1. Introduction

Hypertension is a significant modifiable risk factor for cardiovascular mortality and morbidity globally. Its prevalence is expected to increase significantly in economically developing and developed Asian countries in the next 2 decades, including China and other Asian nations. Lewington et al reported that one-third of Chinese adults in a national cohort population had hypertension, with lower control levels than in Western population and were associated with significant excess mortality. A report from World Health Organization revealed that 266 million Chinese suffer from hypertension, affecting 24% of the population aged 15 years and above. Even for the small island nation of Singapore with its multiethnic Asian population comprising largely Han Chinese and minority Malay and Indian ethnic groups, 23.5% of them have hypertension.

Hypertension is a life-long disease, which is largely managed by the affected patients themselves. Aside from episodic consultations with healthcare professionals, patients with hypertension need to manage multiple aspects of their daily lives in order to control their blood pressure to mitigate their vascular complications. They include recommended measures such as salt and fat restriction in their diet, adherence to adequate, regular physical activities, medication regimens, and scheduled reviews by their physicians. A proportion of patients extend beyond these activities to include self-monitoring of their home blood pressures, weight, and physical exercises. What distinguishes this proactive subset of the population with hypertension may be related to their self-efficacy. Perceived self-efficacy is defined by Albert Bandura as one’s belief in their abilities to organize and succeed in accomplishing an intended task. Such belief plays an important role in determining the approaches toward attaining one’s goals, tasks, and overcoming the challenges. Self-efficacy has been shown to result in better chronic disease self-management. Patients with stronger self-efficacy beliefs are more likely to initiate and maintain recommended health behaviors. Williams et al reported that lower levels of self-efficacy were associated with elevated blood pressure, which increased their cardiovascular risks of stroke and coronary heart diseases.
Assessing an individual’s perceived self-efficacy will be relevant in determining the behavior change of patients and the impact on their health outcomes in chronic disease management. Such assessment will require the evaluation of the multiple facets of self-efficacy and can be challenging. In order to evaluate the self-efficacy among patients with hypertension in any local population, an instrument has to be identified and validated. Currently, there are many instruments available to assess self-efficacy. However, most of these instruments are either not contextualized to the local population, or assessed only a component of self-efficacy or not self-efficacy and not specific to hypertension.[9]

The “Hypertension Self-Care Profile” (HTN-SCP) instrument is a 60-item questionnaire that assesses behavior, motivation, and self-efficacy in patients with hypertension. The self-efficacy domain covers medication adherence and lifestyle modifications, which are key measures in hypertension management.[10]

The HTN-SCP has previously been validated in a Korean American population with Asian values living in a western community.[10] An earlier face validation study of the English version of the instrument in Singapore reported satisfactory internal consistency and test–retest reliability.[11] Despite English being the common language in Singapore, some of the citizens of various ethnic groups may not be conversant in the language. Hence, the use of the HTN-SCP will be restricted if only the English version of the instrument is available to assess patients with hypertension. There is a need to develop the Mandarin version of HTN-SCP (HTN-SCP-Mn) to cater to the local predominantly Chinese population. We postulated that the HTN-SCP-Mn would be understood by the Mandarin-literate users and that it would show satisfactory internal consistency and test–retest reliability.

2. Objective of study
The study aimed to evaluate the internal consistency and test–retest reliability of the HTN-SCP-Mn instrument.

3. Materials and methods

3.1. Study design
A within-subject test–retest study design was conducted on 2 separate occasions (14–21 days apart) to assess the reliability of the translated instrument. Ethics approval was approved by the Centralized Institution Review Board with reference number (2016/2332).

3.2. Subjects

3.2.1. Inclusion criteria.
1. The study population included adult citizens or permanent residents, aged 40 to 79 years, of Chinese ethnic origin and proficient (able to read and understand) in Mandarin language.
2. They had clinical diagnosis of essential hypertension based on disease coding by the International Classification of Diseases (version 10) and were currently managed at the designated polyclinic for at least 1 year. Their diagnosis was affirmed with reference to their electronic health records at the study site.
3. They indicated willingness to access the Internet via any form of devices (smartphone or tablet or laptop or desktop) to administer the web-based questionnaire twice on 2 separate occasions 2 weeks apart.

