce overall dementia risk in older people in the United Kingdom (UK) and Beijing, China.⁹ The development of this application builds on the internet platform used in the Healthy Ageing Through Internet Counselling in the Elderly (HATICE) trial, which recently demonstrated that a coach-supported internet intervention leads to a modest improvement of cardiovascular risk profile of older adults in three European countries.¹⁰ For PRODEMOS, the mHealth intervention will be adjusted according to the needs and wishes from the target population.

Despite a growing interest in risk factor management through mHealth, little is known about needs and views of Chinese older adults regarding lifestyle behaviour change and the potential role of mHealth. With the steep increase in unhealthy lifestyles, dementia and cardiovascular disease (CVD)-related mortality in China, this has become an urgent, national priority.^{11,12} In the current study, we aim to explore the knowledge, experiences, attitudes, needs and views of Chinese older adults regarding healthy lifestyles for the prevention of dementia and CVD through mHealth. The results of this study will facilitate development and cultural adaptation of the PRODEMOS intervention.

METHODS

PRODEMOS trial

The current qualitative study is part of the PRODEMOS randomised controlled trial (RCT). The PRODEMOS RCT aims to include 1200 older adults both in the UK and in China, with an increased dementia risk. Participants are randomised between a coach-supported mHealth intervention and care-as-usual. Main functionalities of the intervention app are similar to the HATICE platform (ie, setting lifestyle goals, entering measurements, receiving coach support through the chat functionality and receiving interactive education). Dementia risk and implementation outcomes are assessed after 18 months.⁹

Participants

For this qualitative study, participants were recruited through a phone call or WeChat (a common Chinese social media platform) by doctors or village leaders within the catchment areas of seven Chinese hospitals participating in the PRODEMOS study. Centres varied regarding type of care offered (general vs specialist) and location (Beijing, urban Tai'an and rural Tai'an area). Eligibility criteria were largely similar to the PRODEMOS

study protocol: aged 55+, possession of a smartphone, non-demented and with increased risk of dementia. Increased dementia risk was defined as ≥ 2 dementia risk factors, that is, history of CVD or diabetes, hypertension, obesity, dyslipidaemia, depression, insufficient physical activity and active smoking.⁸ Participants were recruited based on their medical records, or when they visited the hospital for their regular medication prescription and were purposively sampled on age, sex, living area, history of CVD and diabetes and educational level. Of 26 out of 35 invited individuals were willing to participate in the study. Written informed consent was obtained before the start of each interview. The ethic committee of the Capital Medical University (CMU), Beijing approved the study.

Data collection

Between February and December 2019, we performed semistructured interviews in sets of 3–6 interviews. An interview guide (online supplemental file 1) was composed by researchers from CMU, Edith Cowan University and Amsterdam UMC. It included questions about knowledge, experience, attitudes, needs and views regarding healthy behaviours in general, their potential role in the prevention of dementia and CVD and the perceived window of opportunity for mHealth and coach support. Every interview was preceded by a short introduction on the PRODEMOS study. If deemed necessary, we made adjustments to the interview guide after each set of interviews (eg, adding questions about Traditional Chinese Medicine (TCM) and the preferred background of the coach). Nine researchers (JZ, XL, BJ, HL, WZ, JL, YN, YY and XX) performed the interviews. XL is a professor in general medicine and has broad experience with qualitative research. BJ, HL, WZ, JL, YN, YY and XX are medical doctors and received training in qualitative research from EPMvC. To minimise between-interviewer variation, interviewers were asked to adhere to the interview guide as much as possible. The principal researcher (JZ, PhD student) attended all interviews to make field notes and to ensure that all topics of the interview guide were sufficiently discussed. EE attended six and EPMvC attended four interviews in person, with live translations into English by a professional translator. The interviews took place in the participating centres, local community venues or at the participant's house. The interviews lasted 35–90 min were audio-recorded, and transcribed verbatim. Data collection was finished once data saturation had been reached.

