A Smartphone App (mDASHNa-CC) to Support Healthy Diet and Hypertension Control for Chinese Canadian Seniors: Protocol for Design, Usability and Feasibility Testing

Ping Zou, PhD; Jennifer Stinson, PhD; Monica Parry, PhD; Cindy-Lee Dennis, PhD; Yeqin Yang, PhD; Zhongqiu Lu, PhD

1School of Nursing, Nipissing University, Toronto, ON, Canada
2Lawrence Bloomberg Faculty of Nursing, University of Toronto, Hospital for Sick Children, Toronto, ON, Canada
3Lawrence Bloomberg Faculty of Nursing, University of Toronto, Toronto, ON, Canada
4Lawrence Bloomberg Faculty of Nursing and Department of Psychiatry, University of Toronto, Toronto, ON, Canada
5School of Nursing, Wenzhou Medical University, Wenzhou, China

Abstract

Background: This proposed study aims to translate the Dietary Approach to Stop Hypertension with Sodium (Na) Reduction for Chinese Canadians (DASHNa-CC), a classroom-based, antihypertensive, dietary educational intervention, to an innovative smartphone app (mDASHNa-CC). This study will enable Chinese Canadian seniors to access antihypertensive dietary interventions anytime, regardless of where they are. It is hypothesized that senior Chinese Canadians will be satisfied with their experiences using the mDASHNa-CC app and that the use of this app could lead to a decrease in their blood pressure and improvement in their health-related quality of life.

Objective: The goal of this study is to design and test the usability and feasibility of a smartphone-based dietary educational app to support a healthy diet and hypertension control for Chinese Canadian seniors.

Methods: A mixed-method two-phase design will be used. The study will be conducted in a Chinese immigrant community in Toronto, Ontario, Canada. Chinese Canadian seniors, who are at least 65 years old, self-identified as Chinese, living in Canada, and with elevated blood pressure, will be recruited. In Phase I, we will design and test the usability of the app using a user-centered approach. In Phase II, we will test the feasibility of the app, including implementation (primary outcomes of accrual and attrition rates, technical issues, acceptability of the app, and adherence to the intervention) and preliminary effectiveness (secondary outcomes of systolic and diastolic blood pressure, weight, waist circumference, health-related quality of life, and health service utilization), using a pilot, two-group, randomized controlled trial with a sample size of 60 participants in a Chinese Canadian community.

Results: The study is supported by the Startup Research Grant from Nipissing University, Canada. The research ethics application is under review by a university research ethics review board.

Conclusions: The study results will make several contributions to the existing literature, including illustrating the rigorous design and testing of smartphone app technology for hypertension self-management in the community, exploring an approach to incorporating traditional medicine into chronic illness management in minority communities and promoting equal access to current technology among minority immigrant senior groups.

Trial Registration: Clinicaltrials.gov NCT03988894; https://clinicaltrials.gov/ct2/show/NCT03988894

International Registered Report Identifier (IRRID): PRR1-10.2196/15545
Introduction

Rationale for the Intervention

In Canada, 1.3 million Chinese individuals comprise approximately 4.0% of Canada’s population and 21.2% of the country’s visible minorities [1]. In this Chinese population, hypertension is the most prominent risk factor for cardiovascular disease and accounts for a large proportion of stroke [2] and heart failure [3]. With a 15.1% hypertension prevalence rate [4], Chinese Canadians are at an increased risk of cardiovascular disease and associated morbidity and mortality. Because the prevalence of hypertension increases with age, Chinese Canadian seniors are at especially high risk for hypertension and related mortality [4].

Compared with antihypertensive dietary suggestions in hypertension care guidelines [5], Chinese Canadians have a suboptimal dietary intake, which impacts their blood pressure control. Chinese Canadians’ sodium intake is higher than antihypertensive dietary recommendations [6], and a high proportion of Chinese Canadians consume fewer fruits and vegetables than antihypertensive dietary recommendations [7,8]. In addition, Chinese Canadians have a low dairy intake compared with antihypertensive dietary recommendations [9]. Dietary factors have been identified as the most important risk factors for hypertension among the Chinese population [10]. As such, effective dietary interventions are needed to assist with blood pressure control in Chinese Canadian seniors [11,12].

Dietary Interventions for Hypertension Control

The Dietary Approach to Stop Hypertension (DASH) and sodium reduction are antihypertensive dietary interventions recommended by Canadian hypertension care guidelines [5,13]. Focused on healthy dietary patterns rather than specific nutrients, the DASH diet includes eight food groups (grains, vegetables, fruits, meats, dairy, nuts, fats, and sweets), with specific serving suggestions [14]. The DASH studies demonstrate an effective systolic blood pressure reduction of 4-11 mmHg and a diastolic blood pressure reduction of 2-6 mmHg [15-19]. A systematic review has suggested that sodium reduction is also related to decreased blood pressure [20]. However, the DASH and sodium reduction interventions do not consider the psychosocial factors that influence dietary behaviors, nor have they been tested among Chinese Canadians in a community setting [5,15]. A review paper explored the cultural factors influencing diet and hypertension control in the Chinese Canadian population and suggested that English language proficiency, health literacy, traditional Chinese diet, migration and acculturation, and traditional Chinese medicine (TCM) influence Chinese Canadians’ dietary practices [21]. A culturally tailored intervention is thus needed to facilitate blood pressure control in Chinese Canadians.

Incorporation of Traditional Chinese Medicine for Hypertension Control

Chinese Canadians rely strongly on TCM for chronic illness management and prefer to incorporate TCM into their health care [11]. Food therapy is an essential component of TCM and has been acknowledged as a successful therapy for more than 3000 years [22]. In TCM, food is conceptualized with both nutritional and functional considerations. Like medicines, food can be used to maintain health, prevent and treat diseases, and facilitate rehabilitation [23-27]. There are four principles of TCM food therapy, including light eating, balancing the hot and cold nature of food, harmony of the five flavors of food, and consistency of diets with different health conditions [28,29]. The principal investigator of this study has previously published a literature review on TCM food therapy and hypertension control using a rigorous review method and statistical analysis [30]. Findings suggest that some foods have antihypertensive functions [31-41], and food therapy can facilitate hypertension control [42-45].

Antihypertensive Diet Apps for the Chinese Population

We conducted a scoping review of existing antihypertensive diet apps written in Chinese on the current market. We searched in various app stores and found 24 apps (15 on iTunes, seven on the Google Play Store, and two on the Chinese App Market). All apps were written in Chinese and focused on diets for hypertension control. We screened the app description and conducted a content analysis. We identified several gaps, including: (1) the app producers had no credentials from any licensed health care professional or research team; (2) all apps were in electronic book form, only providing information with no user interactivity; (3) none of the apps focused on senior users; and (4) most apps from iTunes and the Google Play Store were based on Western diets, which may not fit with Chinese diets. The findings from our review are consistent with a review of app studies on hypertension control, which stated that most of the current apps lack standardization and scientific validation [46]. The mobile Dietary Approach to Stop Hypertension with Sodium (Na) Reduction for Chinese Canadians (mDASHNa-CC) app differs from other related apps in the current market in that it will be developed by a team of health care professionals, involve community end-users in the development process, be based on the current gold standard of antihypertensive dietary interventions, incorporate TCM to ensure that it is culturally significant for Chinese seniors, provide immediate response and recommendations according to the patients’ current conditions, and be scientifically tested by a Randomized Control Trial.