3.2.2. Exclusion criteria. Patients, who were not proficient in Mandarin, did not have access to Internet, were not Internet savvy or had known cognitive, visual and auditory impairment from their medical records, were excluded.

3.2.3. Study site. The study was carried out at a typical public primary care clinic (polyclinic) at Queenstown from April to August 2016. The study site is located in the southern-west region of Singapore, serving a population of 98,730 Asian residents in the region in 2014.[12] The average workload per day is approximately 500 patients, of which 15% is related to hypertension (highest among all chronic diseases).

3.3. Sample size calculation
A study population comprising 50 to 99 study subjects is considered a good sample based on the COSMIN recommendation for the conduct of the test–retest reliability assessment.[13] An earlier validation study using a web-based approach by the investigators showed significant dropout rate. The target recruitment size was therefore increased to 150 subjects to cater to attrition.[14]

3.4. Instrument
Permission was granted for the use of the original HTN-SCP instrument by A/Prof HR Han of John Hopkins Hospital.[15] The translation of the HTN-SCP instrument into the Chinese and Malay versions was carried out by qualified bilingual translators from a specialized linguistic agency. Backward translation was also conducted and discrepancies were reviewed and discussed until a final agreement was reached. The questionnaire also included patients’ demographic variables and questions pertaining to their self-management activities.

3.5. Data collection
Patients were screened for eligibility based on the inclusion and exclusion criteria by the site investigator or polyclinic staff at the nurse counseling room or were referred by the family physician after their consultation. Potential subjects were led into a private room where they were given information on the study intent and procedure on the participant information sheets. Time was provided for their consideration, clarification, and understanding before obtaining their informed consent. Enrolled patients were assigned study identification number to allow cross-linkage between the test and retest procedure and to ensure anonymity.

In order to verify the test–retest reliability, participants were required to complete the HTN-SCP-Mn instrument on 2 separate occasions. On recruitment at the study site, patients filled up a web-based version of the HTN-SCP-Mn on a free web-based platform via Qualtrics.[16] Two weeks later, they accessed the web-based version of the HTN-SCP-Mn instrument again. Instructions to carry out the retest were provided to them in hard copy on enrolment.

For the patients who failed to administer the questionnaire 2 weeks after the test, phone calls or emails were sent out to remind them to carry out the retest, allowing an additional week for them to complete the study. Those who failed to administer the retest, despite such measure, were regarded as dropouts. For the latter, the data in the initial test were included in the analysis to correlate with their self-management measures but were excluded from the validation analysis.
3.6. Data analysis

Descriptive statistics were reported for the demographics of participants. Independent t test was used to evaluate the difference between the overall HTN-SCP-Mn scores and recommended self-management activities. A P value of <.05 was considered as statistically significant. Data analysis was performed using the IBM SPSS Statistics for Windows, Version 23.0, IBM Corp (Armonk, NY), released 2015.

The floor or ceiling effects were considered to be present when there are more than 15% of the participants reported the lowest or the highest possible score for each of the 3 domains of the HTN-SCP-Mn: “Behavior”, “Motivation”, and “Self-efficacy”.[16] We assessed the internal consistency of the HTN-SCP using Cronbach alpha statistic, whereby a value of 0.7 was considered acceptable. For good to excellent internal consistency, the range should be above 0.8 to 0.9.[17]

The test–retest reliability can be determined by the intraclass correlation coefficients (ICC) in which ICC ≥ 0.75 indicates excellent reliability, ICC between 0.4 and 0.75 indicates fair to good reliability, and ICC < 0.4 indicates poor reliability.[18]

To determine if any item in the scale was inconsistent with the averaged behavior of the other items, the item total correlation was tested. A mean item total correlation of 0.15 to 0.20 was desirable for scales that measure broad characteristics, while values of 0.40 to 0.50 were required for scales which had narrower characteristics.[19]

4. Results

4.1. Demographic data

A total of 153 patients with hypertension were analyzed for the first test, while the re-test included 79 patients.