Coding and analysis

Thematic analysis was performed by five researchers (JZ, XZ, MS, EPMvC and EE) following the six phases as described by Braun and Clarke.¹³

1. Transcripts were translated into English and shared with the Amsterdam UMC researchers. After each set of interviews, transcripts were thoroughly read by the researchers in their own language. JZ, MS and EE discussed all transcripts. A licensed translator attended

- to make sure that all transcripts were fully understood and appropriately translated.
- Initial coding was performed by two researchers from CMU (JZ and XZ) independently using the MaxQDA software for qualitative research. After coding each set of interviews, codes were compared and discussed until disagreements were resolved, resulting in a new set of codes. EPMvC and EE reviewed the coding of each interview during video meetings with JZ, MS, XZ and the licensed translator. A Dutch medical doctor with extensive knowledge of the Chinese culture and language (RT) was involved in interpretation of the findings.
 - After initial coding of all interviews, researchers from CMU and Amsterdam UMC independently searched for potential themes. Potential themes and their inter-relationship were discussed during several online video meetings and a face-to-face meeting in Beijing.
 - Potential themes were reviewed and organised into thematic maps. The licensed translator attended the online discussions to verify consistency with the original meaning of the texts. All transcripts were re-read by JZ and EE to ensure that the themes were a good representation of the data.
 - Narratives were written for each theme by JZ and EE independently. The narratives were discussed with EPMvC and MS. The names and arrangement of themes and subthemes were refined accordingly.
 - Illustrative examples were selected by JZ and EE, and were translated into English by the licensed translator.

RESULTS

We performed 26 semistructured interviews. Participants were aged 55–86. Demographics and medical history of the participants are presented in [table 1](#).

We identified three key themes: ‘valuing a healthy lifestyle’, ‘sociocultural expectations’ and ‘need for guidance’. The themes and subthemes are listed in [table 2](#).

Valuing a healthy lifestyle

Why it is important to live a healthy lifestyle

Many participants stressed that a healthy lifestyle is important, emphasising the relationship between a healthy lifestyle and CVD. Some interviewees felt that living healthily could reduce the risk of future dementia. Physical activity, a healthy diet and refraining from smoking or drinking alcohol were considered healthy behaviours.

I think the reason why my elder brothers passed away so early is that they smoked and did not exercise. [...] Only now I realise that it’s not healthy to stay up late and do no exercise. Maybe they didn’t realise it at that time (Participant no. 9).

Table 1 Sociodemographic characteristics and medical history of included participants

Characteristic		N=26
Age (year)	Median (range)	64(55–86)
Sex (female)	N (%)	13 (50)
Retired (yes)	N (%)	17 (65)
History of CVD (yes)	N (%)	9 (35)
History of diabetes (yes)	N (%)	13 (50)
Education level*		
<i>Primary school and below</i>		1 (4)
<i>Junior high school</i>	N (%)	8 (31)
<i>Senior high school</i>		9 (35)
<i>College and above</i>		8 (31)
Living situation		
<i>With spouse only</i>	N (%)	9 (35)
<i>With spouse+other family</i>		15 (58)
<i>Alone</i>		2 (8)
Number of risk factors†		
<i>1 or 2</i>	N (%)	8 (31)
<i>3</i>		12 (46)
<i>4 or more</i>		6 (23)
Region		
<i>Beijing</i>	N (%)	21 (81)
<i>Urban Tai’an‡</i>		2 (8)
<i>Rural Tai’an</i>		3 (12)

*Primary school, ISCED level of 1; junior high school, ISCED level of 2; senior high school, ISCED level of 3; college and above, ISCED level of >4.
 †Risk factors include diabetes mellitus, insufficient physical activity according to WHO criteria, active smoking, hypertension, dyslipidaemia, obesity and depression.
 ‡City in Shandong province with 5.5 million inhabitants.
 CVD, cardiovascular disease; ISCED, International Standard Classification of Education.

Some participants mentioned more specific, Chinese healthy behaviours, including taking footbaths, spinning walnuts and having a balanced temperament.

It is said that spinning walnuts can activate blood vessels. I reckon it’s good for preventing cerebrovascular diseases (Participant no. 16).

Table 2 Key themes and subthemes

1. Valuing a healthy lifestyle
Why it is important to live a healthy lifestyle
Experiences on improving lifestyle behaviour change
The role of Traditional Chinese Medicine
2. Sociocultural expectations
3. Need for guidance
Finding reliable, useful information
Need for a tailored health plan and personalised support

Some participants mentioned that, at older age, a healthy lifestyle becomes less important, because disease may already have developed.

