Title Page

Establishing a process to translate and adapt health education materials for natives and immigrants: the case of Mandarin adaptations of cardiac rehabilitation education

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CRediT author statement

XL: methodology, software, formal analysis, investigation, resources, writing (original draft), visualization, project administration. GLMG: conceptualization, methodology, software, formal analysis, investigation, resources, writing (original draft), visualization, and project administrator. SM: investigation, resources, writing (review and editing). SLG: conceptualization, methodology, writing (original draft), project administration. WS: investigation, resources, writing (original draft). LZ: investigation, resources, writing (review and editing). RG: conceptualization, writing (review and editing). PO: conceptualization, methodology, writing (review and editing). CA and NS: conceptualization, writing (review and editing). BD and YZ: investigation, resources, writing (review and editing), supervision.

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Structured Abstract

Background: Cardiac rehabilitation (CR) is a proven model of secondary prevention in which patient education is a core component.

Objectives: To translate and culturally-adapt CR patient education for Mandarin-speaking patients living in China as well as immigrants, and offer recommendation for best practices in adaptation for both.

Methods: These steps were undertaken in China and Canada: 1) preparation; 2) translation and adaptation; 3) review by healthcare providers based on PEMAT-P; 4) think-aloud review by patients; and 5) finalization.

Results: Two independent Mandarin translations were undertaken using best practices: one domestic (China) and one international (immigrants). Input by 23 experts instigated revisions. Experts rated the language and content as culturally-appropriate, and perceived the materials would benefit their patients. A revised version was then administered to 36 patients, based on which a few edits were made to optimize understandability.

Conclusions: Some important differences emerged between translations adapted for native versus immigrant settings.

Keywords: Patient Education as Topic; Cardiac Rehabilitation; Health Education; Translating; Asian Continental Ancestry Group.

Abbreviations List

CAD = Coronary Artery Disease

CR = Cardiac Rehabilitation

CVD = Cardiovascular diseases

HAPA = Health Action Process Approach

ISPOR = The Professional Society for Health Economics and Outcomes Research

PEMAT-P = Patient Education Materials Assessment Tool for Printable Materials

REDCap = Research Electronic Data Capture

Introduction

The growing burden of cardiovascular diseases (CVD) in China has rendered it a major public health issue, with 11 million people living with coronary artery disease (CAD).[1] Moreover, consistent with overall increases in global migration, many Chinese people have resettled in Asian, but also Western, countries (e.g., Unites States, Canada);[2] this renders control of CVD an issue for Chinese people elsewhere as well. Indeed, in 2019, Chinese-born migrants were the third largest foreign-born population in the world, with nearly 11 million people living outside of China.[3] While immigrants are often healthier than their non-immigrating counterparts, over time the stresses of acculturation and adoption of Western lifestyles increase the risk of CVD.[4,5] The burden of CVD in Chinese immigrants is also then important to address,[6,7] particularly given their higher mortality after hospitalization.[8] Secondary prevention strategies – particularly where they are culturally-relevant and hence readily implementable by patients[9-12] – can mitigate this burden.

Cardiac rehabilitation (CR) is a well-established model of secondary prevention.[13] Patient participation reduces CVD mortality by approximately 25% and hospital readmissions by 18% compared to usual care.[14] CR delivers internationally-agreed core components, including centrally patient education.[15] Indeed, results from systematic reviews demonstrate the benefits of educational interventions in cardiac patients, with regard to patient knowledge,[16] health behavior change,[17-20] depression and anxiety levels,[21] quality of life,[22] recurrent events,[17] hospitalizations;[21] education provision may also reduce healthcare costs.[21,22] A recent meta-analysis also demonstrates the benefits of education interventions in adult Chinese cardiac patients specifically, on health behaviors, disease-related knowledge, and quality of life.[23]

Despite these well-established benefits and hence referral recommendations in clinical practice guidelines for CVD,[24] CR programs are not sufficiently available,[25] with the second greatest need of any country globally in China.[26] Thankfully, the number of CR programs is also growing at the fastest rate of any country globally in China.[27] However, there are no evidence-based and validated CR education materials in the Chinese language available to our knowledge, also then that are applicable to Chinese culture and hence of optimal patient utility; if patients do not receive comprehensive information that is understandable and applicable to them, this could reduce the potential benefit of patient education for improving patient outcomes. Moreover, given the large number of Chinese who have migrated and their increased CVD burden as outlined above, it is incumbent upon us as healthcare professionals to offer this population patient education they can understand, and that can be applied in their context.[28] While it is not feasible to offer this in all CR programs as they would not have available staff with all needed language skills, having online resources available could bridge this gap, particularly considering self-directed educational programs are preferred by most Chinese cardiac patients.[29]

Cardiac College™ is the only standardized, comprehensive, evidence-based, online, multi-media patient education intervention freely-available worldwide to our knowledge. It was developed through a rigorous process, informed by adult learning principles[30] and the Health Action Process Approach (HAPA),[31] in partnership with patients and global CR experts.[32] It is comprised of 5 modules delivered in-person, in print and/or online (interactive, mostly asynchronous), addressing the nature of CVD and its' medical management, heart health behaviour change, and psychosocial well-being. The impact of Cardiac College,™ and patient satisfaction with the materials are well-established.[33-35] Cardiac College™ is now available in eight languages, and these effects have been tested and established for the English,[33] French,[33]

Spanish,[34] and Portuguese[35] versions to date. However, we have not yet rigorously considered how applicable translations are to natives of those languages in their home countries, as well as for the immigrants for which they were designed.

Given the above, there is a need for a Simplified Chinese version of Cardiac College™ applicable to Mandarin-speaking patients, wherever they live. However, context must be carefully considered. For example, dietary advice needs to be appropriate to locally-available and commonly-eaten foods; this can be very different within China, but also when compared to the many countries where Chinese people immigrate such as Canada and Australia.[36] By translating and adapting patient education materials for patients in their home countries and those where they most commonly immigrate at the same time, efficiency and quality could be optimized. Yet, we could find no direction in the literature on methods or best practices to achieve this.[37] Therefore, the aim of this study was to: (1) translate and culturally-adapt the Cardiac College™ educational materials for Mandarin-speaking people living with CVD in China (domestic version) and elsewhere (international), and (2) forward a rigorous process for translation and adaptation of any patient education interventions applicable to both natives and many immigrants.

Methods

Design

A series of five steps, including reviews, qualitative and quantitative sub-studies were followed in parallel in China (domestic version, applicable for China and potentially Chinese immigrants in neighboring Asian countries) and Canada/Australia (international version, applicable for Chinese immigrants to "Western" countries; Figure 1).

Ethics approval was obtained from the review board of all hospitals where CR programs were located in both countries. This study was undertaken between December 2018 and April 2021. All participants provided written informed consent.

CR Patient Educational Materials: Cardiac College™

Cardiac College™ aims to help people understand their heart disease and its' treatment, and take control of their health (https://www.healtheuniversity.ca/EN/Pages/default.aspx). The goals underpinning the design and development of the College[32] are to reduce barriers to access, as well as enable knowledge acquisition and heart-health behaviours, to ultimately improve patient outcomes. All content is written in plain language to ensure clear and actionable messaging for a diverse audience. Cardiac College™ content, covering 5 modules (Table 1), is delivered in the following formats:

- Nine booklets (PDFs online available for download): Treat Heart Disease (4 booklets), Get Active (1 booklet), Eat Healthy (1 booklet), Feel Well (2 booklets), and Take Control (1 booklet).
- Slide presentations: a set of 18 PowerPoint files (approximately 3/module) to support delivery of the patient education curriculum by the CR team in interactive lectures, with each education session approximately 30 minutes in duration. Each session slide set is ordered as follows: introduction (2-3 slides including title, review slide on past week's topic and session learning objectives), content (6-10 slides), and conclusion (2-3 slides including next steps and preparation for the next session).
- Website: in English, there is also a website which includes 69 educational videos (including recipes and resistance training videos), 87 downloadable PDFs with

tools to support self-management, as well as online and live educational sessions. Furthermore, there is a 12-week online learning program (https://www.healtheuniversity.ca/EN/CardiacCollege/THRIVE/), which is also available in French, Portuguese, and Spanish.

Procedures, Measures and Analysis by Phase

Phase 1: Preparation

The first step involved the assembly of a multi-disciplinary team, including representation from all relevant stakeholder groups related to this project. The team was comprised of the following members: three experts in patient education, translation and adaptation of materials (GLMG, CA, YqZ), Cardiac College™ developers, including three physicians with expertise in CR delivery and heart treatments (PO, NS, SM), Chinese registered nurses specialized in cardiac care, including one with a PhD degree working clinically with Chinese immigrants in Australia (LZ) and two PhD candidates (WS and XL, the latter working clinically with cardiac patients in China), two nurse experts in CR delivery (RG in Western settings and BD in China), and a global leader in delivery of CR in low-resource settings (SG). All Chinese-born members of the team outside China were fully bilingual.

The first phase also involved literature reviews on several topics, including a rapid grey literature search regarding best practices in translation and cultural adaptation. The review strategy was intended to be broad, inclusive and capture as much relevant literature as possible to inform our subsequent work. For the best practices search, we followed recommended processes,[38] including searching online databases that included grey and peer-reviewed literature, and repositories. We also undertook web searches using Google and Google Scholar, hand-searched some relevant identified conference proceedings, checked reference lists from relevant

publications, as well as finally consulting with content experts, stakeholders and review team members.

The first systematic search focused on the information needs and health literacy levels of Chinese-speaking CVD patients in China and elsewhere. The search strategy for Medline, shown in Appendix 1, was developed with direction from an information specialist. Second, a systematic review on the availability and effects of education interventions on health behaviours and outcomes in Chinese cardiac patients, with particular focus on how effective interventions were structured, was also undertaken. Details are available elsewhere.[24] Finally, we undertook an environmental scan on the availability of patient education materials in China, and contacted China Heart Federation's Cardiovascular Disease Prevention and Rehabilitation Professional Committee to understand the patient education needs of CR programs developing in China.