Preliminary Work: Success of the DASHNa-CC Pilot Trial

The Dietary Approach to Stop Hypertension with Sodium Reduction for Chinese Canadians (DASHNa-CC) intervention was designed based on current literature and clinical expertise.
The DASHNa-CC integrates TCM food therapy into the DASH and sodium reduction dietary intervention for blood pressure control. Adapted from DASH, DASHNa-CC is designed as a standardized, culturally sensitive, dietary education intervention for Chinese Canadians. The contents of the DASHNa-CC intervention have three components: (1) the DASH diet pattern, including characteristics of the DASH diet, serving size estimation tool, foods rich in calcium, and foods rich in potassium; (2) sodium reduction, including the importance of sodium reduction for cardiac health, goals of sodium reduction, and 20 sodium reduction strategies; (3) TCM food therapy, including the contribution of TCM to hypertension control, four principles of TCM food therapy, and 34 foods and five herbal teas with antihypertensive functions recommended by TCM food therapy. The intervention delivery consisted of: (1) the DASHNa-CC Intervention Manual; (2) two classroom sessions (2 hours per session); and (3) one 20-minute booster telephone call.

From August to December 2014, 60 participants were recruited in a pilot randomized controlled trial to examine the feasibility and potential effects of the DASHNa-CC intervention. The research findings suggested that participants adhered well to the DASH diet pattern, sodium reduction, and TCM food therapy strategies. The loss to follow-up rate was 5%. Participants were highly satisfied with the intervention and perceived that the intervention contents were helpful, the delivery approaches were suitable, and their participation in the pilot trial was beneficial rather than a burden on their lives. Compared to the control group, the intervention group lowered their systolic blood pressure by 3.8 mmHg ($t_{55}=-1.58; P=.12$) more than the control and lowered their diastolic blood pressure by 2.4 mmHg ($t_{53}=-1.22; P=.23$). These blood pressure reductions were clinically important to reduce hypertension-related mortality and morbidity [47,48]. In addition, the intervention group had a significant improvement from baseline to eight weeks post-randomization in the physical component score ($t_{55}=2.13; P=.04$) of the Medical Outcomes Study 36-Item Short-Form version two (SF-36v2). It is concluded that the DASHNa-CC intervention has the potential to decrease systolic and diastolic blood pressure and improve the health-related quality of life for Chinese Canadians. Three papers, which discuss the main research findings suggested that participants adhered well to the requirements of learning dietary educational material, conducting dietary self-assessments, and monitoring blood pressure with the mDASHNa-CC app; and potential effects of the DASHNa-CC intervention. The research questions of implementation are: (1) What are the rates of participant accrual and attrition; (2) What technical issues arise over the study; (3) What is the acceptability of the study protocol; (4) To what extent do participants adhere to the requirements of learning dietary educational material, conducting dietary self-assessments, and monitoring blood pressure with the mDASHNa-CC app; and (5) To what extent do participants adhere to the dietary recommendations in the mDASHNa-CC app? The research questions of preliminary effectiveness are: Compared to usual care, what is the effect of an 8-week mDASHNa-CC app intervention on systolic and diastolic blood pressure, body weight, waist circumference, health-related quality of life, and health service utilization?

Why is the mDASHNa-CC Smartphone App Needed?

The smartphone app version of the DASHNa-CC intervention (mDASHNa-CC) is proposed because many Chinese Canadian seniors were unable to participate in the pilot study due to busy life schedules (eg, taking care of grandchildren) and were unable to travel to the community center where the DASHNa-CC intervention was delivered. Also, in this pilot study, it was found that most Chinese Canadian seniors were well-educated, technologically savvy, able to access the internet, owned a smartphone, and were willing to learn new skills and knowledge to improve their hypertension control. The academic committee of the DASHNa-CC pilot study suggested transferring the DASHNa-CC to a home-based intervention using a website or smartphone technology to better meet the health care needs of Chinese Canadian seniors. We conducted two focus group discussions with 20 pilot study participants in the community in 2016. All participants had a smartphone and expressed an eagerness to use our app when it becomes available. They stated that they “review the manual frequently, and a smartphone app will make the manual easier to use,” and “this is something new and I want to try.”

Specific Aims

The overall aim of this two-phase study is to translate the Dietary Approach to Stop Hypertension with Sodium Reduction for Chinese Canadians, a classroom-based antihypertensive dietary educational intervention, to an innovative smartphone app (mDASHNa-CC). This smartphone app would enable and empower Chinese Canadian seniors’ to access this antihypertensive intervention anytime, regardless of where they are.

Research Objectives and Research Questions

The research objectives are to design and test the usability and feasibility of a smartphone-based dietary educational app to support a healthy diet and hypertension control for Chinese Canadian seniors. In the Phase I usability testing study, the research questions are: (1) How can the mDASHNa-CC app be designed according to the DASHNa-CC intervention and the current literature on hypertension webpages and apps; and (2) How can the mDASHNa-CC app be refined using a user-centered design approach to ensure it is easy to use, efficient, and satisfying for participants? The Phase II pilot feasibility testing study will examine the implementation and preliminary effectiveness of using the mDASHNa-CC app with Chinese Canadians seniors who have hypertension in the community. The research questions of implementation are: (1) What are the rates of participant accrual and attrition; (2) What technical issues arise over the study; (3) What is the acceptability of the study protocol; (4) To what extent do participants adhere to the requirements of learning dietary educational material, conducting dietary self-assessments, and monitoring blood pressure with the mDASHNa-CC app; and (5) To what extent do participants adhere to the dietary recommendations in the mDASHNa-CC app? The research questions of preliminary effectiveness are: Compared to usual care, what is the effect of an 8-week mDASHNa-CC app intervention on systolic and diastolic blood pressure, body weight, waist circumference, health-related quality of life, and health service utilization?