I often drink alcohol, eat meat and sometimes pickled vegetables. I think these are not so good, but I feel I found out too late. The underlying diseases already developed (Participant no. 4).

Other participants mentioned that health is largely determined by destiny or genetic predisposition rather than by lifestyle behaviours.

I don't know [about risk factors for dementia]. But sometimes it is your fate to get sick, this has to do with genes (Participant no. 16).

Experiences on improving lifestyle behaviour

All participants had experience with lifestyle behaviour change, often triggered when a participant experienced illness. Confrontation with diseases, such as CVD or diabetes, could be a motivator to quit smoking or make changes to their diet. Also, the disease or death of a close friend or relative could be a trigger to change behaviour.

I quit smoking after I got sick. [...] I quit smoking straight after I had a myocardial infarction (Participant no. 10).

A friend from the past has cancer, which is a huge alert for us [to smoke or drink less alcohol] (Participant no. 11).

Some participants started to change their behaviour after they found out about abnormal values during regular health check-ups, for example, for blood pressure and cholesterol.

There was a time when my blood pressure was really high [...]. Then I quit smoking and started drinking less alcohol (Participant no. 15).

The role of TCM

Some participants used TCM to stay healthy, such as acupuncture and Tai Chi. Such activities could go hand-in-hand with other lifestyle changes, such as changes in diet. Moreover, some participants mentioned that they used medicinal TCM to stay healthy, although most participants mentioned use of medicinal TCM to treat rather than prevent disease. Some participants did not use medicinal TCM because, in their experience, the effect of TCM comes too slow.

I practiced Tai Chi, and now we also practice Yi Jin Gong and Ba Duan Jin every morning. Since my father is in his eighties, it's more suitable for him to do this kind of low-intensity exercise. I do the same exercise together with him (Participant no. 25).

I don't use traditional Chinese medicine very often because it works too slowly. When my blood pressure is high, the effect will be too slow after taking it. The

problem of high blood pressure cannot be solved by traditional Chinese medicine (Participant no. 24).

Sociocultural expectations

Participants mentioned that support from their family and friends can be helpful to start or maintain healthy behaviours. For some, the social environment was the drive to change behaviour, as they tried to quit smoking or drinking because others urged them to do so.

There is no need to be told by others because I know how to do this [a healthy lifestyle], but I don't want to do it. However, I'm especially willing to do it when my children say it once in a while (Participant no. 10).

Similarly, family members could take the lead in lifestyle support, for example, by cooking and eating healthier food for the sake of the spouse's health.

Previously, I cooked whatever he liked to eat, [...] but since he suffered from myocardial infarction, I cook with the principle of less meat, less fat and less salt (Participant no. 20).

Participants mentioned that engaging in change together can facilitate behaviour change. Some participants went walking or square dancing together with friends, family members or people living in the same neighbourhood and reminded each other of the intended behaviour. Drinking or smoking behaviour could also be influenced by the social environment, although sometimes in a more unconscious way.

[...] we live in the company dormitory in which there are more than 200 households. We often make an appointment to walk together. It really works (Participant no. 19).

I think it has a lot to do with the crowd. It helps if you're dealing with people who are willing to change. If there are four people, of whom three of us don't smoke and only I smoke, then I will smoke less, but if everyone does, I will smoke more. [...] Others certainly influence me (Participant no. 11).

Also, the *digital* social network could be of support. Almost all participants had experiences with use of one or more lifestyle-related miniprogrammes (comparable to apps) offered by WeChat. Examples of such programmes are platforms for health-related knowledge exchange and lifestyle groups where peers can support each other to live healthily. For some participants, comparing their own results (ie, number of steps), with the results of others, could serve as an impetus to further increase their efforts.

I think one of the best things about my participation in this weight loss program is that there is a WeChat Group. Especially when I just joined, it was also a stimulant for me to see others exercise in the group (Participant no. 25).

My son enables WeChat Sports for me. [...] When it is time, I will go out for a walk. After the walk, I will

compare my steps with others. It is like a task, it motivates me (Participant no. 6).