In regards to analytic approach for this phase, analysis of the systematic review is reported elsewhere.[23] For the rapid grey literature search, two people independently vetted identified citations; data from included studies was extracted and summarized, and used to inform this work.

Phase 2: Translation, adaptation, reconciliation and harmonization

Based on the reviewed best practices in translation and adaptation,[39] the second phase involved the following four steps:

1. Forward translation: the materials (i.e., booklets and slides) in the source language (English) were translated into the target language (Simplified Chinese). Based on the information gathered from phase 1, two separate translations were performed, using different types of translators. While using certified translators is recommended,[39] given one would be done in this manner and the versions would be reconciled, we decided to use healthcare providers for

the other. We perceived this would ensure clinical accuracy, help to reduce medical "jargon" which translators would likely not know how to express in "lay" language to ensure the materials were at the appropriate level of health literacy, and optimize cultural adaptation. The translation in China ("domestic" version) was undertaken by 9 bilingual healthcare providers, including 7 medical doctors with PhD degrees and 2 head nurses with master's degrees, from the setting specified below. Each healthcare provider translated a specific booklet related to their area of expertise, and another 2 members of the team proofread and reviewed the translations before the next step, discussing any queries with XL. Any disagreements were reviewed within the group. The translation in Toronto, Canada for the "international" version was undertaken by a team of certified translators from a third-party company.

2. Reconciliation of both translations with the English version, and cultural adaptation: A group of 4 healthcare providers (1 medical doctor and 3 nurses) reviewed the two translated versions, with the aim of identifying differences and similarities with the original version and ensuring cultural relevance. In this process, the team carefully considered ethnocultural differences in terms of customs (including family structures), values (e.g., filial piety), and beliefs (e.g., value of Traditional Chinese Medicine).
3. Back-Translation and Back-Translation Review: the two Chinese versions of the materials were back-translated to the source language (English); again, this was done by certified translators for the international version. For the domestic version, a nurse with a bachelor's degree with experience overseas and another English translator without a medical background back-translated the title pages and one page of each booklet separately. Two nursing PhD students engaged in CR research (WS and XL) jointly completed the back-

translation review. For practical purposes, a more literal (not conceptual) back translation was created of parts of the booklets. Discrepancies between the original and the back-translated versions were discussed between team members, with decisions on final wording made by consensus.

4. Harmonization between domestic and international versions: The team, led by a nursing teacher with a master's degree and XL, examined differences between the 2 translated and adapted versions. Their goal was to ensure accuracy in relation to the source version, while working towards the greatest consistency between the two translations as possible, but also ensuring appropriate adaptations to context. Regular videoconferencing meetings to review all booklets and slides were held until consensus was achieved.

After these four steps, the two versions were then prepared for graphical finalization, including consideration of any image changes needed.

Phase 3: Expert review

Healthcare providers who were not involved in the translation and who considered Simplified Chinese as their first language were contacted to give input on the booklets. Experts were sought in each CR area (e.g., exercise physiologists for the exercise booklets, doctors for the physiology booklets, nurses for self-management, dietitians for nutrition booklets). These experts were identified through team member contacts and online searching (e.g., publications, International Chinese medical associations, healthcare providers speaking Mandarin). Sampling was purposive, with the aim to secure input from experts in both rural and urban areas across China, Canada and Australia. Consenting experts were asked to review as many applicable booklets as they were willing. We ensured each booklet was reviewed by ≥2 experts, but continued soliciting input until no major concerns were raised on each.

For both versions, experts provided signed informed consent, were provided the booklets and slides corresponding to their chosen content area(s), and then were asked to provide input including completion of the Patient Education Materials Assessment Tool for Printable Materials (PEMAT-P).[40] For the domestic version, potential experts were contacted via phone call or wechat, and the materials were completed on hard copy forms and mailed (pre-paid return envelope provided). For the international version, recruitment, consent and data collection were undertaken electronically. The survey was administered via Research Electronic Data Capture (REDCap).[41] Each expert reviewed 1-4 booklets.

The PEMAT-P is a psychometrically-validated self-report instrument that assesses the understandability (17 items) and actionability (7 items) of printed patient education materials.[39] All item response options are "Disagree" (0 points) or "Agree" (1 point), and some "Not Applicable". Scale scores (ranging from 0-100%) are computed by summing the points, dividing by the possible number of items (excluding not applicable responses) and multiplying by 100; the higher the score, the more understandable or actionable the material.[42] We also asked experts to rate the materials with respect to cultural appropriateness, perceived benefit, and understandability, using investigator-generated questions with Likert-type response options ranging from 1=strongly disagree to 5=strongly agree. Finally, they were asked to track edits and make suggestions directly in the booklets and session slide files.

PEMAT-P scores were analyzed with SPSS 25.0. If individual item scores were below 70%, we considered applicable approaches to edit and improve the materials. We then re-administered the materials until scores were above this threshold. Open-ended suggestions provided were also carefully considered by the team, and edits made as appropriate. The type of change was codified based on best practices[39,43-45] as incorrect information, word accuracy,

improving readability, cultural appropriateness, and formatting. Input received was considered by the team during monthly videocalls. Where there was consensus, revisions would be made, and the revised version used in subsequent evaluations.

Phase 4: Patient review

Next, the revised materials were tested in target patients to ensure understandability and cultural relevance of the translations, using the think-aloud technique.[46,47] This is a process-tracing technique used to understand the sequence of thoughts behind processing materials. With informed consent, patients were instructed to read the booklets and say their thoughts aloud while doing so. If the content was unclear or needed information was missing, the patients were directed to also say that out loud; interviewers made corresponding notes on a second copy of materials. A semi-structured interview ensued; the interview guide was based on the PEMAT-P (Appendix 2).[40]

Inclusion criteria were CAD diagnosis, as well as ability to read and understand the education materials. Exclusion criteria were: having severe complications or a mental condition that would preclude patients from reading the materials. Each patient read 1-3 booklets as they were willing (slides were not assessed in this phase); continued recruitment was planned until no further actionable thoughts or themes were raised (i.e., saturation).

This was undertaken individually or in groups in-person in Mandarin in China (domestic version of booklets), and individually virtually in Canada (international version of booklets). For the domestic version (China), patients from a cardiac inpatient unit (see setting below) read the booklets in a conference room in the presence of their doctors and a nurse. For the international version (Canada), CR attendees from three programs in the Greater Toronto Area that could speak both English and Simplified Chinese were invited to participate. Interviews were held in

English through a videoconferencing platform, led by 1-2 researchers (with at least one of them being fluent in Simplified Chinese), but participants read the booklets aloud in Mandarin and were invited to make comments in either English or Mandarin.

These sessions, on average 20-30 minutes in length (depending on the number of booklets), were audio-taped. Audio-recordings were transcribed verbatim, except to preserve anonymity. For the patient review in China (domestic version), transcripts were content analyzed[48] independently by two members of the research team (XL and SM) and for the international version it was analyzed independently by one member and reviewed by others, if needed (GG, XK, WS). For the patient review in Canada (international version), when patients provided comments in Mandarin, the transcribed content was translated by a team member (WS) to English. Suggested edits and wording changes (if any) for each version were decided by the independent bilingual research team members through consensus.

Settings for Data Collection

Both the recruitment of translators (domestic version) and patient data collection in China was done in the cardiology department of Shanghai Xinhua Hospital, a tertiary hospital in Shanghai where revascularization procedures are performed. More than 5000 cardiac patients are discharged every year from the hospital. There is a CR program affiliated with the department.

Canada is home to 1.3 million Chinese people.[36] Canadian patient data were collected in the Greater Toronto Area, among the top 5 most diverse cities in the world.[49] Data collection took place at 3 CR programs located in the following healthcare institutions: Toronto Rehabilitation Institute (outpatient, academic hospital), Toronto Western Hospital (community-based, inpatient, academic hospital) and Carefirst. The CR programs at the hospitals, where Cardiac College™ originates, serve approximately 2,400 patients each year. Carefirst is a

community-based healthcare centre (primarily primary care), with a focus on serving the Chinese community. They offer chronic disease management programs including patient education delivered by a multi-disciplinary team.

Phase 5: Finalization

Finally, booklet and slide edits were reviewed overall, considering content revisions and images, and finalized by the team. Final differences between the domestic (China) and international versions (Canada) were revisited, confirmed, and then tabulated. Booklets were sent for publishing, and then distribution.

Results

Phase 1: Preparation

First, the literature search identified 31 references, of which 12 provided information on information needs and health literacy levels of Chinese cardiac patients, which was used to inform this work. Native Chinese cardiac patient's CVD information needs are many,[50-53] with needs related to psychological care, social support and behaviour change lower in native Chinese patients compared to other cultural groups.[50,53] Yet, studies have shown an important gap in native Chinese cardiac patients' learning in the area of psychosocial health, with patients often ignoring information provided in this area despite its' importance;[54] this gap is made worse by the fact that many organizations do not provide psychological care and social support in China.[50,55,56]

In addition, Chinese immigrants appear to have higher educational needs compared to natives,[53] which has also been reported in the literature in other patient groups.[57-59] Information needs also differed with patients' educational level, such that patients with lower educational attainment had higher needs in all areas including the heart, nutrition, exercise, medication,

social relationships, psychological factors, emergency and safety, diagnosis and treatment, and risk factors.[50,52,53]

The review also revealed that both native and immigrant Chinese patients alike and their physicians often fail to communicate effectively about CVD care, leaving patients in great need for education.[60,61] The literature review also showed that structured education interventions are usually well-accepted by native and immigrant Chinese cardiac patients, who have relatively good adherence to secondary prevention programs, and hence could learn alot.[60,61] Finally, studies assessing health literacy levels of native and immigrant Chinese cardiac patients identified these groups have inadequate health literacy.[62-66]

Second, the systematic review on the availability and effects of education interventions on health behaviours and outcomes in native and/or immigrant Chinese cardiac patients yielded 2809 results, of which 18 randomized controlled trials were included. Results suggested that education interventions are effective in improving Chinese patients' physical activity, dietary habits, medication adherence, and health-related quality of life. However, there was inconsistency in reporting of education intervention elements, and few studies (n=3), although positive, assessed disease-related knowledge of patients; therefore, there was unfortunately no direction to inform our work specifically. Detailed results are reported elsewhere.[23]

With regard to the environmental scan, the International Council of Cardiovascular Prevention and Rehabilitation's global audit of CR programs revealed patients in China receive an average of only 4.2 education sessions per program, which is less half of what is offered globally; when also considering the length of education sessions, ultimately Chinese patients receive one-third of the total minutes of education that is received by CR patients on average globally (133 vs 400 minutes).[67] Ultimately we were not able to identify a rigorously-developed

education intervention that included all core CR components designed for Chinese-speaking patients, further supporting the need for this work.