Theoretical Framework

Social cognitive theory, a behavioral model commonly applied to the design of interventions intended for the self-directed management of chronic disease, will be used as the governing behavioral change theory for the mDASHNa-CC intervention. The key constructs of this theory include psychological determinants of behavior, observational learning, environmental determinants of behavior, self-regulation, and moral disengagement [52]. These constructs emphasize the dynamic interaction of personal, behavioral, and environmental factors that could alter human behavior [52]. Social cognitive theory
has been successfully used to guide the app design for diabetes control in Canada [53]. Learning from this Canadian evidence, we applied social cognitive theory to our app design for antihypertensive dietary behavior self-management. Evidence suggests that psychological and environmental determinants impact Chinese adults’ dietary behavior and hypertension control. We hypothesized that promoting positive psychological and environmental determinants can enhance dietary behavior and blood pressure control. Learning is considered as the foundational function for the mDASHNa-CC app; therefore, antihypertensive dietary education acts as an essential component of the app. The core function of the app is self-regulation; thus, dietary self-assessments and blood pressure self-monitoring are embedded in this app as the main functions. In addition, automatic feedback according to dietary self-assessments and blood pressure data is incorporated in the app to encourage health behavior changes. This app design will drive self-efficacy through observational learning, self-regulation, and incentive motivation. The behavior changes will be achieved through self-monitoring, tailored feedback, structured education, and incentivizing positive behavior.

Methods

Phase I: Design and Usability Testing of the mDASHNa-CC App

Adhering to a phased sequential approach to the development of complex technology-based interventions [54], the development of the mobile Dietary Approach to Stop Hypertension with Sodium (Na) Reduction for Chinese Canadians (mDASHNa-CC) app will include app design, usability testing, and feasibility testing. A user-centered design approach will be applied, where seniors will be actively engaged in all aspects of the research process, including the app’s design, the usability and feasibility testing, and the refinement of the prototype.

Convenience sampling will be used to recruit eligible individuals. To access the most representative sample of Chinese Canadian seniors, a community center in Toronto where Chinese Canadians occupy a high percentage of the total population will be used for blood pressure screening, participant recruitment, app testing, and participant follow-up. In partnership with the Ontario Chinese Senior Association, we will host blood pressure screening events in the Chinese community to facilitate the recruitment process. The app testing procedures will commence after participation eligibility is assessed, informed consent is obtained, and a trained research assistant collects demographic and other outcome data. This study will include all Chinese Canadians who: (1) are at least 65 years old; (2) have a systolic blood pressure higher than 140 mmHg, or a diastolic blood pressure higher than 90 mmHg, or are on antihypertensive medications, based on preintervention baseline assessment; (3) can understand (listen) and speak in Mandarin or Cantonese, and can read and write in Chinese; and (4) have access to a smartphone. Since self-reporting has been recommended as the preferred approach to measure ethnicity and has been widely applied in public health studies [55,56], the identification of Chinese Canadians in this study will be based on self-reporting of ethnicity. The study will exclude individuals who: (1) have special dietary requirements; (2) are a household member of another mDASHNa-CC participant; or (3) plan to leave the area before the anticipated end of the study.

App Design

Based on the findings of the DASHNa-CC pilot trial, the major functions of the app will include: (1) antihypertensive dietary education; (2) dietary self-assessments; (3) automatic feedback according to dietary self-assessments; (4) blood pressure monitoring; and (5) automatic feedback according to blood pressure data. To enhance individuals’ interest in using the app, a new function of the app that will be utilized is built-in age and culture-specific entertainment content as a reward for learning dietary education material, conducting dietary self-assessment, and monitoring blood pressure [57]. The entertainment content, including Chinese songs, videos, or Beijing opera, will be suggested by senior Chinese Canadians in the community.

The antihypertensive dietary education is based on the DASHNa-CC intervention and includes the content of the DASH diet pattern, sodium reduction, and TCM food therapy. It is recommended that participants review the educational content and answer the related questions, and they will also be asked to conduct a dietary self-assessment every day on the app. Based on this, the app will automatically provide feedback and suggestions. Participants are also asked to measure their blood pressure twice a day using a home blood pressure monitor. They will then record the data in the app, which will automatically provide feedback regarding their blood pressure status. Frequent use of the app will be rewarded with built-in entertainment content. The data entered by seniors will be stored locally on the smartphone and then communicated to the server when the phone is online using an encrypted protocol. The server will be hosted at Nipissing University behind a firewall in a secure network environment. A username and password will be required to access the data. The app development will be completed by a software programmer who has extensive experience in educational smartphone app development in the Chinese Canadian community.

Usability Testing

Usability testing is a widely used methodology that incorporates an iterative process of testing an intervention’s user-interface and then applying the results to redesign the prototype to meet users’ needs. The current literature supports the importance of usability testing to increase the likelihood of a technology-based intervention’s effectiveness [58]. It is recommended that usability testing takes two to three cycles and involves five to seven participants in every cycle [57,59].

Low Fidelity User-Centered Design

A qualitative usability testing approach will be used with multiple iterative cycles of semistructured audiotaped interviews. The app interface designs will be trialed with participants. A total of seven seniors in each cycle will be shown paper screenshots of the application and asked what they like and dislike about the interface design, contents, major functions, and built-in entertainment. The list of interview questions will
be modified during the interview process considering emerging themes and field notes related to perceived ease of use. The research assistant will record problems with the app. Seniors will also be asked to provide further suggestions for improvement. Design elements will be modified, and new paper screenshots will be generated and tested with iterative cycles until no further changes are suggested.

**High Fidelity User-Centered Design**

Following the development of a fully functional smartphone-based prototype, usability testing (multiple iterative cycles) with semistructured audiotaped interviews will be conducted again with seven seniors in each cycle. In this phase, a trained research assistant will first provide seniors with a brief (approximately 5 minutes) demonstration of the app on a smartphone using a standardized dietary assessment vignette. Seniors will then be asked to complete a dietary self-assessment in the app and record their food intake while thinking aloud about their likes, dislikes, and difficulties with the app. At the end of each session, a research assistant will ask a series of open-ended questions related to ease of use, what seniors liked or disliked about the app, and any technical issues. The research assistant will record the answers to questions, write field notes on ease of app use, and explore emerging themes. After the first iterative cycle, changes will be made based on the themes identified from seniors’ opinions. Conflicting suggestions will be handled based on the majority. Another iterative cycle will be conducted with another seven seniors until there are no further recommendations for change to the app.

**Measurement Tools**

The baseline participant demographic characteristics will be collected via the Participant Information Questionnaire. This questionnaire includes 23 questions about socioeconomic status, risk factors for hypertension, and migration history. This questionnaire was used in the DASHNa-CC pilot study. In addition, overall comfort level with smartphones will be ascertained using a questionnaire about smartphone ownership, level of use, and likeability. This questionnaire has been used successfully in previous app studies [57].

**Data Analysis**

Demographic data will be analyzed using the software SPSS version 20.0 (IBM Corporation, New York, United States). To describe the sample, various descriptive statistics (eg, means, standard deviations, proportions), dependent on the level of measurement of the variables, will be calculated for sample demographics and other baseline information.

In both low and high-fidelity usability testing, audiotaped usability interviews will be transcribed verbatim. All transcripts from the usability testing phases will be verified against the tapes and imported into the software NVivo 10.0 (QRS International, Chatstone, Australia) for coding. The field notes taken during the interviews will also be transcribed and included in the analytic process. By using thematic coding, data will be coded according to the study objectives and categorized to reflect the emerging themes [60]. Any changes to the prototype will be made based on feedback from each iterative cycle of testing.