Many interviewees had important family responsibilities, such as taking care of their grandchildren or their ill or disabled spouse and/or parents. The need to take care of others was often a motive to stay healthy, as participants feared to burden others with these care tasks or become a burden to others if they themselves would develop disease. Apart from being a motive, time-consuming family responsibilities were sometimes a barrier for healthy behaviours, such as physical activity.

If we are in good health, the burden on our children will be less. Otherwise, [...] our children's burden will increase (Participant no. 6).

It feels like I'm spending too much time taking care of my family, and then neglect my own health. I feel the family burden is too heavy. (Participant no. 4).

Some participants experienced conflicts between the choice for improved lifestyle behaviours and meeting social expectations, as participants seemed to associate smoking and drinking alcohol with hospitality. Participants mentioned difficulties to forbid guests to smoke in the house, leading to secondary smoking, especially when guests were not part of the inner social circle. Moreover, some participants were inclined to accept cigarettes or drinks, as a courtesy, when offered by others.

It annoys us if guests smoke in our house, my husband says not to let them come in our house in the future. But once the guests have arrived, how can we say that they cannot come? (Participant no. 5).

[...] if my son-in-law comes over, I won't tell him not to smoke here. I can persuade my son and daughter, but not my son-in-law (Participant no. 9).

Need for guidance

Finding reliable, useful information

Most participants were willing to improve their lifestyle behaviour but did not know how to achieve this all by themselves. Most interviewees obtained their health information from TV or WeChat, yet often questioned its general reliability and applicability to their personal (health) situation.

I just think there's too much information on Baidu [Chinese search engine, comparable to Google], sometimes it's not all correct and sometimes it doesn't fit my disease condition (Participant no. 20).

Participants expressed a need for comprehensive information about the CVD risk factors or diseases they suffered from and personalised advice on how to improve these conditions.

I need guidance from others. It should be based on my actual situation, instead of just telling me how to do, which may be harmful to me. I hope it will be a

personalised guidance focusing on me (Participant no. 3).

Need for a tailored health plan and personalised support

Participants called for a health plan suited to their needs and abilities. Such a plan would need to be quite clear cut, for example, about what, when and how much one should eat in their specific situation.

[I need information] for example, how to do exercise; when and how long do I need to sleep? In terms of meals, it should be specific: what to eat, what I can eat and the most important is how much to eat, requiring a refined recipe (Participant no. 24).

On the other hand, some participants mentioned that guidance should not be too strict because making too major changes at once would be unrealistic.

Other people can give me advice. I'll follow it if I think it works, but it should not be too strict. For example, if you tell me I can't eat meat for a week, I can't do that (Participant no. 22).

Ideally, lifestyle advice should be given by a health professional best qualified for this task. Some participants felt that this was best done by doctors, given their expertise on the complex interplay of disease, medication and lifestyle behaviours. However, many interviewees realised that doctors often lack the time to provide intensive lifestyle support. Some felt that nurses could take on the role of competent lifestyle coaches, provided that they would be supervised by doctors.

I think nurses may be less professional, but provide better service. Nurses may be more patient in communicating with others, but less knowledgeable than doctors (Participant no. 23).

If nurses are unable to answer questions, I believe [...] doctors can provide guidance. Moreover, you don't have to answer me in real time, just give me guidance after your discussion (Participant no. 19).

DISCUSSION

Summary of main findings

In this study on perspectives regarding healthy lifestyles to reduce dementia and cardiovascular risk among Chinese older adults, we identified three main themes. First, following a healthy lifestyle was generally regarded important. In addition to generic healthy behaviours, participants considered certain specific Chinese behaviours healthy, including tai chi, and acupuncture. Second, sociocultural context played an important role in lifestyle behaviour change. The main motive to stay healthy was to limit the burden put on family members, because, by Chinese tradition, children often take care of their elderly parents and (retired) parents take care of grandchildren. However, family responsibilities may also impede healthy behaviour such as regular physical



activity. Moreover, other Chinese social values, such as being hospitable to guests by allowing them to adhere to smoking and drinking habits, sometimes conflicted with own intended health behaviours. Third, participants often regarded information on TV and WeChat as too generic or incorrect. There seemed to be a need for reliable and personalised lifestyle advice and guidance from a health professional.