Finally, for the rapid grey literature search for best practices, a few approaches to translation and cultural adaptation were considered to be the most relevant and rigorous, and henced formed the basis of our methods.[39,43,44,68] The Professional Society for Health Economics and Outcomes Research (ISPOR) Task Force for Translation and Cultural Adaptation process in particular is excellent for translation methods, and an update did consider issues regarding culturally adapting for natives and immigrants.[69] Other sources suggest cultural adaptation is optimized with qualitative work in the form of individual or group interviews with members of the target culture, and pre-testing of the translated version in a group of target users.[45,70]

Thus, using the information regarding the health literacy level of native and immigrant Chinese patients, their information needs/ knowledge, and the acceptability and impact of patient education in this population, we formalized a 5-phase process to develop in parallel a domestic and international translation of Cardiac College™ in Simplified Chinese based on ISPOR,[39] but added processes to culturally adapt each version for their context, before verification in accordance again with ISPOR (Figure 1).

Phase 2: Translation, adaptation, reconciliation and harmonization

Steps 1-4 were performed as planned. In steps 2 and 3, 37 discrepancies were identified between the 2 versions with the English. The team(s) concurred 16 did not need to be corrected; the remaining 21 discrepancies were modified either to improve accuracy or cultural appropriateness.

At the fourth and final step of this phase, 42 differences between the domestic and international versions were identified. Forty changes were made to improve word accuracy or

readability, and 2 to ensure cultural appropriateness (final differences between the versions after all phases are shown in Table 3).

Phase 3: Expert Review

Table 1 presents PEMAT-P and other ratings for each booklet for the domestic and international versions of the materials. For the domestic version, 10 experts participated, including 2 nurses, 2 physicians, 2 dietitians, 2 pharmacists and 2 physical therapists. These professionals had a mean of 12.6±12.2 years providing care for cardiac patients, and a mean of 38.3±10.0 years living in China. All PEMAT-P scores were 70% or above. The Understandability Score ranged from 81% to 100%, and the Actionability Score ranged from 70% to 97%. The scores for the booklet *Taking your heart medicines* were the lowest for both the PEMAT-P and investigator-generated items.

Table 2 presents a summary of changes in the domestic version by booklet based on expert review in China. Two pharmacists raised 9 suggestions to improve the translation, and clarified the different brand names of medications available in China; Changes were made accordingly. Overall, 43 changes were made to 5 booklets based on the expert's reviews, with 30 being to improve cultural appropriateness, 6 to increase readability, 3 due to incorrect information, and 4 to increase accuracy. For the following booklets, no changes were required based on the expert's review: *Common tests and treatments*, *Managing stress for a healthy heart*, *Enjoying a healthy relationship and sexual intimacy*, and *Setting goals for a healthy heart*.

For the international version, 13 healthcare providers agreed to review the materials: 6 nurses, 5 physicians and 2 dietitians from China, Australia and Canada. These professionals had a mean of 14.8±9.6 years providing care for cardiac patients, and a mean of 32.1±12.4 years living outside of China, if applicable. All PEMAT-P understandability and actionability scores

were higher than 75%. Overall, language and content of all booklets were considered culturally appropriate to Chinese immigrants. Experts identified that these materials would benefit their practice and/or their patients, that they were easy to understand and without major issues.

Based on comments provided by the experts in their open-ended specific input, the booklets were edited; Table 2 also presents a corresponding summary of changes in the international version by booklet. Per booklet, the mean number of changes to increase readability was 13.0±8.4, the mean number of changes related to word accuracy was 7.0±4.4, the mean number of changes related to cultural appropriateness was 2.9±3.7, the mean number of changes due to incorrect information was 2.4±3.1, and the mean number of changes related to formatting was 1.4±1.9.

In regard to the slides, for the domestic version there were no changes in design and length, however three cultural adaptations were made. These were related to exercise safety (emergency number changed to a national one), exercise in cold and hot weather (air quality health index changed to a national one), and how to choose heart healthy foods (conversion of ounces to grams). For the international version, slides were condensed and simplified, with more images and videos added. Experts that reviewed both versions of these materials stated the slides would be very useful for educating patients.

Phase 4: Patient Review

For the domestic version, 35 Chinese patients and 1 family member (58.3% male, mean age = 58.2±11.7 years, 83.0% post-Percutaneous Coronary Intervention) from the cardiac inpatient unit read the printed booklets using the Think Aloud protocol. Six patients reviewed booklet 1, 9 booklet 3, 10 booklet 5 and 4 booklet 8; the other booklets were reviewed by 8 patients each. Patients gave 28 suggestions, with 20 being related to cultural appropriateness and

8 concerning readability. For the international version, 3 Chinese patients (33.3% male, mean age = 60.3±1.0 years old) from the community-based healthcare centre read the printed booklets using the Think Aloud protocol. Each patient reviewed 4 booklets each (booklets 2, 3, and 5 were reviewed by 2 patients and the others by one patient only). Patients gave 5 suggestions, all of them related to readability. Corresponding edits were made based on patients' input for both versions (Table 4).

As for the semi-structured interview at the end of the Think-Aloud sessions, content analyses revealed the following in both versions: information was comprehensive and addressed their needs, the format/length was acceptable, content was applicable and feasible, and they would apply the information in the booklets in their life. There were also some suggestions for the domestic version, such as that although the materials were good, the translation was not "smooth" and needed editing in some parts. The content was easily understood but it was long, so patients suggested user-friendly modes to read and disseminate the booklets such as wechat, barcodes, face-to-face, or other synchronous interaction. Patients were very interested in the diet materials; they wished there could be more education about the heart-healthiness of traditional Chinese cuisine, such as steamed stuffed buns and soybean oil, and wondered how should they eat if they have complications such as gout or diabetes. Overall, all patients gave high praise for the education material, and wished to receive the 9 booklets once complete.

Phase 5: Finalization

The domestic and international revised booklets were then reviewed by the research team, as well as the slides subsequent to the expert review. Cultural distinctions between the booklets, summarized in Table 3, were considered appropriate given the findings of the literature review[50-53,55, 56, 57-66,71-74] and experience of the team with patients in both settings. Consensus

was achieved on the final versions. The domestic version (booklets and slides) is available in PDF upon request from the first author, and the international version (booklets) is available in PDF form at: https://www.healtheuniversity.ca/zh/CardiacCollege/Pages/default.aspx. Slides for the international version are available upon request from the second author.

Discussion

The burden of CVD in Chinese natives and immigrants is high, however, CR programs – a Class 1A recommendation for CVD care[75] – are not readily-available worldwide; and where they are, they do not always offer comprehensive patient education, and not always in patient's first language.[76] The need to provide educational resources for China and the Chinese was clear from the literature review, and appropriate translation and adaptation of educational materials was a vital first step towards wide-scale availability of such evidence-based materials. Through this multi-method study, a systematic way of translating and adapting educational materials in one language for multiple contexts where they are needed has been forwarded. The process was 5-fold: (1) preparation, (2) translation, adaptation, reconciliation, and harmonization, (3) expert review, (4) patient review, as well as (5) finalization and dissemination. Through testing this process, a domestic (specific for China, but likely also applicable to immigrants in Asian countries) and an international (for Mandarin-speaking immigrants in Western settings) version of a CR education program have been created, with which patients and experts alike were satisfied with the content, word choice and style, use of numbers and visual aids, organization, layout and design.

Culture was foremost through this process. It was considered in the literature reviews, translations, expert as well as patient review. Indeed, through this process, many cultural adaptations were made, including reference to Traditional Chinese Medicine, different physical

activities, foods, and preferred sources for information. Given the findings, including family in the education process would be prudent where possible.

In terms of best practices for the translation and cultural adaptation of educational materials in the same language but for use in different settings, our group recommends the following: 1) involve stakeholders from the beginning and throughout the process. Include members in the team that developed and studied the original intervention, as well as stakeholders associated with the new population and context to ensure cultural appropriateness; 2) learn as much as you can about the population that will use these materials. Literature searches, needs assessment, and multiple encounters with them are recommended; 3) pilot materials with the target population; and 4) document the entire process for transparency and potential future deliberation. Increases in migration globally buttress the great need for cross-cultural adaptation of materials, thus we hope the process undertaken by our team and associated learnings can benefit others. We invite others to use this process, and refine it based on their experience, so a robust, generalizable process can be forwarded. Although resources are required for translation which can render this infeasible in low-resource settings, by partnering with regions where immigration is high, resources can be shared.

There are clinical and research implications of this work. The Chinese version of Cardiac College™ can be a potential value-added component to CR programs designed for Mandarin-speaking CVD patients, both in China and internationally. We understand it is not feasible to tailor these materials to all different groups for a full program, but offering components of CR tailored to culture and language is warranted, in accordance with context. Availability of translated and adapted patient education materials that patients can review on their own could overcome patient barriers to CR use and self-management,[77] and hence reduce inequities in

access and care. This work provides a replicable model that other researchers and clinicians can use, not only for education materials, but potentially for measures and other interventions too.