Table 1 shows the characteristics of the 153 patients, of which 54.9% were male, and the median age of 59 years old. More than half (54.9%) had at least secondary education. There were 32.7% who had hypertension only, while 59.5% of all hypertension patients also had dyslipidemia. More than half of the patients measured their blood pressure at home (54.2%) and measured their weight regularly (51.6%) (Table 2).

Due to the dropout of 74 subjects leading to an attrition rate of 48%, the demographic characteristics of the study population and the defaulter group were compared. However, no differences in terms of their median age (interquartile range), gender, and level of education (Table 3) were detected.

In Table 2, those who recorded their blood pressure readings regularly had higher HTN-SCP-Mn score than those who did not document their measurements regularly.

The Motivation domain had the highest average score of 62.1, compared with Self-efficacy (59.9) and Behavior (46.4) (Table 4). No subject presented with minimal score for all 3 domains; however, “Motivation” and “Self-efficacy” domains had minimal ceiling of <4%.
Table 4

| Domains         | No. of items | Mean (SD) | Ceiling effect proportion (%) | Item-Total Correlation Range | Cronbach Alpha | ICC   | ICC, 95% CI |
|-----------------|--------------|-----------|-------------------------------|------------------------------|----------------|-------|-------------|
| Behavior        | 20           | 46.4 (10.4)| 0                             | (0.058–0.677)                | 0.838          | 0.643 | (0.403–0.756) |
| Motivation      | 20           | 62.1 (9.9 )| 6 (3.9)                       | (0.374–0.798)                | 0.929          | 0.579 | (0.411–0.709) |
| Self-efficacy   | 20           | 59.9 (10.5)| 5 (3.3)                       | (0.326–0.767)                | 0.927          | 0.710 | (0.578–0.805) |

CI = confidence interval. ICC = Intraclass correlation coefficient. SD = standard deviation.

4.2. Reliability of instrument

Cronbach alpha test of internal consistency was 0.838, 0.929, and 0.927, respectively, for the Behavior, Motivation, and Self-efficacy domains. This indicates excellent internal consistency for all 3 domains. For item to total correlation coefficient, “Behavior” domain ranged from 0.058 to 0.677 (Table 4), of which the lower end indicates that some items might correlate well with the rest of the items. The ranges for other 2 domains are quite similar, and they indicate good correlation.

The test-retest reliability of the HTN-SCP-Mn indicates fair to good reliability and stability of the instrument with ICC ranging from 0.571 to 0.710.

5. Discussion

Overall, the HTN-SCP-Mn instrument showed satisfactory internal consistency, reliability, and stability in local patients who were proficient in mandarin. The low ceiling effect indicates better discrimination when it is administered to a heterogeneous group of patients with hypertension. What is required next is to validate and correlate the scores of the instrument with objective assessment of self-care measures by the patients.

Nonetheless, the administration of the 60-question HTN-SCP-Mn may be tedious in its application in routine clinical practice. It seems that the regular self-monitoring of home blood pressure alone is a good indicator of self-care, based on the higher correlation between this self-reported measure and the HTN-SCP-Mn scores. This finding suggests that the instrument can potentially be trimmed down but the abridged version will require further validation study.

5.1. Strength and limitations

The use of a web-based approach in administering the retest portion of the study was intended to provide convenience to subjects but it also resulted in higher level of dropouts despite reminders. Reimbursements to compensate subjects of their portion of the study was intended to provide convenience to the content of the instrument to the local habits, it may alienate and restrict its usage in other countries with significant Chinese population. One measure to reduce this limitation is to add specific examples relevant to the local context in country-specific instrument, but this should be evaluated with further study.