Comparison with the existing literature

The interviewees appeared well aware of the relationship between lifestyle and chronic disease risk. This finding is in contrast with a survey performed in 2013 among 925 elderly living in Jinan, China, suggesting that participants had limited knowledge on and awareness of the relationship between lifestyle behaviour and chronic disease risk.¹⁴ Moreover, comparable studies on health literacy in general showed lower rates among people of higher age groups.^{15 16} Since we specifically aimed for participants with known vascular risk factors, this may have led to selection of people with increased awareness for (secondary) disease prevention, as was also found in a cross-sectional study comparing 46 000 Chinese people with and without CVD.¹⁷ Another explanation may be that, in recent years, prevention of dementia and CVD has become central to the agenda of Chinese policymakers. The 2008 healthcare reform has strongly focused on improving preventive healthcare and health education,^{18 19} for example, through large-scale health promotion through TV programmes and several public health strategies to discourage cigarette smoking and reduce salt intake in larger cities such as Beijing.^{7 20} This increased public attention may have contributed to interviewees' awareness of healthy lifestyles in the prevention of diseases.

Our interviewees indicated that being accommodating to guests sometimes conflicted with their own healthy behaviours. This finding is in accordance with results from a focus group study in Beijing, where adults (30+) believed that smoking and drinking alcohol were necessary to earn respect from their guests.²¹ In the Chinese culture, drinking alcohol—traditionally as an important part of special celebrations and festivals—and sharing tobaccos are common ways to show respect, especially in rural areas.^{22 23} China's most recent national health policy²⁴ focuses especially on promotion and popularisation of healthy lifestyles. Perhaps, with continuous public attention, and alcohol and tobacco control strategies that take cultural aspects into account, healthy behaviours will more and more become part of Chinese sociocultural habits, starting in younger and urban communities.²⁴

Our participants expressed a need for professional guidance, which is in accordance with a previous qualitative study among Chinese rural adults. They were highly motivated to change their behaviour but were unable to succeed without professional support.²¹ In China, many health-related information is available on Chinese internet. However, the needs of end users are not always

met, as they find it difficult to judge the validity of health information on the internet.²⁵ Moreover, existing apps often lack personalised and professional guidance.^{26 27} China has approximately two doctors per 1000 inhabitants, compared with 3.6 in the European Union.^{21 28} Although our interviewees often considered doctors most qualified for lifestyle support based on their expertise, some realise that doctors may lack the time to meet their needs. For many participants, lifestyle support given by a nurse or other healthcare professional would, therefore be acceptable, especially when supervised by a doctor.

Strengths and limitations

A strength of our study is our purposive sample with participants who differ regarding their CVD history, living situation and education level. This approach gave us an extensive overview of the potential attitudes, needs and wishes of Chinese older adults living in the Greater Beijing area. We were able to build on previous qualitative research experiences on evaluating lifestyle coaching and use of digital self-management applications in Europe.^{29–32} In order to overcome cultural and language barriers, a licensed interpreter was involved in the translations of all interview transcripts and multiple in-depth discussions of our (preliminary) findings with the Chinese partners and other experts in Chinese culture and language. Furthermore, the interview guide was aimed at discussing examples from daily experiences to limit the chance of socially desirable answers. We followed the consolidated criteria for reporting qualitative research guidelines to improve the interpretation and reproducibility of our results.³³

A limitation of our study is that most of our interviewees lived in the urban Beijing area. This limits our scope to urban older adults, where there are considerable differences between urban and rural areas in China regarding healthcare and awareness for disease prevention.^{19 34 35} Another potential limitation is that some interviewees and interviewees had a doctor–patient relationship. This may occasionally have led to selective questions or socially desirable answers. We have deliberately decided on this approach, because, in Chinese culture, private issues, including lifestyle behaviours, are most easily discussed with people who are well trusted. An independent researcher was present at all interviews to standardise the interviews.