There are several directions for future research stemming from this work, in addition to those raised above. First, for this version to be considered evidence-based, there is a need to evaluate how effective these materials are in native and international Mandarin-speaking patients. Our team will evaluate these materials in CR programs in China, Canada, and Australia, assessing its effects on knowledge, health behavior, functional capacity and risk reduction. Research is also needed on how these educational materials can be successfully integrated into existing CR programs, both those delivered in Mandarin or other languages. This should include identification of barriers and facilitators to their use by staff and patients alike (e.g., are the slides useful to staff and engaging to patients? Can patients in programs with few other Mandarin-speaking patients independently use the booklets?), acceptability by patients, satisfaction, and ultimately CR adherence.

Caution is warranted in interpreting these results. First, although we followed the same 5-phase process for the domestic and international versions, there were some differences. Second, some of the booklets were reviewed by only one expert or patient, so saturation was not achieved. Third, although we have created a version of materials to be used for Mandarin-speaking patients in China and beyond, there are different norms in health practices and behaviours within China and in the countries where they commonly immigrate. Thus, while the domestic version may be applicable for Chinese in Indonesia, Thailand or Malaysia (countries with the most overseas Chinese) and the international version for Chinese in the United States (Western country with the most overseas Chinese), a cultural review of these materials is warranted before use in other countries.[69] Finally, while efficacy has been demonstrated for other

language versions of Cardiac College™,[33-35] this study does not demonstrate the effectiveness of this educational intervention in Mandarin-speaking patients domestically or internationally; however, as outlined above we have initiated efficacy studies in China as well as Canada and Australia, so this can be determined.

Conclusion

Given high chronic disease burden and global migration rates, adaptation of patient education materials for context is prudent, and can be done rigorously. This study established a process to develop patient educational materials translated and culturally validated for natives and immigrants. This tailored approach by context created two much-needed versions of educational materials for Mandarin-speaking patients, that may be applicable in CR programs in many Asian and Western countries that serve Chinese patients around the globe.

References

1. Ma LY, Chen WW, Gao RL, et al. China cardiovascular diseases report 2018: an updated summary. *J Geriatr Cardiol*. 2020;17(1):1-8. doi:10.11909/j.issn.1671-5411.2020.01.001

2. Zhu G. A preliminary study of international migration of the Chinese people. *Chin J Popul Sci*. 1994;6(4):403-415.

3. United Nations. World migration report. 2020. Accessed 28 April 2021. https://www.un.org/sites/un2.un.org/files/wmr_2020.pdf

4. Rosenmöller DL, Gasevic D, Seidell J, Lear SA. Determinants of changes in dietary patterns among Chinese immigrants: a cross-sectional analysis. *Int J Behav Nutr Phys Act*. 2011;8:42. doi:10.1186/1479-5868-8-42

5. Lv N, Cason KL. Dietary pattern change and acculturation of Chinese Americans in Pennsylvania. *J Am Diet Assoc*. 2004;104(5):771-778. doi:10.1016/j.jada.2004.02.032

6. Jin K, Gullick J, Neubeck L, Koo F, Ding D. Acculturation is associated with higher prevalence of cardiovascular disease risk-factors among Chinese immigrants in Australia: Evidence from a large population-based cohort. *Eur J Prev Cardiol*. 2017;24(18):2000-2008. doi:10.1177/2047487317736828

7. Chiu M, Austin PC, Manuel DG, Tu JV. Cardiovascular risk factor profiles of recent immigrants vs long-term residents of Ontario: a multi-ethnic study. *Can J Cardiol*. 2012;28(1):20-26. doi:10.1016/j.cjca.2011.06.002

8. Jin K, Ding D, Gullick J, Koo F, Neubeck L. A Chinese Immigrant Paradox? Low Coronary Heart Disease Incidence but Higher Short-Term Mortality in Western-Dwelling Chinese Immigrants: A Systematic Review and Meta-Analysis. *J Am Heart Assoc*. 2015;4(12):e002568. doi:10.1161/JAHA.115.002568

9. Zhou Y, Li J, Du S, et al. Cardiac rehabilitation knowledge in patients with coronary heart disease in Baoding city of China: A cross-sectional study. *Int J Nurs Sci*. 2017;4(1):24-28. doi:10.1016/j.ijnss.2016.12.011

10. Ma C, Yang Q, Huang S. Translation and Psychometric Evaluation of the Chinese Version of the Information Needs in Cardiac Rehabilitation Tool. *J Cardiopulm Rehabil Prev*. 2019;39(5):331-337. doi:10.1097/HCR.0000000000000411

11. Jin H, Wei Q, Chen L, et al. Obstacles and alternative options for cardiac rehabilitation in Nanjing, China: an exploratory study. *BMC Cardiovasc Disord*. 2014;14:20. doi:10.1186/1471-2261-14-20

12. Yang L, Luo S, Yang s, et al. Validation of the Chinese version of the Coronary Artery Disease Education Questionnaire – Short Version: A tool to evaluate knowledge of cardiac rehabilitation components. *Global Heart*. 2021;16(1):17.doi:10.5334/gh.912

13. Oldridge N, Taylor RS. Cost-effectiveness of exercise therapy in patients with coronary heart disease, chronic heart failure and associated risk factors: A systematic review of economic evaluations of randomized clinical trials. *Eur J Prev Cardiol*. 2020;27(10):1045-1055. doi:10.1177/2047487319881839

14. Anderson L, Thompson DR, Oldridge N, et al. Exercise-based cardiac rehabilitation for coronary heart disease. *Cochrane Database Syst Rev*. 2016;2016(1):CD001800. doi:10.1002/14651858.CD001800.pub3

15. Grace SL, Turk-Adawi KI, Contractor A, et al. Cardiac Rehabilitation Delivery Model for Low-Resource Settings: An International Council of Cardiovascular Prevention and Rehabilitation Consensus Statement. *Prog Cardiovasc Dis*. 2016;59(3):303-322. doi:10.1016/j.pcad.2016.08.004

16. Ghisi GL, Abdallah F, Grace SL, Thomas S, Oh P. A systematic review of patient education in cardiac patients: do they increase knowledge and promote health behavior change?. *Patient Educ Couns*. 2014;95(2):160-174. doi:10.1016/j.pec.2014.01.012

17. Dusseldorp E, van Elderen T, Maes S, Meulman J, Kraaij V. A meta-analysis of psycho-educational programs for coronary heart disease. *Health Psychol.* 1999;18:506-519.

18. Aldcroft SA, Taylor NF, Blackstock FC, O'Halloran PD. Psychoeducational rehabilitation for health behavior change in coronary artery disease: a systematic review of controlled trials. *J Cardiopulm Rehabil Prev*. 2011;31(5):273-281. doi:10.1097/HCR.0b013e318220a7c9

19. Mullen PD, Mains DA, Velez R. A meta-analysis of controlled trials of cardiac patient education. *Patient Educ Counsel*;1992;19:143-162.

20. Halldorsdottir H, Thoroddsen A, Ingadottir B. Impact of technology-based patient education on modifiable cardiovascular risk factors of people with coronary heart disease: A systematic review. *Patient Educ Couns*. 2020;103(10):2018-2028. doi:10.1016/j.pec.2020.05.027

21. Fredericks S, Yau T. Clinical effectiveness of individual patient education in heart surgery patients: A systematic review and meta-analysis. *Int J Nurs Stud*. 2017;65:44-53. doi:10.1016/j.ijnurstu.2016.11.001

22. Anderson L, Brown JP, Clark AM, et al. Patient education in the management of coronary heart disease. *Cochrane Database Syst Rev*. 2017;6(6):CD008895. doi:10.1002/14651858.CD008895.pub3

23. Feng YY, Chaves GSS, Shi W, et al. Education interventions in Chinese cardiac patients on health behaviours, disease-related knowledge, and health outcomes: A systematic review and meta-analysis [published online ahead of print, 2020 Dec 5]. *Patient Educ Couns*. 2020;S0738-3991(20)30665-0. doi:10.1016/j.pec.2020.12.001

24. Smith SC Jr, Benjamin EJ, Bonow RO, et al. AHA/ACCF Secondary Prevention and Risk Reduction Therapy for Patients with Coronary and other Atherosclerotic Vascular Disease: 2011 update: a guideline from the American Heart Association and American College of Cardiology Foundation [published correction appears in Circulation. 2015 Apr 14; 131(15): e408]. *Circulation*. 2011;124(22):2458-2473. doi:10.1161/CIR.0b013e318235eb4d

25. Turk-Adawi K, Supervia M, Lopez-Jimenez F, et al. Cardiac Rehabilitation Availability and Density around the Globe. *EClinicalMedicine*. 2019;13:31-45. doi:10.1016/j.eclinm.2019.06.007

26. Zhang Z, Pack Q, Squires RW, Lopez-Jimenez F, Yu L, Thomas RJ. Availability and characteristics of cardiac rehabilitation programmes in China. *Heart Asia*. 2016;8(2):9-12. doi:10.1136/heartasia-2016-010758

27. Bei Y, Yang T, Xiao J. Cardiovascular medicine in China: what can we do to achieve the Healthy China 2030 plan?. *BMC Med*. 2018;16(1):132. doi:10.1186/s12916-018-1133-4

28. Vanzella LM, Oh P, Pakosh M, Ghisi GLM. Barriers to Cardiac Rehabilitation in Ethnic Minority Groups: A Scoping Review [published online ahead of print, 2021 Jan 25]. *J Immigr Minor Health*. 2021;10.1007/s10903-021-01147-1. doi:10.1007/s10903-021-01147-1

29. Jin H, Wei Q, Chen L, et al. Obstacles and alternative options for cardiac rehabilitation in Nanjing, China: an exploratory study. *BMC Cardiovasc Disord*. 2014;14:20. doi:10.1186/1471-2261-14-20