**Phase II: Feasibility Testing of mDASHNa-CC App**

Following usability testing, a pilot randomized controlled trial [61] feasibility study will be conducted with Chinese Canadian seniors to determine implementation (primary outcomes, including accrual and attrition rates, technical issues, acceptability of the app, and adherence to the intervention,) and preliminary effectiveness (secondary outcomes, including systolic and diastolic blood pressure, weight, waist circumference, health-related quality of life, and health service utilization). This study is designed as a pilot two-group (1:1) randomized controlled trial with a sample size of 60 participants (block of 20) in a Chinese Canadian community in the Greater Toronto Area.

The sampling procedures and setting will be the same as the Phase I study. A convenience sample of 60 Chinese Canadian seniors will participate in this study. Self-identified Chinese Canadians were recruited if they met the following inclusion criteria: (1) at least 65 years of age; (2) had a systolic blood pressure between 140 to 159 mmHg or a diastolic blood pressure between 90 to 99 mmHg; (3) were able to understand and speak Mandarin and read and write Chinese; and (4) had access to a smartphone. Individuals were excluded if they: (1) used antihypertensive medications, insulin, or oral hypoglycemic agents; (2) had a cardiovascular event during the previous three months; (3) had a history of congestive heart failure; (4) had a cancer diagnosis or had undergone cancer treatment during the past two years; or (5) had special dietary requirements.

As a pilot study is not powered to be a hypothesis-testing trial, formal sample size calculations are not recommended [62]. Instead, the sample size suggested was based on recommendations for feasibility trials [63]. In this pilot study, 60 eligible participants will be recruited. Following university ethics approval, participants will be recruited by blood pressure screening events in diverse community settings. The recruitment process of Phase II is the same as that of Phase I. Study procedures will commence after eligibility is assessed, informed consent is obtained, and demographic and baseline outcome data are collected by a trained research assistant.

Using an online randomization tool provided by Interrand Company, Ottawa, Canada, participants will be randomized into either an intervention group or a control group. Participants randomized to the intervention group will receive the mDASHNa-CC app intervention for eight weeks plus usual care; participants randomized to the control group will receive usual care. Coinvestigators, collaborators, and outcome assessors will be blinded to the group assignment. Because this study is an app educational intervention, it will be impossible to blind participants to the group assignment. The group assignment will be concealed until all outcome data are collected [64]. After all outcome data are collected eight weeks post-randomization, participants in the control group will also be offered use of the app.

The control group will be usual care. Usual care consists of three parts: (1) receiving a general hypertension health education booklet from the Heart and Stroke Foundation of Ontario; (2) being encouraged to see their family physicians or primary health care providers regarding their blood pressure status (those
who do not have a primary health care provider will be referred to a walk-in clinic or a community health center; and (3) having access to family physicians, telehealth, emergency care, hospitals, and other health care facilities in the Greater Toronto Area as required.

In addition to usual care, those participants randomized to the intervention group will be offered use of the app. A trained research assistant will teach them how to use it, they will load the app on their smartphones, and then they will be requested to review educational material, conduct dietary self-assessments, and monitor blood pressure for eight weeks. Telephone assistance from a trained research assistant will be available to seniors in case of technical problems or if any questions arise about the app. The research team will conduct a daily review of a summary of each senior’s report so that participant safety issues can be identified and resolved. By the end of the eight weeks postrandomization, seniors will be prompted by phone using an audible alert to complete the app evaluation questionnaire on their smartphone, which will ascertain likes and dislikes with the app.

Measurement Tools
Baseline demographic characteristics will be collected via the participant information questionnaire, which is described in the measurement tools section in the Phase I study. Implementation outcomes will describe the feasibility of using the app with Chinese Canadian seniors in the community. Implementation will be measured as:

- Accrual and attrition rates: The mDASHNa-CC recruitment log has been designed to record data related to the number of eligible seniors per recruitment day, reasons for ineligibility, and reasons for nonparticipation. The mDASHNa-CC Activity Log has been designed to record data on attrition, including occurrence/reasons for attrition, technical difficulties, adherence, and outcome measure completion. A trained research assistant will complete the logs daily during the research process.
- Technical issues: The occurrence and description of technical problems will be recorded on the mDASHNa-CC activity log by a trained research assistant.
- Acceptability: The acceptability e-scale ascertains perceptions related to how helpful, difficult, and enjoyable electronic-based programs are to use, how understandable questions are, and how acceptable the time invested in reporting was [65]. This scale demonstrated validity and reliability in various prior studies [65]. For the present study, the wording of the scale will be slightly modified, and a free-text question, where seniors are encouraged to enter any other information that they feel would be important to discuss, will be added. Seniors in the intervention group will fill out this scale by email four weeks and eight weeks postrandomization.
- Adherence: A built-in number counter will measure participants’ adherence to the requirements of learning dietary educational material, conducting dietary self-assessments, and monitoring blood pressure in the mDASHNa-CC app. The number counter will record the time and frequency of app use. The dietary intake will be measured at baseline and eight weeks postrandomization by a one-to-one dietary interview using the validated Automated Multiple Pass Method [66] by a trained research assistant in the community center. This approach was successfully tested in the DASHNa-CC pilot study. Adherence to the DASH will be measured by the validated DASH component score of each food group, and the total DASH score [67]. Adherence to the sodium reduction will be measured by a 24-hour urine test [68]. Adherence to TCM food therapy will be measured using a 24-statement questionnaire on a 5-point Likert scale, which was validated in the DASHNa-CC pilot study [69].

Preliminary Effectiveness and Outcomes
Except for health service utilization, which will be measured only at eight weeks postrandomization, the other following outcomes will be measured at baseline and eight weeks postrandomization at the community center by a trained research assistant during a one-to-one appointment. If a participant cannot visit the center, a home visit by a trained research assistant will be arranged.

- Systolic and diastolic blood pressures: Systolic and diastolic blood pressures will be measured with the home blood pressure monitor, Omron BP785, whose validity and reliability have been tested [70]. All blood pressure measurements will be performed following the recommended techniques by the Canadian Hypertension Education Program guidelines [5]. Each participant will be offered an Omron BP785 and training on how to measure blood pressure at home and how to record the results; however, blood pressure at baseline and eight weeks postrandomization will be measured by a trained research assistant.
- Bodyweight: An electronic body weight scale will measure weight.
- Waist circumference: Waist circumference will be measured by measurement tape following proper techniques [71-74].
- Health-related quality of life: Health-related quality of life will be measured by the SF-36v2 [75,76].
- Health service utilization: Health service utilization data will be collected via the Health Service Utilization Questionnaire, which was modified from the Health Service Utilization Questionnaire previously used in Ontario [77].