Implications for practice and research

Despite high awareness for disease prevention and motivation to adopt a healthy lifestyle, Chinese older adults expressed a strong need for tailored lifestyle support from a health professional. With approximately 67% of inhabitants owning a smartphone in 2020, China is in the top 10 countries with highest smartphone coverage.³⁶ There are many Chinese smartphone applications and mini-programmes to help individuals adopt a healthier lifestyle. However, only very few have been scientifically studied or validated.³⁷ Fuelled by the findings of our study, we have tried to adjust the

PRODEMOS intervention to the needs and wishes of the Chinese target population. The PRODEMOS app will be embedded as a mini-programme in the WeChat environment. Results from other apps or mini-programmes, such as step counters, will be automatically transferred to the PRODEMOS mini-programme. If desired, participants can choose traditional Chinese options to work on their healthy lifestyle, including tai chi and square dancing, although our intervention, which focuses on lifestyle rather than medication use, does not include advice on medicinal TCM. To facilitate peer support, the platform will enable participation of a spouse and other cohabitating relatives in the same study arm, and offers 'peer videos', showing experiences of other older adults who changed their lifestyle behaviours. Based on the needs and wishes for coaching, PRODEMOS participants will receive trustworthy health information and personalised coaching, tailored to the participant's health condition and social environment. To optimally fit into Chinese current practice, coaching in PRODEMOS will be performed by nurses, with supervision from a doctor. Coaches will be specifically trained to provide lifestyle advice that matches well with daily routines of participants, involving relevant peers. Specific attention will be paid to sociocultural values, such as time constraints due to family responsibilities, which may complicate (sustained) behaviour change.

The mHealth intervention will be tested in an RCT in the greater Beijing area in the coming years. Facilitating a personalised approach, it has the potential to support Chinese older adults to improve their lifestyle-related risk factors for CVD and dementia.

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REFERENCES

- 1 Zhang Y, Xu Y, Nie H, *et al*. Prevalence of dementia and major dementia subtypes in the Chinese populations: a meta-analysis of dementia prevalence surveys, 1980-2010. *J Clin Neurosci* 2012;19:1333-7.
- 2 Chan KY, Wang W, Wu JJ, *et al*. Epidemiology of Alzheimer's disease and other forms of dementia in China, 1990-2010: a systematic review and analysis. *Lancet* 2013;381:2016-23.
- 3 Zhang NJ, Guo M, Zheng X. China: awakening giant developing solutions to population aging. *Gerontologist* 2012;52:589-96.
- 4 Baumgart M, Snyder HM, Carrillo MC, *et al*. Summary of the evidence on modifiable risk factors for cognitive decline and dementia: a population-based perspective. *Alzheimers Dement* 2015;11:718-26.
- 5 Livingston G, Huntley J, Sommerlad A, *et al*. Dementia prevention, intervention, and care: 2020 report of the Lancet Commission. *Lancet* 2020;396:413-46.
- 6 Number of Internet users in China from December 2008 to March 2020, 2020. Available: <https://www.statista.com/statistics/265140/number-of-internet-users-in-china/>