30. Russell SS. An overview of adult-learning processes. *Urol Nurs*. 2006;26(5):349-370.

31. Schwarzer R, Lippke S, Luszczynska A. Mechanisms of health behavior change in persons with chronic illness or disability: the Health Action Process Approach (HAPA). *Rehabil Psychol*. 2011;56(3):161-170. doi:10.1037/a0024509

32. Ghisi GLM, Scane K, Sandison N, et al. Development of and educational curriculum for cardiac rehabilitation patients and their families. *Clin Exp Cardiol.* 2015;6:5. doi:10.4172/2155-9880.1000373

33. Ghisi GLM, Rouleau F, Ross MK, et al. Effectiveness of an Education Intervention Among Cardiac Rehabilitation Patients in Canada: A Multi-Site Study. *CJC Open*. 2020;2(4):214-221. doi:10.1016/j.cjco.2020.02.008

34. Ghisi GLM, Grace SL, Anchique CV, et al. Translation and evaluation of a comprehensive educational program for cardiac rehabilitation patients in Latin America: A multi-national, longitudinal study [published online ahead of print, 2020 Oct 13]. *Patient Educ Couns*. 2020;S0738-3991(20)30543-7. doi:10.1016/j.pec.2020.10.008

35. Ghisi GLM, Chaves GSS, Ribeiro AL, Oh P, Britto RR, Grace SL. Comprehensive Cardiac Rehabilitation Effectiveness in a Middle-Income Setting: A RANDOMIZED CONTROLLED TRIAL. *J Cardiopulm Rehabil Prev*. 2020;40(6):399-406. doi:10.1097/HCR.0000000000000512

36. Statista. Countries with the largest numbers of overseas Chinese. 2021. Accessed 28 April 2021. https://www.statista.com/statistics/279530/countries-with-the-largest-number-of-overseas-chinese/

37. Epstein J, Santo RM, Guillemin F. A review of guidelines for cross-cultural adaptation of questionnaires could not bring out a consensus. *J Clin Epidemiol.* 2015;68(4):435-441. doi: 10.1016/j.jclinepi.2014.11.021.

38. Mahood Q, Van Eerd D, Irvin E. Searching for grey literature for systematic reviews: challenges and benefits. *Res Synth Methods*. 2014;5(3):221-234. doi:10.1002/jrsm.1106

39. Wild D, Grove A, Martin M, et al. Principles of Good Practice for the Translation and Cultural Adaptation Process for Patient-Reported Outcomes (PRO) Measures: report of the

ISPOR Task Force for Translation and Cultural Adaptation. *Value Health*. 2005;8(2):94-104. doi:10.1111/j.1524-4733.2005.04054.x

40. Shoemaker SJ, Wolf MS, Brach C. Development of the Patient Education Materials Assessment Tool (PEMAT): a new measure of understandability and actionability for print and audiovisual patient information. *Patient Educ Couns*. 2014;96(3):395-403. doi:10.1016/j.pec.2014.05.027

41. Harris PA, Taylor R, Minor BL, et al. The REDCap consortium: Building an international community of software platform partners. *J Biomed Inform*. 2019;95:103208. doi:10.1016/j.jbi.2019.103208

42. Agency for Healthcare Research and Quality. The Patient Education Materials Assessment Tool (PEMAT) and User's Guide. 2013. Accessed 28 April, 2021. https://www.ahrq.gov/health-literacy/patient-education/pemat.html

43. Ace Concern England. Communicating with diverse audience: A practical guide to producing translated materials in appropriate languages and formats for people from minorities ethnic communities. 2006. Accessed 28 April, 2021. https://www.ageuk.org.uk/documents/en-gb/for-professionals/equality-and-human-rights/379_1105_communicating_with_diverse_audiences_2006_pro.pdf?dtrk=true

44. Alberta Health Services. Best practices in interpretation and translation services. 2008. Accessed 28 April, 2021. https://www.albertahealthservices.ca/findhealth/Service.aspx?id=1080491&serviceAtFacilityID=1125981

45. Beaton DE, Bombardier C, Guillemin F, Ferraz MB. Guidelines for the process of cross-cultural adaptation of self-report measures. *Spine (Phila Pa 1976)*. 2000;25(24):3186-3191. doi:10.1097/00007632-200012150-00014

46. Güss CD. What Is Going Through Your Mind? Thinking Aloud as a Method in Cross-Cultural Psychology. *Front Psychol*. 2018;9:1292. doi:10.3389/fpsyg.2018.01292

47. Eccles DW, Arsal G. The think aloud method: what is it and how do I use it? *Qual Res Sport Exerc Health.* 2017; 9: 514-531.

48. Elo S, Kyngäs H. The qualitative content analysis process. *J Adv Nurs*. 2008;62(1):107-115. doi:10.1111/j.1365-2648.2007.04569.x

49. World Atlas. The most diverse cities in the world. 28 March 2019. Accessed 28 April, 2021. https://www.worldatlas.com/articles/the-most-diverse-cities-in-the-world.html

50. Ma C, Yang Q, Huang S. Translation and Psychometric Evaluation of the Chinese Version of the Information Needs in Cardiac Rehabilitation Tool. *J Cardiopulm Rehabil Prev*. 2019;39(5):331-337. doi:10.1097/HCR.0000000000000411

51. Liu XL, Willis K, Wu CJ, Shi Y, Johnson M. 'Better to save one life than build a seven-storied pagoda': a qualitative study of health education for patients with acute coronary syndrome and type 2 diabetes mellitus in Shanghai, China. *BMJ Open*. 2018;8(8):e019351. doi:10.1136/bmjopen-2017-019351

52. Xiao J, Huang L, Li L. [Demands for cardiac rehabilitation information in patients with coronary atherosclerotic heart disease and influential factors]. *Zhong Nan Da Xue Xue Bao Yi Xue Ban*. 2017;42(8):973-978. doi:10.11817/j.issn.1672-7347.2017.08.016

53. Yu M, Chair SY, Chan CW, Li X, Choi KC. Perceived learning needs of patients with heart failure in China: a cross-sectional questionnaire survey. *Contemp Nurse*. 2012;41(1):70-77. doi:10.5172/conu.2012.41.1.70

54. Carney RM, Freedland KE. Depression and coronary heart disease. *Nat Rev Cardiol*. 2017;14(3):145-155. doi:10.1038/nrcardio.2016.181

55. Jin H, Wei Q, Chen L, et al. Obstacles and alternative options for cardiac rehabilitation in Nanjing, China: an exploratory study. *BMC Cardiovasc Disord*. 2014;14:20. doi:10.1186/1471-2261-14-20

56. Guo P, East L, Arthur A. A preoperative education intervention to reduce anxiety and improve recovery among Chinese cardiac patients: a randomized controlled trial. *Int J Nurs Stud*. 2012;49(2):129-137. doi:10.1016/j.ijnurstu.2011.08.008

57. Vahabi M. Breast cancer and screening information needs and preferred communication medium among Iranian immigrant women in Toronto. *Health Soc Care Community*. 2011;19(6):626-635. doi:10.1111/j.1365-2524.2011.01004.x

58. Butow PN, Bell ML, Aldridge LJ, et al. Unmet needs in immigrant cancer survivors: a cross-sectional population-based study. *Support Care Cancer*. 2013;21(9):2509-2520. doi:10.1007/s00520-013-1819-2

59. Omenka OI, Watson DP, Hendrie HC. Understanding the healthcare experiences and needs of African immigrants in the United States: a scoping review. *BMC Public Health*. 2020;20(1):27. doi:10.1186/s12889-019-8127-9

60. Sarkar U, Schillinger D, Bibbins-Domingo K, Nápoles A, Karliner L, Pérez-Stable EJ. Patient-physicians' information exchange in outpatient cardiac care: time for a heart to heart?. *Patient Educ Couns*. 2011;85(2):173-179. doi:10.1016/j.pec.2010.09.017

61. Lu M, Hravnak M, Ma J, et al. Prediction of Changes in Adherence to Secondary Prevention Among Patients With Coronary Artery Disease. *Nurs Res*. 2020;69(5):E199-E207. doi:10.1097/NNR.0000000000000433

62. Zhang J, Gilmour S, Liu Y, Ota E. Effect of health literacy on quality of life among patients with chronic heart failure in China. *Qual Life Res*. 2020;29(2):453-461. doi:10.1007/s11136-019-02332-4

63. Wang C, Kane RL, Xu D, Meng Q. Health literacy as a moderator of health-related quality of life responses to chronic disease among Chinese rural women. *BMC Womens Health*. 2015;15:34. doi:10.1186/s12905-015-0190-5

64. Wang C, Lang J, Xuan L, Li X, Zhang L. The effect of health literacy and self-management efficacy on the health-related quality of life of hypertensive patients in a western rural area of China: a cross-sectional study. *Int J Equity Health*. 2017;16(1):58. doi:10.1186/s12939-017-0551-9

65. Zhang L, Ding D, Neubeck L, Gallagher R. Health literacy as a predictor of emergency department visits and self-rated health among Chinese immigrants: findings from an Australian survey. *Patient Educ Couns*. 2020;103(11):2353-2360. doi:10.1016/j.pec.2020.04.017

66. Zhang L, Ding D, Fethney J, Neubeck L, Gallagher R. Tools to measure health literacy among Chinese speakers: A systematic review. *Patient Educ Couns*. 2020;103(5):888-897. doi:10.1016/j.pec.2019.11.028

67. Lima de Melo Ghisi G, Pesah E, Turk-Adawi K, Supervia M, Lopez Jimenez F, Grace SL. Cardiac Rehabilitation Models around the Globe. *J Clin Med*. 2018;7(9):260. doi:10.3390/jcm7090260

68. World Health Organization. Process for translation and adaptation of instruments.2021. Accessed 27 May, 2021. https://www.who.int/substance_abuse/research_tools/translation/en/

69. Eremenco S, Pease S, Mann S, Berry P; PRO Consortium's Process Subcommittee. Patient-Reported Outcome (PRO) Consortium translation process: consensus development of updated best practices. *J Patient Rep Outcomes.* 2017;2(1):12. doi: 10.1186/s41687-018-0037-6.