Data Analysis and Statistical Methods
Demographic data will be analyzed using the software SPSS version 20.0 by a biostatistician. To describe the sample, various descriptive statistics (eg, means, standard deviations, proportions), dependent on the level of measurement of the variables, will be calculated for sample demographics and other baseline information. Descriptive statistics will be calculated to demonstrate how participants adhered to and are satisfied with the app. Open-ended questions will be reviewed by two researchers independently. Qualitative data will be organized into meaningful groups, combining similar patterns into themes. In feasibility testing, adherence is defined as 100% when 28/28 blood pressure entries and 14/14 dietary self-assessments entries are completed within the two weeks. An independent, two-sample, two-tailed t test will be used to examine the
differences in mean change scores between the control and intervention groups regarding blood pressure, weight, waist circumference, and health-related quality of life.

**Quality Control**

Quality control strategies will be implemented. Onsite training will be provided to the research staff. The training will include research ethics, privacy and confidentiality, orientation to research protocol and procedure, literature search and review, data collection tools, data analysis methods, and community networking. The training will provide staff with adequate time for interactive learning, on-site practice, and skill preparation for comprehensive teamwork in the project [78]. To make sure there is consistency in data collection, a uniform data collection tool will be used. The principal investigator will work closely with research staff in the data collection and analysis process. Team meetings will be conducted every month for progress updates and problem-solving. Research staff will be requested to make research notes daily. Discussion and debriefing will be provided promptly if needed. To sustain participant motivation to the project, patient contact will be organized in patient-preferred time to encourage participation. A research assistant will remind participants in advance of each research event [79]. In addition, city public transport tickets will be provided to assist with commuting costs. Participation certificates will be provided to honor participants’ contributions to the study.

**Results**

The study is supported by the Startup Research Grant from Nipissing University, Canada. The research ethics application is under review by a university research ethics review board.

**Discussion**

**Knowledge Translation**

Our knowledge translation plan incorporates strategies to ensure that our app will stand apart from existing apps in the eyes of Chinese Canadian seniors and other Chinese populations. Firstly, our networks with Chinese Canadian communities and our engagement of key consumer groups (Ontario Chinese Senior Association and other Chinese senior groups and community centers) will help to spread awareness of our app to people in the community using a grassroots approach. Collaboration with the community to provide workshops, information sessions, support groups, and social media interviews will promote the use of our app in the community. Secondly, our research team includes a nurse, a dietitian, a TCM practitioner, and a medical doctor who are in various organizations in Canada. Upon completion of the project, these leaders will be able to endorse the uptake of our app at their clinics and the practices of their colleagues. Thirdly, we will enter our app into competitions for technology design awards nationally and internationally to further solidify its credibility and earn patient buy-in. This strategy can also help disseminate our app outside Canada, including the United States, where 2.4 million Chinese individuals live, and East Asian countries, such as China, where hypertension is emerging as a critical public health issue [80,81]. Fourthly, we will partner with Hypertension Canada, Toronto Public Health, Wenzhou Medical School (P. R. China), and other organizations to promote the use of our app. Endorsement of an app by health promotion organizations can lend legitimacy to a new tool. Fifthly, national, and international academic audiences will be reached through academic publications and presentations at conferences by researchers. Finally, fact sheets, research summaries, presentations in leadership forums, and policy recommendations will be used to communicate research findings with government and policymakers to promote related policy changes.

**Human Subjects**

Chinese Canadian seniors will be the research subjects in this study. As a technology-based dietary educational intervention, this study poses no known risks to participants. All participants have access to telehealth, emergency care, hospitals, and other health care facilities in the Greater Toronto Area. All participants are free to use all these health care services anytime, as needed.

There are no known benefits to participation in this pilot trial. However, participants in the DASH trial reported reduced blood pressure and enhanced quality of life [15,82]. Participants in a trial of TCM food therapy in China also reported improved health-related quality of life and reduced the use of their antihypertensive medications [45]. By participating in this study, participants will gain knowledge about healthy eating and the importance of blood pressure control. Participants will be instructed to monitor their blood pressure. In addition, a CAD$20 ($15) dollar gift card and a certificate of participation will be offered to all participants as a token of appreciation for their participation. Every participant will be offered two city public transportation tickets every time they attend the research activities to compensate for travel expenses. Participants will receive the study results by email.

**Implications**

The study results will make contributions in six areas: (1) produce a smartphone app, which allows a large number of seniors, their families, and other community members to access the dietary intervention for hypertension control, and could potentially be used across Canada and internationally in large Chinese ethnic populations; (2) illustrate the rigorous design and testing of smartphone app technology for hypertension self-management in the community; (3) explore the approach of incorporating traditional medicine in chronic illness management in minority communities; (4) contribute to culturally sensitive care, which is an urgent need due to global migration and has implications for immigrant-recipient countries and multiethnic societies; (5) promote equal access to current technology among minority immigrant senior groups; and (6) facilitate the full randomized trial in the future to examine the effects of the app on blood pressure and health-related quality of life.
Acknowledgments
This study is supported by the Startup Research Grant, Nipissing University, Canada.

Authors’ Contributions
PZ conceptualized the project and drafted the manuscript. JS, MP, CLD, YY, and ZL reviewed and edited the manuscript. All authors read and approved the final manuscript.

Conflicts of Interest
None declared.