- 7 Fang EF, Scheibye-Knudsen M, Jahn HJ, *et al*. A research agenda for aging in China in the 21st century. *Ageing Res Rev* 2015;24:197–205.
- 8 Mobile phone Internet user penetration in China from 2015 to 2019 with a forecast until 2025, 2020. Available: <https://www.statista.com/statistics/309015/china-mobile-phone-internet-user-penetration/>
- 9 Eggink E, Hafdi M, Hoevenaer-Blom MP, *et al*. Prevention of dementia using mobile phone applications (PRODEMOS): protocol for an international randomised controlled trial. *BMJ Open* 2021;11:e049762.
- 10 Richard E, Moll van Charante EP, Hoevenaer-Blom MP, *et al*. Healthy ageing through Internet counselling in the elderly (HATICE): a multinational, randomised controlled trial. *Lancet Digit Health* 2019;1:e424–34.
- 11 Wang W. Cardiovascular health in China: low level vs high diversity. *Lancet Reg Health West Pac* 2020;3:100038.
- 12 Xu J, Wang J, Wimo A, *et al*. The economic burden of dementia in China, 1990–2030: implications for health policy. *Bull World Health Organ* 2017;95:18–26.
- 13 Braun V, Clarke V. Using thematic analysis in psychology. *Qual Res Psychol* 2006;3:77–101.
- 14 Song YP, Ma W, Yi XR, *et al*. Chronic diseases knowledge and related factors among the elderly in Jinan, China. *PLoS One* 2013;8:e68599.
- 15 Shi JH, Qi L, Li YQ, *et al*. Investigation of health literacy status in Beijing, China. *Health Lit Res Pract* 2020;4:e174–84.
- 16 Wang W, Zhang Y, Lin B, *et al*. The urban-rural disparity in the status and risk factors of health literacy: a cross-sectional survey in central China. *Int J Environ Res Public Health* 2020;17:3848.
- 17 Wang C, Li W, Yin L, *et al*. Comparison of healthy lifestyle behaviors among individuals with and without cardiovascular diseases from urban and rural areas in China: a cross-sectional study. *PLoS One* 2017;12:e0181981.
- 18 Chen Z. Launch of the health-care reform plan in China. *Lancet* 2009;373:1322–4.
- 19 Blumenthal D, Hsiao W. Lessons from the East—China's rapidly evolving health care system. *N Engl J Med* 2015;372:1281–5.
- 20 Hu Y, Sun X, Yuan Z, *et al*. Another step change for tobacco control in China? *Lancet* 2015;386:339–40.
- 21 Zhang Y, Ma D, Cui R, *et al*. Facilitators and barriers of adopting healthy lifestyle in rural China: a qualitative analysis through social capital perspectives. *Nagoya J Med Sci* 2016;78:163–73.
- 22 Newman I. Cultural aspects of drinking patterns and alcohol controls in China. *The Globe* 2002;1:18–21.
- 23 Ding D, Hovell MF. Cigarettes, social reinforcement, and culture: a commentary on "Tobacco as a social currency: cigarette gifting and sharing in China". *Nicotine Tob Res* 2012;14:255–7.
- 24 Tan X, Zhang Y, Shao H. Healthy China 2030, a breakthrough for improving health. *Glob Health Promot* 2019;26:96–9.
- 25 Li AHF. Whom to trust when sick? *China Perspectives* 2016:79–83.
- 26 Li SX, Deng R. Design strategy of mobile medical service for chronic diseases from the perspective of integration of sports and medicine. *Packaging Engineering* 2020;41:202–6.
- 27 Wang QY, Li A, Dong YR. Status analysis of the mobile medical APP based on the medical service chain. *Chin Hosp Manage* 2018;38:48–9.
- 28 OECD/EU. Health at a glance: Europe 2018: state of health in the EU cycle, 2020. Available: https://doi.org/10.1787/health_glance_eur-2018-en
- 29 Ligthart SA, van den Eerenbeemt KDM, Pols J, *et al*. Perspectives of older people engaging in nurse-led cardiovascular prevention programmes: a qualitative study in primary care in the Netherlands. *Br J Gen Pract* 2015;65:e41–8.
- 30 van Middelaar T, Beishuizen CRL, Guillemont J, *et al*. Engaging older people in an Internet platform for cardiovascular risk self-management: a qualitative study among Dutch HATICE participants. *BMJ Open* 2018;8:e019683.
- 31 Akenine U, Barbera M, Beishuizen CR, *et al*. Attitudes of at-risk older adults about prevention of cardiovascular disease and dementia using eHealth: a qualitative study in a European context. *BMJ Open* 2020;10:e037050.
- 32 Coley N, Rosenberg A, van Middelaar T, *et al*. Older adults' reasons for participating in an eHealth prevention trial: a cross-country, mixed-methods comparison. *J Am Med Dir Assoc* 2019;20:843–9.
- 33 Tong A, Sainsbury P, Craig J. Consolidated criteria for reporting qualitative research (COREQ): a 32-item checklist for interviews and focus groups. *Int J Qual Health Care* 2007;19:349–57.
- 34 Tang S, Ehiri J, Long Q. China's biggest, most neglected health challenge: non-communicable diseases. *Infect Dis Poverty* 2013;2:7.
- 35 Shao S, Zhao F, Wang J, *et al*. The ecology of medical care in Beijing. *PLoS One* 2013;8:e82446.
- 36 Penetration rate of smartphones in selected countries, 2021. Available: <https://www.statista.com/statistics/539395/smartphone-penetration-worldwide-by-country/>
- 37 Kumar S, Nilsen WJ, Abernethy A, *et al*. Mobile health technology evaluation: the mHealth evidence workshop. *Am J Prev Med* 2013;45:228–36.