70. Sidani S, Guruge S, Miranda J, Ford-Gilboe M, Varcoe C. Cultural adaptation and translation of measures: an integrated method. *Res Nurs Health*. 2010;33(2):133-143. doi:10.1002/nur.20364

71. Zhu H, Ye Z, Jin J. Investigation of knowledge and attitude of cardiac rehabilitation in patients with acute myocardial infarction. *Chin J Nurs*. 2020;1 (5):78–83.

72. Zhou Y, Li J, Du S, et al. Cardiac rehabilitation knowledge in patients with coronary heart disease in Baoding city of China: A cross-sectional study. *Int J Nurs Sci*. 2017;4(1):24-28. doi:10.1016/j.ijnss.2016.12.011

73. Tao XJ, Ying WU, Zhang Y, et al. Nurse' willingness of early cardiac rehabilitation in patients with acute myocardial infarction and its influence factors. *J Nurs*. 2015.

74. Zhu H, Ye Z, Ning L, Han X, Wu Y. Knowledge and Attitude of the Medical Staff Concerning Cardiac Rehabilitation in Zhejiang Province, China: A Cross-Sectional Study. *Patient Prefer Adherence*. 2020;14:1771-1777. doi:10.2147/PPA.S270503

75. Simon M, Korn K, Cho L, Blackburn GG, Raymond C. Cardiac rehabilitation: A class 1 recommendation. *Cleve Clin J Med*. 2018;85(7):551-558. doi:10.3949/ccjm.85a.17037

76. Supervia M, Turk-Adawi K, Lopez-Jimenez F, et al. Nature of Cardiac Rehabilitation Around the Globe. *EClinicalMedicine*. 2019;13:46-56. doi:10.1016/j.eclinm.2019.06.006

77. Nguyen HQ, Carrieri-Kohlman V, Rankin SH, Slaughter R, Stulbarg MS. Supporting cardiac recovery through eHealth technology. *J Cardiovasc Nurs*. 2004;19(3):200-208. doi:10.1097/00005082-200405000-00009

Figure title and legends

Figure 1: The 5-phase process to translate and adapt health education materials for Mandarin-speaking natives and immigrants

1

PREPARATION

Assemble multi-disciplinary team, and including representation from all relevant stakeholder groups

Systematic review

Search for best practices in translation and adaptation

Environmental scan

2

TRANSLATION, ADAPTATION, RECONCILIATION & HARMONIZATION

Forward translation

Reconciliation

Back translation

Review

3

EXPERT REVIEW

Input on materials

PEMAT-P survey

4

PATIENT REVIEW

Think Aloud sessions

5

FINALIZATION

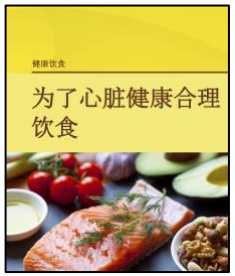
Final review

Dissemination for evaluation

Table 1: PEMAT-P rankings for each booklet and mean and standard deviation from the 3 Likert-type questions for the domestic and international versions by experts (n=34)

Booklet	Domestic version / International version	Number of experts	Understandability score	Actionability score	Language and content culturally appropriate to Chinese immigrants* (mean±SD)	These materials benefit practice and/or patients* (mean±SD)	Materials easy to follow and without any major problems* (mean±SD)
How your heart works		n=2	82%	84%	4.0±1.4	4.0±1.4	4.0±1.4
		n=1	94%	75%	4.0±0.0	5.0±0.0	4.0±0.0
Common tests and treatments		n=2	92%	90%	4.5±0.7	4.5±0.7	4.5±0.7
		n=1	100%	100%	4.0±0.0	4.0±0.0	4.0±0.0

Taking your heart medicines		n=2	81%	70%	3.0±0.0	4.0±0.0	3.0±0.0
		n=2	100%	100%	4.5±0.5	5.0±0.0	5.0±0.0
Managing your symptoms		n=2	89%	93%	4.5±0.7	4.5±0.7	4.5±0.7
		n=1	82%	75%	4.0±0.0	3.0±0.0	5.0±0.0

Staying active for a health heart		n=2	97%	96%	5.0±0.0	5.0±0.0	4.5±0.7
		n=6	82%	100%	3.7±1.2	4.2±0.8	3.8±0.8
Eating well for a healthy heart		n=2	100%	97%	5.0±0.0	4.5±0.7	5.0±0.0
		n=2	100%	100%	3.0±1.4	3.5±0.7	4.0±0.0

Managing stress for a healthy heart		n=2	88%	89%	4.0±1.4	4.5±0.7	4.5±0.7
		n=1	100%	100%	4.0±0.0	5.0±0.0	4.0±0.0
Enjoying a healthy relationship and sexual intimacy		n=2	88%	87%	4.0±1.4	4.5±0.7	4.0±1.4
		n=1	100%	100%	5.0±0.0	5.0±0.0	5.0±0.0

Setting goals for a healthy heart		n=2	97%	96%	5.0±0.0	4.0±0.0	5.0±0.0
		n=1	100%	100%	5.0±0.0	5.0±0.0	5.0±0.0

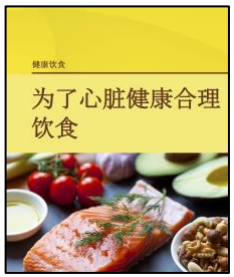
SD standard deviation.
* Likert-type scale ranging from 1=strongly disagree to 5=strongly agree.

Table 2: Summary of changes to the domestic and international versions of Chinese Cardiac College based on expert's input by booklet and type

Booklet	Domestic version / International version	Incorrect information	Changes related to word accuracy	Changes related to improving readability	Changes related to cultural appropriateness	Changes related to formatting	Other comments and suggestions (with ways addressed)
How your heart works		-	-	-	4 changes Pages 12 and17: the desirable level of fiber was changed from 25-50 grams/day to 25-30grams/day Page 14: added 5 kilometer conversion beside 3 miles. Page 17: added daily sugar maximum amount, and converted teaspoon into tablespoon. Page 26: change amount of limit alcohol per day. Page 33: Healthy targets for waist size other than among Chinese were deleted.	-	Revise risk factors' recommendations based on China's 2016 Dietary Guidelines.
		6 corrections Page 7: Supposed to be "Blood pressure diary" instead of "High Blood Sugar Level". Page 20: Risk "factor" was translated to be Risk "file". Pages 21, 29, 30: Needed to delete the link on these pages to an external website. English language website available only. Page 30: Needed to delete a link to helpguide.org. English language website available only.	10 changes Pages 11, 13, 15, 21, 23, 24, 30, 33, 43, 44	16 changes Pages: 5, 10, 12, 19, 25, 27, 28, 30, 33, 34, 39, 41-45	3 changes Page 18: family history term most commonly used in Chinese culture; pages 26 and 28: issues with different quantifiers used in Chinese	5 changes Pages: 12, 22, 24, 25, 33	-
Common tests and treatments		-	-	-	-	-	-
		1 correction Page 13; At rest and again after exercise had not been translated.	4 changes Pages 3, 12, 17, 19	11 changes Pages 5, 9-12, 14-17, 19, 20	1 change Page 12: use of the term healthcare provider	2 changes Pages 18, 19	The material is simple and easy to understand. It will be very useful for patient's education. Keeping the English names of the drug class.

Booklet	Domestic version / International version	Incorrect information	Changes related to word accuracy	Changes related to improving readability	Changes related to cultural appropriateness	Changes related to formatting	Other comments and suggestions (with ways addressed)
Taking your heart medicines		-	-	3 changes Pages: 1, 3, 4	4 changes Page 4: underneath the heading "What should I know about taking this medicine?" add one sentence "Please remember if you have symptom of bleeding, notify the doctor immediately. Page 10, 13 and 14:name of medications added Nitrostat®, Repatha®; Praluent®, Gemfibrozil. The translated medication names were corrected to align with the existing brand names of the medication.	-	-
		1 correction Page 13: Wrong Chinese name of Ticagrelor.	8 changes Pages 9, 11-13, 22, 27, 29, 30	9 changes Pages 1, 4, 9, 13, 15, 18, 25, 27, 28	1 change Page 11: natural therapy and supplement terms are not commonly used in Chinese culture; better replaced with Chinese herbal medicine and vitamins	1 change Page 15	I would also recommend adding both English and Chinese medication names as immigrants will find the English names on their medication box. Also, keeping the English names of the drug class in the index and each section title. e.g.,Anticoagulant, Antiplatelet, ACE-inhibitors, ARB, Beta-blockers, etc. To have a traditional character version of these brochures for people from Taiwan and Hong Kong. It would be much easier to produce a version in traditional Chinese after the simplified version is finalized (we have the domestic version).
Managing your symptoms		-	-	-	1 change Page 7: "1 spray of your nitroglycerin" was replaced with "1 tablet of your nitroglycerin"; "2 sprays of your nitroglycerin" was replaced with "2 tablets of your nitroglycerin". The original wording was "spray", which was replaced with "tablet" in accordance with current clinical practice in China.	-	-
		2 corrections Page 12: In the last paragraph, RPE was wrongly translated in Chinese; they are two different scales. Page 27: Amount of the same medicine is typed with a wrong word in Chinese 计量 vs 剂量.	7 changes Pages 11, 13, 18, 22-24, 27	11 changes Pages 5,6,10-12, 15, 16, 19-22, 27	3 changes Page 9: golf is not a common physical activity in the Chinese community. Maybe change to walking and ball sports; page 12: emergency number: Australia 000, China 120, Canada 911; page 14: the chest pain guideline is different in every country	-	-