References
1. Statistics C. Immigration and Ethnocultural Diversity in Canada: National Household Survey 2011. Ottawa: Ministry of Industry; 2013. URL: https://www12.statcan.gc.ca/nhs-enm/2011/as-sa/99-010-x/99-010-x2011001-eng.pdf [accessed 2020-02-18]
2. Yong H, Foody J, Linong J, Dong Z, Wang Y, Ma L, et al. A Systematic Literature Review of Risk Factors for Stroke in China. Cardiology in Review 2013;21(2):77-93. [doi: 10.1097/crd.0b013e3182748d37]
3. Moe GW, Tu J. Heart failure in the ethnic minorities. Current Opinion in Cardiology 2010;25(2):124-130. [doi: 10.1097/hco.0b013e328335fe44]
4. Chiu M, Austin PC, Manuel DG, Tu JV. Comparison of cardiovascular risk profiles among ethnic groups using population health surveys between 1996 and 2007. CMAJ 2010 May 18;182(8):E301-E310 [FREE Full text] [doi: 10.1503/cmaj.091676] [Medline: 20403888]
5. Dasgupta K, Quinn RR, Zarnke KB, Rabi DM, Ravani P, Daskalopoulou SS, Canadian Hypertension Education Program. The 2014 Canadian Hypertension Education Program recommendations for blood pressure measurement, diagnosis, assessment of risk, prevention, and treatment of hypertension. Can J Cardiol 2014 May;30(5):485-501 [FREE Full text] [doi: 10.1016/j.cjca.2014.02.002] [Medline: 24786438]
6. Zhao D, Qi Y, Zheng Z, Wang Y, Zhang X, Li H, et al. Dietary factors associated with hypertension. Nat Rev Cardiol 2011 Jul 05;8(8):456-465. [doi: 10.1038/nrcardio.2011.75] [Medline: 21727918]
7. Hislop TG, Tu S, Teh C, Li L, Low A, Taylor VM, et al. Knowledge and Behaviour Regarding Heart Disease Prevention in Chinese Canadian Immigrants. Can J Public Health 2008 May 1;99(3):232-235. [doi: 10.1007/bf03405480]
8. Taylor VM, Yasui Y, Tu S, Neuhouser ML, Li L, Woodall E, et al. Heart disease prevention among Chinese immigrants. J Community Health 2007 Oct 24;32(5):299-310. [doi: 10.1007/s10900-007-9057-5] [Medline: 17922202]
9. Lv N, Cason KL. Current Dietary Pattern and Acculturation of Chinese Americans in Pennsylvania. Topics in Clinical Nutrition 2003;18(4):291-300. [doi: 10.1097/00008486-200310000-00010]
10. Wang J, Li Y. Characteristics of hypertension in the Chinese population. Curr Hypertens Rep 2012 Oct 29;14(5):410-415. [doi: 10.1007/s11906-012-0288-1] [Medline: 22843493]
11. King KM, LeBlanc P, Carr W, Quan H. Chinese immigrants' management of their cardiovascular disease risk. West J Nurs Res 2007 Nov;29(7):804-826. [doi: 1177/0193945906296431] [Medline: 17526869]
12. Li W, Stewart AL, Stotts N, Froelicher ES. Cultural factors associated with antihypertensive medication adherence in Chinese immigrants. J Cardiovasc Nurs 2006;21(5):354-362. [doi: 10.1097/00005082-200609000-00005] [Medline: 16966912]
13. Registered NAOO. Nursing Management of Hypertension. 2005. URL: https://rnao.ca/bpg/guidelines/nursing-management-hypertension [accessed 2020-02-18]
14. Karanja NM, Obarzanek E, Lin P, McCullough ML, Phillips KM, Swain JF, et al. Descriptive Characteristics of the Dietary Patterns Used in the Dietary Approaches to Stop Hypertension Trial. Journal of the American Dietetic Association 1999 Aug;99(8):S19-S27. [doi: 10.1016/s0002-8223(99)00412-5]
15. Appel LJ, Moore TJ, Obarzanek E, Vollmer WM, Svetkey LP, Sacks FM, et al. A Clinical Trial of the Effects of Dietary Patterns on Blood Pressure. N Engl J Med 1997 Apr 17;336(16):1117-1124. [doi: 10.1056/nejm199704173361601]
16. Vogt TM, Appel LJ, Obarzanek E, Moore TJ, Vollmer WM, Svetkey LP, et al. Dietary Approaches to Stop Hypertension: rationale, design, and methods. DASH Collaborative Research Group. J Am Diet Assoc 1999 Aug;99(8 Suppl):S12-S18. [doi: 10.1016/s0002-8223(99)00411-3] [Medline: 10450289]
17. Miller ER, Ehringer TP, Young DR, Jehn M, Charleston J, Rhodes D, et al. Results of the Diet, Exercise, and Weight Loss Intervention Trial (DEW-IT). Hypertension 2002 Nov;40(5):612-618. [doi: 10.1161/01.hyp.0000037217.96002.8e] [Medline: 12411452]
18. Sacks FM, Svetkey LP, Vollmer WM, Appel LJ, Bray GA, Harsha D, DASH-Sodium Collaborative Research Group. Effects on blood pressure of reduced dietary sodium and the Dietary Approaches to Stop Hypertension (DASH) diet. DASH-Sodium Collaborative Research Group. N Engl J Med 2001 Jan 04;344(1):3-10. [doi: 10.1056/NEJM200101043440101] [Medline: 11136953]
19. Appel LJ, Champagne CM, Harsha DW, Cooper LS, Obarzanek E, Elmer PJ. Writing Group of the PREMIER Collaborative Research Group. Effects of comprehensive lifestyle modification on blood pressure control: main results of the PREMIER clinical trial. JAMA 2003 Apr 23;289(16):2083-2093. [doi: 10.1001/jama.289.16.2083] [Medline: 12709466]

20. He FJ, MacGregor GA. Effect of longer-term modest salt reduction on blood pressure. Cochrane Database of Systematic Reviews 2004 Jan 26(1):1-3. [doi: 10.1002/14651858.cd004937]

21. Zou P. Diet and Blood Pressure Control in Chinese Canadians: Cultural Considerations. J Immigr Minor Health 2017 Apr 17;19(2):477-483. [doi: 10.1007/s10903-016-0493-0] [Medline: 27640010]

22. Topham DL. Traditional Chinese Medicine in Orthopaedic Nursing. Orthopaedic Nursing 1999;18(6):45?-52. [doi: 10.1097/0000006416-19991000-00009]

23. Xu Y. Perspectives on the 21st century development of functional foods: bridging Chinese medicated diet and functional foods. Int J Food Sci Tech 2001 Mar;36(3):229-242. [doi: 10.1046/j.1365-2621.2001.01-1.00461.x]

24. Cao Y. Introduction on History of Chinese Food Therapy (Chinese). Chinese Folk Therapy 2001;9:46-47. [doi: 10.1055/b-0034-67038]

25. Dahl M. Nutrition for Chinese populations. Health Care Food Nutr Focus 2004 Apr;21(4):8-9. [Medline: 15088473]

26. Wang B. The Yellow Emperor's Cannon Internal Medicine (Chinese). Beijing: Chinese Press of Science and Technology; 1997.

27. Kung T. Outline of the constitutional food-adjusting (Chinese). Academy of Zhejiang Chinese Medical University 2006;30(3):217-219.

28. Zhang XL, Wu F. Regimen in Traditional Chinese Medicine (Chinese). Beijing: China Press of Traditional Chinese Medicine; 2005.

29. Liu ZC. Basic Theories of Traditional Chinese Medicine (Chinese). Beijing: High Education Press; 2007.

30. Zou P. Traditional Chinese Medicine, Food Therapy, and Hypertension Control: A Narrative Review of Chinese Literature. Am. J. Chin. Med 2016 Dec 06;44(08):1579-1594. [doi: 10.1142/s0192415x16500889]

31. Chen HZ. The Diet of Adjustment and Nutrition (Chinese version). Beijing: People Military Press; 2003.

32. Yu S. Yellow Emperor's Internal Medicine (Chinese version). Beijing: Press of Zhao Hua; 2006.

33. Xu S, Niu B. Shen Long Ben Cao Jing (Chinese Version). Shijiazhuang: The Press of Science and Technology of Hebei; 1994.

34. Li S. Ben Cao Gang Mu. Beijing: The Press of Science; 1998.

35. Zhang Z. Shang Han Zha Bing Lun (Chinese version). Shijiazhuang: The Press of Science and Technology of Hebei; 1994.

36. Chen X. Effective Treatment Therapies of Traditional Chinese Medicine on Hypertension (Chinese version). Guangzhou: Press of Guangzhou; 2003.