Booklet	Domestic version / International version	Incorrect information	Changes related to word accuracy	Changes related to improving readability	Changes related to cultural appropriateness	Changes related to formatting	Other comments and suggestions (with ways addressed)
Staying active for a health heart		3 corrections Page 6: shopping mall map weblink for the Greater Toronto Area was removed. Page 20: “toe” was mistakenly translated. Page 38: sentence “Use running shoes for your exercise” was corrected.	4 changes Pages 31, 32, 37, 38	3 changes Pages 11, 20, 30	6 changes Page 6: on Indoor/Outdoor Track “The mobile App records walking trajectory to help you measure walking/running distance” was added. Doctors think that with the rapid development of information technology, people can use mobile apps to record walking trajectories and measure distance. Page 10: in the “ways to measure your walking route” section, “use mobile phone App to record indoor and outdoor sports tracks” was added. Map.baidu.com was also added instead of gmap pedometer website. Page 10: in “ways to measure your walking route”, “Use a surveyor’s measuring wheel to measure your distance. Talk to your Cardiac Rehab Supervisor about borrowing the wheel from the program” was deleted. Pages 42 and 43: “Air Quality Index” was replaced with the Air quality categories in China.	-	-
		3 corrections Page 13: There is a repeating word of treadmills in the first dot point of “Fitness/Gym/Recreation Facility” section. Page 18: What intensity level do I “exercise” at; exercise was missed in the translation. Page 30: The third questions of “how much weight should I lift?” is completely translated to something else.	12 changes Pages 6, 13, 15, 16, 30, 31, 33, 38, 49, 55, 56, 60	33 changes Pages 4, 6, 8-11, 13, 14, 16, 19-21, 27, 28, 30-33, 36, 40, 41, 43, 46, 48, 49, 51, 53-55, 57-59, 61	10 changes Page 13: HeartWise and web resource for Mall walking is not applicable in other countries; page 17: web resource for Mall walking and Google Maps is not applicable in other countries. Perhaps replace it with a recommended mobile App, WeChat, pedometer or Fitbit to track; page 18: golf is not a common physical activity in the Chinese community. Maybe change to walking and ball sports; pages 35-36: weight in pounds converted to kilograms; page 46: miles converted to kilometres; page 48: only kilometres and centimetres needed; page 51: web link is deleted as not applicable in other countries; pages 55 and 59: ounces were deleted, only ml left; page 62: other resources are not applicable to other countries.	1 change no specific page	The information needs to be condensed and simplified. Too much information may confuse and alienate the consumer from retaining key messages. (Files have been condensed and simplified.) The presentation lacks interaction with consumers. You should consider providing some more images or videos instead of just text. (More images added to slides.) It is unnecessary to teach patients how to check their radial or jugular pulses in a cardiac rehab exercise program. (It was removed). To assess the patient’s exertion level, we often recommend to patients that they can carry on their normal conversation. (Changed as suggested). Consider including a consumer feedback/question at the end of the session.

Booklet	Domestic version / International version	Incorrect information	Changes related to word accuracy	Changes related to improving readability	Changes related to cultural appropriateness	Changes related to formatting	Other comments and suggestions (with ways addressed)
Eating well for a healthy heart		-	-	-	15 changes Page 2: it was added transitional language to compare the Mediterranean diet with the 2016 edition of the dietary guidelines for Chinese, and summarized the commonalities between the two dietary recommendations. Page 3: “Make sure to consume 300-500 grams of vegetables per day and dark vegetables should account for 1/2.” was added. Page 5: “Include healthy fats with all meals” on p5, “25-30 grams of cooking oil per day” was added. Page 7: Choose fish and seafood at least 3 times a week” on p6 “Eat 280-525 grams of fish per week (3-5 servings)” was added. Also, “Have 2 to 3 servings of milk or alternatives each day” was changed to “Have 300 grams (1-2 servings) of milk or alternatives every day”. Page 9: Choose meat in moderation” on p7, “have 280-525 grams per week (3-5 servings)” was added. Page 11: Eat less salt (sodium)” “The daily salt for adults does not exceed 6 grams, about the amount of a beer bottle cap (with rubber pad removed)” was added. Page 13: change in recommendations of daily healthy fats and oils consumption. Page 25: Chinese Resident Food Guide (2016) was added as a resource. Page 26: “Sample menu” was removed. “How much is 30 grams of dietary fiber” and an explanatory picture were added; “Eating is not an experiment, so don’t be too entangled. As long as you follow the requirements of the dietary guidelines, eating 250-400 grams of cereals, 300-500 grams of vegetables, 200-350 grams of fruits, and 30-50 grams of beans per day can fully meet the needs of dietary fiber.” was added. Page 31: “How much added sugar can I have?” on p31, “the 2016 edition of the dietary guidelines for Chinese states that the intake of added or free sugar should be controlled at no more than 50 grams per day, preferably under 25 grams.” was added. Page 39: Most [75 percent (%)] of the sodium that people in Canada eat comes from processed and restaurant foods. Only 10-25% comes from the salt shaker” was removed. Page 51 and 57: change in alcohol consumption limits. Page 66: In “Milk and alternatives”, “Milk & Alternatives, Aim for 2-3 Servings Daily” was changed to “Milk & Alternatives, Aim for 1-2 Servings Daily”.	-	Changes made based on nutritionists’ recommendations and the 2016 edition of the dietary guidelines for Chinese.
		9 corrections Page 17: Morning tea: Greek Yogurt was translated to Greek milk tea; afternoon snack: 1 cup sliced red and yellow peppers was translated to peppers. Page 28: ® seems unnecessary to be there in the first dot point of “how can I eat more fibre?”. Page 32: Edamame (soybean, green, cooked) is the one in the English version, but in the Chinese version it is corn starch, and a reviewer says that it is not high in fibre. Page 38: This page ends with Pulse Canada, 2012. What does	14 changes Pages 14, 23, 27, 28, 41, 44, 49, 51-54, 67, 74, 78	15 changes Pages 5, 9, 10, 13, 15-17, 26, 37, 38, 41, 47, 48, 53, 69	8 changes Page 12: Would be nice to include culturally common breakfast items like congee. Northern Chinese has millet congee “小米粥“, red bean black rice congee “红豆黑米粥“); page 12: Chinese cuisine has lots of soy products that could be added in this section as examples, such as dried tofu ”豆干“ would be great to use in stir fry; Chinese cuisine also uses beans as part of grains, such as making pancake with beans and making congee with beans; page 13: maybe mentioning about smoking point with olive oil and alternatives as a stir fry oil as many Chinese cuisine uses oil in stir frying; pages 14, 15, 17 and 35: ounce converted to gram; pages 21, 58: added seaweeds “紫菜、海带“, rich in omega-3 and common in Chinese cuisine; pages 23, 24: deleted Pakora, and replaced with deep fried dough sticks and spring roll“油条、春卷“; page 34: cultural appropriate breakfast option added “whole grain bread and low fat milk”; page 44, 58: sugar and sweets, include Chinese desserts, such as egg tart, green bean cake, etc).	4 changes Pages 10, 49, 57, 62	-

		that mean? Need to be translated or should it be deleted? Page 42: Recommend specific type of fibre cereal this refers to. Page 43: Maple serve was changed. Page 48: Problems with numbers of titles. Page 69: The original translation does not make sense there.					
Managing stress for a healthy heart		-	-	-	-	-	-
		-	5 changes Pages 14, 18, 19, 22, 23	8 changes Pages 6, 10, 14, 15, 17-20	-	-	-
Enjoying a healthy relationship and sexual intimacy		-	-	-	-	-	-
		-	2 changes Pages 14, 20	3 changes Pages 5, 12, 14	-	-	-

Booklet	Domestic version / International version	Incorrect information	Changes related to word accuracy	Changes related to improving readability	Changes related to cultural appropriateness	Changes related to formatting	Other comments and suggestions (with ways addressed)
Setting goals for a healthy heart		-	-	-	-	-	-
		-	1 change Page 30	11 changes Pages 5, 10, 15-17, 19, 21, 24, 28-30	-	-	-

ACE indicates angiotensin converting enzyme; ARB angiotensin II receptor blockers; RPE rating of perceived exertion.

Table 3: Cultural distinctions between the domestic and international versions of Chinese Cardiac College by booklet and content area

Booklet	Content Area	Version	
		Domestic	International
How your heart works	Differences in alcohol and waist circumference guideline recommendations	The alcohol limit, the daily fiber and desirable level of added sugar was revised according to China's 2016 Dietary Guidelines. Deleted the healthy target for waist sizes except for Chinese.	N/A
Common tests and treatments	Differences in diagnostic equipment	Replaced the example picture of an ECG machine, to reflect what is commonly used in China.	N/A
	Differences in medication names	Only Chinese names of the medications are listed.	Listing both English and Chinese names of the drug class.
Taking your heart medicines	Different alternative therapies used	N/A	Supplements are not commonly used in Chinese culture, so these were replaced with Chinese herbal medicine and vitamins which are.
	Differences in medication names	N/A	Keeping the English names of the drug class. Health providers will refer to the English name of the medications when caring for Chinese immigrants as they are on their pill bottles.
Managing your symptoms	Differences in chest pain guidelines	Spray of nitroglycerin is not common in China, so and it was replaced with 1 tablet of nitroglycerin.	N/A

	Difference in the emergency number	Emergency Number: 911 for Canada, 120 for China.	Emergency Number: 000 for Australia, 911 for Canada and US, 120 for China
	Examples of common exercises	N/A	Golf is not a common physical activity in the Chinese community, so changed to walking and ball sports, which are common in Chinese immigrant groups.
Staying active for a health heart	Different resources and devices/apps used to measure walking	Deleted some measures of walking routes which are not applicable in China (e.g., mall walking, gmap, odometer and measuring wheel). Added common measures for step tracking, such as mobile apps and Baidu map.	Community resources for mall walking etc are specific to context and hence not applicable elsewhere. Mall walking and gmap are not applicable in any other countries except Canada; Added relevant free resources for step tracking, such as mobile apps, WeChat in-built app, pedometer or Fitbit, which are commonly used by Chinese immigrants for measuring daily activities.
	Differences in units of measurement	Added instructions for conversion between pounds and kilograms. Added units in kilometres in addition to miles. Add centimeters in addition to inches.	Converted weight units from pound to kilograms. Converted mile to kilometres.
	Differences in Air Quality metrics	The Air Quality Index and activity for each air quality category was developed in the context of Canada. Replaced them with Chinese Air Quality Index and corresponding exercises	N/A

	Differences in familiarity with resistance training exercises	People are more familiar with aerobic training and have limited knowledge about resistance training. Added pictures of each resistance exercise to improve patient's understanding.	Exercise examples were added such as fast walking and playing ball sports, which are common in Chinese immigrant groups.
Eating well for a healthy heart	Differences in diet recommendations and guidelines	The weight of daily vegetables, fruits, fish and seafood, milk or alternatives, meat, oil, sugar was added and the recommended portions were changed based on the China's 2016 Dietary Guidelines. The alcohol limit for men and women was revised according to China's 2016 Dietary Guidelines.	N/A
	Differences in common foods	Some food Chinese do not commonly eat, such as hemp seeds and psyllium were deleted. More culturally-appropriate examples added to reflect daily menu for fiber consumption compliance.	Include breakfast items common for Chinese immigrants like congee, such as millet congee and red bean, black rice congee. Chinese cuisine has lots of soy products that were added in this section as examples, such as dried tofu. Chinese cuisine also uses beans as part of grains, such as making pancakes with beans and making congee with beans. Seaweeds were added, which are rich in omega-3 and common in Chinese cuisine. More culturally-appropriate examples added to the sample menu for a day. For

			example, deep fried dough sticks and spring roll were added. Common Chinese desserts were provided as examples of sugars and sweets, such as egg tart, green bean cake, etc.
	Differences in units	Weight unit was converted from ounces to grams.	
Managing stress for a healthy heart	No changes	-	-
Enjoying a healthy relationship and sexual intimacy	No changes	-	-
Setting goals for a healthy heart	No changes	-	-

N/A indicates not applicable (i.e. no cultural tailoring different other than what is in another version column); ECG electrocardiogram.

Table 4: Summary of changes to the Chinese Cardiac College based on patient review by version and booklet (N=38)

Booklet	Domestic version	International version
How your heart works		
	Page 16, '8-10 exercises' was removed in the type of Resistance Training Exercise. There was no illustration or description there, which may cause ambiguity.	No changes
Common tests and treatments		
	Page 1: the picture showing a patient having EKG examination was replaced with a picture which was in line with current equipment in China. Added the full Chinese names of medical acronyms, such as on page 1, ECG, Holter; page 4, echo; page 9, CABG. Provided translation regarding the stent picture on page 8, CABG picture on page 9 and heart valve picture on page 12.	No changes
Taking your heart medicines		
	No changes.	English names of the medications added next to the Chinese translation.
Managing your symptoms		
	In pages 4, 6 and 7, "911" was replaced with "120". China's emergency number is 120.	No changes

Staying active for a health heart	 In the “ways to measure your walking route” on page 10, “Use the odometer on your car to measure the route” was removed, because in China use of a private vehicle is not as common as in Canada. On p37, “marijuana” was removed because it is illegal to have marijuana in China but no Canada.	 No changes
Eating well for a healthy heart	 In table of page 3, to make it easier for patients to understand and follow, the pictures showing one portion of fruits and vegetable were added. On page 6, a picture and corresponding description about one portion of nuts were added to make it easier for patients to understand and follow. On page 6, a picture and description about one portion of fish and seafood was added to make it easier for patients to understand and follow. On page 7, a picture and description about one portion of meat was added to make it easier for patients to understand and follow. On page 13, “Plant sources of omega-3 fats include hemp hearts and hemp seeds” was removed because not commonly used. On pages 19 and 21, “psyllium” was removed because Chinese generally do not eat psyllium. In table on page 22, Food, Serving Size, Total Fibre (g) of “Artichoke, cooked” was removed because Chinese generally do not eat artichoke. In table on page 24, Food, Serving Size, Total Fibre (g) of “Bran Buds (with Psyllium)” was removed because Chinese generally do not eat psyllium. In table on page 24, Food, Serving Size, Total Fibre (g) of “Cheerios™” was removed because Chinese generally do not eat the specific brand of cereals. On page 32, “molasses” was removed because Chinese generally do not eat molasses.	 No changes

	On page 33, “chicory root extract (inulin fibre)” was removed because Chinese generally do not eat chicory. On page 34, “all-bran buds, Cheerios, Fiber1” was removed because Chinese generally don’t eat bran buds or specific brands of cereals such as Cheerios. On page 35, “agave,” was removed because Chinese generally do not eat agave. Also, “Maple syrup,” was removed because Maple syrup is not common in China. On page 41, “Stewed tomatoes, canned” was removed because Chinese generally do not eat canned tomatoes. On page 42, “Cottage cheese (1%, 2%), Blue, Feta, Cheese spread, Cheddar, Colby, edam, gouda, mozzarella, provolone, camembert, Cottage cheese, fat-free” was removed because Chinese generally do not eat these types of cheese. On page 44, “Liverwurst” was removed because Chinese generally do not eat liverwurst. On page 45, “Refried beans, canned” was removed because Chinese generally do not eat refried beans. Also, “egg substitute” was removed because Chinese generally do not eat egg substitutes. In “other” on pages 45 and 46, “Yeast extract spread, salt substitute, cardia, half salt, sauce (cheese, nacho cheese), capers, canned” was removed because Chinese generally do not eat these foods.	
Managing stress for a healthy heart	 No changes.	 No changes.
Enjoying a healthy relationship and sexual intimacy	 No changes.	 No changes.
Setting goals for a healthy heart		 No changes.

	Some senior patients did not understand the meaning of “vision” on Pages 5,6,10,15,16 so another frequently-used word was substituted: “desire”.

Acronyms: EKG indicates electrocardiograph; ECG electrocardiogram; CABG coronary artery bypass graft

Appendix 1: Search strategy

Database: Ovid MEDLINE(R) ALL <1946 to March 24, 2021>

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1 exp China/ (210663)
2 (Chinese or Mandarin or Cantonese or China or Hong Kong or Beijing or Peking).mp,kw. (505167)
3 1 or 2 (507007)
4 exp Heart Diseases/ (1154537)
5 ((cardiac or heart or coronary) adj3 (disease* or disorder* or dysfunction* or deficien* or anomal* or failure*)).tw,kw. (478574)
6 cardiopath*.tw,kw. (5400)
7 (rehab* adj3 (cardiac or cardiovascular or heart or myocardial)).tw,kw. (8296)
8 or/4-7 (1315996)
9 Cardiac Rehabilitation/ (2696)
10 exp Exercise Therapy/ (53458)
11 (exercis* therap* or therapeutic exercis* or kinesiotherap* or kinesitherap*).tw,kw. (7338)
12 (rehab* adj3 (cardiac or cardiovascular)).tw,kw. (7588)
13 or/9-12 (63198)
14 3 and 8 and 13 (138)
15 Patient Education as Topic/ (86541)
16 ((educat* or literacy or knowledg* or information) and (rehab* adj3 (cardiac or cardiovascular))).tw,kw. (1559)
17 ((educat* or literacy or knowledg* or information) adj3 needs).tw,kw. (15566)
18 exp information literacy/ (6724)
19 or/15-18 (107135)
20 14 and 19 (41)
21 from 20 keep 3,12,18,24,36 (5)
22 3 and 8 and 19 (102)
23 from 22 keep 6,8,11,13,17-19,21,23,25,29,32,36-39,50,52,55,60-61,64,77-79,85,89,97,100 (29)
24 21 or 23 (31)

Appendix 2: Think-Aloud protocol with subsequent Semi-Structured Interview Guide

Introduction

Hello. My name is [name]. I'd like to start off by thanking you for participating in this research. We'll be together for about 30 minutes.

Purpose and Instructions for Think-Aloud

The reason we are here today is to gather your opinions and attitudes related to the educational materials you have received, called Cardiac College. These materials have been translated and culturally-adapted to Chinese and we want to know your opinion about their usability, clarity, your understanding and their effectiveness for your learning.

We will do 2 things: (1) you will read the [mention which one] booklet aloud and state your impressions as you go along, and (2) answer a few questions at the end.

The patient education program has 9 booklets and has been developed by a group of researchers, healthcare providers, and patients. They have been translated in 8 languages and used in cardiac rehabilitation programs in 10 countries around the world.

As you read this booklet, think out loud. By that, I mean while you are going through the pages, I want you to state what you're thinking as you go along. For instance, if the content is unclear or needed information is missing, please say those things out loud. Please be forthright so we get the most input we can to improve it.

We would like to test the materials under real-world circumstance, so we will pretend that you are on your own. I will be making notes as you go along.

This session will be audio-recorded. I will be sure not to link your identity to the recording. We will transcribe this session within the next 10 days and once the transcription is done we will destroy the audio recording. Transcripts will be kept for 10 years following completion of the study.

Do you have any questions before we begin?

Record

Post-Protocol Interview Guide

Thank you. Your insights have been very helpful. What questions do you have about the booklets before I ask mine?

1. Content: Was the material applicable to your reality as a cardiac patient? Does the material include information or content that distracts from its' purpose?

2. Word Choice & Style: do you think the material uses common, everyday language? Were you comfortable and knowledgeable with the medical terms used (if any)?

3. Use of numbers: do you think the numbers appearing in the materials are clear and easy to understand (if any)?

4. Organization: do you think the material presents information in a logical sequence?

5. Layout & Design: what do you think about the layout and design? Things we should revise?

6. Use of Visual Aids: do you think the material uses illustrations and photos that are clear and uncluttered? Do you think the tables are simple? Do you think visual aids were used appropriately (i.e. to make content more easily understood)?

7. What suggestions do you have for us to improve these materials?

8. Lastly, is there anything else we should consider?

[After completion of interview questions] *OK, we're finished. Thank you so much for your time. Your input was invaluable.*