37. Li W, Liu L, Puente JG, Li Y, Jiang X, Jin S, et al. Hypertension and health-related quality of life: an epidemiological study in patients attending hospital clinics in China. J Hypertens 2005 Sep;23(9):1667-1676. [doi: 10.1097/01.hjh.0000174971.64589.39] [Medline: 16093911]

38. Pan Y. Treatment and Adjustment with Chinese Medicine and Western Medicine on Hypertension. Hong kong: The Company of Tian Heng Culture Press; 2001.

39. Peng M. Food Therapy of Treatment for Four Seasons on Hypertension (Chinese). Zhengzhou: Press of Peasants in Middle Plain in China; 2004.

40. Liu Z, Yao C. The Nutritious Diet and Food Therapy on Common Chronic Diseases: Hypertension. Beijing: Press of People's Health; 2002.

41. Li J, Xie Y. Nature Therapy of Hypertension (Chinese version). Xian: Press of Shanxi Teaching University; 2005.

42. Hou X. A study on dietary therapy of noodle with high protein to patients with hypertension, hyperlipemia, diabetes (Chinese). Journal of Shangdong Agricultural University 1995;26:445-470 [FREE Full text]

43. Rong W. Treatment using single Semen Cassiae on 43 cases essential hypertension patients (Chinese). Heilongjiang Journal of Traditional Chinese Medicine 2003;4:24-25 [FREE Full text]

44. Tsi D, Das N, Tan B. Effects of aqueous celery (Apium graveolens) extract on lipid parameters of rats fed a high fat diet. Planta Med 1995 Feb 4;61(1):18-21. [doi: 10.1055/s-2006-957990] [Medline: 7700983]

45. Shen C, Pang SMC, Kwong EWY, Cheng Z. The effect of Chinese food therapy on community dwelling Chinese hypertensive patients with Yin-deficiency. J Clin Nurs 2010 Apr;19(7-8):1008-1020. [doi: 10.1111/j.1365-2702.2009.02937.x] [Medline: 20492045]

46. Fiske A, Wetherell JL, Gatz M. Depression in older adults. Annu Rev Clin Psychol 2009 Apr;5(1):363-389 [FREE Full text] [doi: 10.1146/annurev.clinpsy.032408.153621] [Medline: 19327033]

47. Stamler R. Implications of the INTERSALT study. Hypertension 1991 Jan 01;17(1 Suppl):I16-I20. [doi: 10.1161/01.hyp.17.1_suppl.i16] [Medline: 1986996]

48. Cook NEA, Cohen J, Hebert PR, Taylor JO, Hennekens CH. Implications of small reductions in diastolic blood pressure for primary prevention. Arch Intern Med 1995 Apr 10;155(7):701-709. [Medline: 7695458]

49. Zou P. Dennis C, Lee R, Parry M. Dietary Approach to Stop Hypertension with Sodium Reduction for Chinese Canadians (DASHNa-CC): A Pilot Randomized Controlled Trial. J Nutr Health Aging 2017 Dec 9;21(10):1225-1232. [doi: 10.1007/s12603-016-0861-4] [Medline: 29188883]

https://www.researchprotocols.org/2020/4/e15545

JMIR Res Protoc 2020 | vol. 9 | iss. 4 | e15545 | p. 9

(page number not for citation purposes)
50. Zou P. Recruitment process of a Chinese immigrant study in Canada. Appl Nurs Res 2017 Aug;36:84-87. [doi: 10.1016/j.apnr.2017.06.005] [Medline: 28720245]

51. Zou P, Dennis C, Lee R, Parry M. Hypertension Prevalence, Health Service Utilization, and Participant Satisfaction: Findings From a Pilot Randomized Controlled Trial in Aged Chinese Canadians. Inquiry 2017 Jan 01;54:46958017724942 [FREE Full text] [doi: 10.1177/0046958017724942] [Medline: 28853303]

52. Glanz K, Rimer B, Viswanath K. Health behavior and health education: Theory, research, and practice. San Francisco, California, United States: Jossey-Bass; 2008.

53. Goyal S, Morita P, Lewis GF, Yu C, Seto E, Cafazzo JA. The Systematic Design of a Behavioural Mobile Health Application for the Self-Management of Type 2 Diabetes. Can J Diabetes 2016 Feb;40(1):95-104. [doi: 10.1016/j.jcjd.2015.06.007] [Medline: 26455762]

54. Campbell NC, Murray E, Darbyshire J, Emery J, Farmer A, Griffiths F, et al. Designing and evaluating complex interventions to improve health care. BMJ 2007 Mar 01;334(7591):455-459. [doi: 10.1136/bmj.39108.379965.be]

55. Laws M, Heckscher RA. Racial and ethnic identification practices in public health data systems in New England. Public Health Reports 2002 Jan;117(1):50-61. [doi: 10.1161/s033-3549(04)50108-5]

56. Mays VM, Ponce NA, Washington DL, Cochran SD. Classification of race and ethnicity: implications for public health. Annu Rev Public Health 2003 Jan;24(1):83-110 [FREE Full text] [doi: 10.1146/annurev.publichealth.24.100901.140927] [Medline: 12668755]

57. Stinson JN, Jibb LA, Nguyen C, Nathan PC, Maloney AM, Dupuis LL, et al. Development and testing of a multidimensional iPhone pain assessment application for adolescents with cancer. J Med Internet Res 2013 Mar 08;15(3):e51 [FREE Full text] [doi: 10.2196/jmir.2350] [Medline: 23457457]

58. McCurdie T, Taneva S, Casselman M, Yeung M, McDaniel C, Ho W, et al. mHealth consumer apps: the case for user-centered design. Biomed Instrum Technol 2012 Sep;Suppl(2):49-56. [doi: 10.2345/0899-8205-46.s2.49] [Medline: 23039777]

59. Macriefd H. How To Specify the Participant Group Size for Usability Studies: A Practitioner’s Guide. Journal of Usability Studies 2009;5(1):34-45 [FREE Full text]

60. Hsieh H, Shannon SE. Three approaches to qualitative content analysis. Qual Health Res 2005 Nov;15(9):1277-1288 [doi: 10.1177/1049733305276687] [Medline: 16204405]

61. Schulz KF, Altman DG, Moher D, CONSORT Group. CONSORT 2010 Statement: updated guidelines for reporting parallel group randomised trials. BMJ 2010 Mar;340:c869 [FREE Full text]

62. Arain M, Campbell MJ, Cooper CL, Lancaster GA. What is a pilot or feasibility study? A review of current practice and editorial policy. BMC Med Res Methodol 2010 Mar 24;10(1):67 [FREE Full text] [doi: 10.1186/1471-2288-10-67] [Medline: 20637084]

63. Hertzog MA. Considerations in determining sample size for pilot studies. Res Nurs Health 2008 Apr;31(2):180-191. [doi: 10.1002/nur.20247] [Medline: 18183564]

64. Day SJ, Altman DG. Statistics notes: blinding in clinical trials and other studies. BMJ 2000;321(7590):504 [FREE Full text] [doi: 10.1136/bmj.321.7590.504] [Medline: 10948038]

65. Wu W, Johnson R, Schepp KG, Berry DL. Electronic Self-report Symptom and Quality of Life for Adolescent Patients with Cancer. Cancer Nursing 2011;34(6):479-486. [doi: 10.1097/ncc.0b013e31820a5bdd]

66. Dwyer J, Picciano MF, Raiten DJ. Collection of food and dietary supplement intake data: What We Eat in America-NHANES. Am. J. Chin. Med 2016 Dec 06;44(08):1579-1594 [FREE Full text] [doi: 10.1142/s0192415x16500889] [Medline: 27538008]

67. Chahine, Topouchian J, Blacher J, Assemani N, Asmar R, Ibanez I, et al. Validation of four devices: Omron M6 Comfort, Omron HEM-7420, Withings BP-800, and Polygreen KP-7670 for home blood pressure measurement according to the European Society of Hypertension International Protocol. VHRM 2014 Jan;33. [doi: 10.2147/vhrm.s53968] [Medline: 24320217]

68. Zhou B, Stamler J, Dennis B, Moag-Stahlberg A, Okuda N, Robertson C, INTERMAP Research Group. Nutrient intakes of middle-aged men and women in China, Japan, United Kingdom, and United States in the late 1990s: the INTERMAP study. J Hum Hypertens 2003 Sep 18;17(9):623-630 [FREE Full text] [doi: 10.1088/sj.jhh.1001605] [Medline: 13679952]

69. Zou P. Traditional Chinese Medicine, Food Therapy, and Hypertension Control: A Narrative Review of Chinese Literature. Am. J. Chin. Med. 2016 Dec 06;44(08):1579-1594. [doi: 10.1142/s0192415x16500889] [Medline: 27538008]

70. Chahine, Topouchian J, Blacher J, Assemani N, Asmar R, Ibanez I, et al. Validation of four devices: Omron M6 Comfort, Omron HEM-7420, Withings BP-800, and Polygreen KP-7670 for home blood pressure measurement according to the European Society of Hypertension International Protocol. VHRM 2014 Jan;33. [doi: 10.2147/vhrm.s53968] [Medline: 24320217]

71. Zou P, Dennis C, Lee R, Parry M. Hypertension Prevalence, Health Service Utilization, and Participant Satisfaction: Findings From a Pilot Randomized Controlled Trial in Aged Chinese Canadians. Inquiry 2017 Jan 01;54:46958017724942 [FREE Full text] [doi: 10.1177/0046958017724942] [Medline: 28853303]

72. Mason C, Katzmarzyk PT. Effect of the site of measurement of waist circumference on the prevalence of the metabolic syndrome. Am J Cardiol 2009 Jun 15;103(12):1716-1720. [doi: 10.1016/j.amjcard.2009.02.018] [Medline: 19539081]

73. Mason C, Katzmarzyk PT. Variability in waist circumference measurements according to anatomic measurement site. Obesity (Silver Spring) 2009 Sep 02;17(9):1789-1795 [FREE Full text] [doi: 10.1038/oby.2009.87] [Medline: 19343017]

74. DhalIWAL SS, Welborn TA. Measurement error and ethnic comparisons of measures of abdominal obesity. Prev Med 2009 Aug;49(2-3):148-152. [doi: 10.1016/j.ypmed.2009.06.023] [Medline: 19589354]
75. Ware JE. SF-36 health survey update. Spine (Phila Pa 1976) 2000 Dec 15;25(24):3130-3139. [doi: 10.1097/00007632-200012150-00008] [Medline: 11124729]

76. Ware JE, Sherbourne CD. The MOS 36-Item Short-Form Health Survey (SF-36). Medical Care 1992;30(6):473-483. [doi: 10.1097/00005650-199206000-00002]

77. Dennis CL, Hodnett E, Gallop R, Chalmers B. The effect of peer support on breast-feeding duration among primiparous women: a randomized controlled trial. CMAJ 2002 Jan 08;166(1):21-28 [FREE Full text]

78. Walker R, Morris DW, Greer TL, Trivedi MH. Research staff training in a multisite randomized clinical trial: Methods and recommendations from the Stimulant Reduction Intervention using Dosed Exercise (STRIDE) trial. Addict Res Theory 2014 Dec 18;22(5):407-415 [FREE Full text] [doi: 10.3109/16066359.2013.868446] [Medline: 25379036]

79. Babu GR, Karthik M, Ravi D, Ana Y, Shriyan P, Hasige KK, et al. What makes the pregnant women revisit public hospitals for research? Participant engagement and retention trial in a public hospital (PERTH): an RCT protocol. BMC Pregnancy Childbirth 2018 Sep 12;18(1):369 [FREE Full text] [doi: 10.1186/s12884-018-2000-1] [Medline: 30208868]

80. Popkin BM, Adair LS, Ng SW. Global nutrition transition and the pandemic of obesity in developing countries. Nutr Rev 2012 Jan;70(1):3-21 [FREE Full text] [doi: 10.1111/j.1753-4887.2011.00456.x] [Medline: 22221213]

81. Perkovic V, Huxley R, Wu Y, Prabhakaran D, MacMahon S. The Burden of Blood Pressure-Related Disease. Hypertension 2007 Dec;50(6):991-997. [doi: 10.1161/hypertensionaha.107.095497]

82. Plaisted CS, Lin P, Ard JD, McClure ML, Svetkey LP. The Effects of Dietary Patterns on Quality of Life. Journal of the American Dietetic Association 1999 Aug;99(8):S84-S89. [doi: 10.1016/s0002-8223(99)00421-6]

Abbreviations

- **DASH**: Dietary Approach to Stop Hypertension
- **DASHNa-CC**: Dietary Approach to Stop Hypertension with Sodium (Na) Reduction for Chinese Canadians
- **mDASHNa-CC**: Mobile Dietary Approach to Stop Hypertension with Sodium (Na) Reduction for Chinese Canadians
- **SF-36v2**: Medical Outcomes Study 36-Item Short-Form version two
- **TCM**: Traditional Chinese Medicine

©Ping Zou, Jennifer Stinson, Monica Parry, Cindy-Lee Dennis, Yeqin Yang, Zhongqiu Lu. Originally published in JMIR Research Protocols (http://www.researchprotocols.org), 02.04.2020. This is an open-access article distributed under the terms of the Creative Commons Attribution License (https://creativecommons.org/licenses/by/4.0/), which permits unrestricted use, distribution, and reproduction in any medium, provided the original work, first published in JMIR Research Protocols, is properly cited. The complete bibliographic information, a link to the original publication on http://www.researchprotocols.org, as well as this copyright and license information must be included.