6. Conclusion

The results showed good test-retest reliability and internal consistency of the HTN-SCP-mandarin tool. It can potentially be used to assess self-efficacy among patients with hypertension who are proficient in Mandarin. Further study is needed to correlate its scores with actual demonstration of self-efficacy by patients.

Acknowledgments

The developer of the original instrument, A/P Hae-Ra Han of the School of Nursing in the John Hopkins University, had kindly allowed the research team to validate the HTN-SCP instrument for the Singapore study. The investigators are also grateful to the nursing students from Ngee Ann Polytechnic who assisted in carrying out the study.

References

[1] WHO. World Health Day 2013. A Global Brief on Hypertension: Silent Killer, Global Public Health Crisis. WHO. Available at: http://www.who.int/campaigns/world-health-day/2013/en/. Accessed May 21, 2015.
[2] Lewington S, Lacey B, Clarke R, et al. The burden of hypertension and associated risk for cardiovascular mortality in China. JAMA Intern Med 2016;176:524–32.
[3] Top 4 Conditions of Polyclinic Attendances. Ministry of Health. Available at: https://www.moh.gov.sg/content/moh_webhome/statistics/Health_Facts_Singapore/Top_4_Conditions_of_Polyclinic_Attendances. html. Accessed May 25, 2015.
[4] Clinical Practice Guidelines: Hypertension. Ministry of Health Singapore; 2005, p. 68. Available at: https://www.moh.gov.sg/content/dam/moh_web/HPP/Doctors/cpg_medical/withdrawn/cpg_Hypertension-Jun%202003.pdf. Accessed July 17, 2017.
[5] Bandura A. Ramachaudran VS. Self-efficacy. Encyclopedia of Human Behavior. Vol. 4. New York: Academic Press, 1994; 71–81.
[6] Bodenheimer T, Lorig K, Holman H, et al. Patient self-management of chronic disease in primary care. JAMA 2002;288:2469–75.
[7] Marks R, Allegrange J-P. A review and synthesis of research evidence for self-efficacy-enhancing interventions for reducing chronic disability: implications for health education practice (part II). Health Promot Pract 2005;6:148–56.
[8] Williams MV, Baker DW, Parker RM, et al. Relationship of functional health literacy to patients’ knowledge of their chronic disease. A study of patients with hypertension and diabetes. Arch Intern Med 1998;158:166–72.
[9] Lua AYH, Hong L, Bong SHS, et al. A narrative review of the evaluation and selection of instruments which assess self-efficacy amongst patients with essential hypertension. Proc Singap Heartc 2016;25:98–104.
[10] Han H-R, Lee H, Commodoire-Mensah Y, et al. Development and validation of the Hypertension Self-Care Profile: a practical tool to measure hypertension self-care. J Cardiovasc Nurs 2014;29:E11–20.
[11] Koh YLE, Lua YHA, Hong L, et al. Using a web-based approach to assess test-retest reliability of the “Hypertension Self-Care Profile” tool in an Asian population: a validation study. Medicine (Baltimore) 2016;95:e2955.
[12] Department of Statistics, Singapore. Geographic Distribution of the Singapore Resident Population; 2010. Available at: http://www.singstat.gov.sg/publications/publications-and-papers/population#geo-spatial_data. Accessed November 20, 2015.
[13] Terwee C. COSMIN checklist with 4-point scale; April 2015. Available at: http://www.cosmin.nl/images/upload/4.2.COSMIN%20checklist%20with%204-point%20scale%202%22%22%20June%202011.pdf. Accessed January 25, 2016.
[14] Paiva CE, Barroso EM, Carneseca EC, et al. A critical analysis of test-retest reliability in instrument validation studies of cancer patients under palliative care: a systematic review. BMC Med Res Methodol 2014;14:8.

[15] Qualtrics Software. Provo, UT; 2014. Available at: http://www.qualtrics.com. Accessed January 28, 2016.

[16] Cronbach LJ. Coefficient alpha and the internal structure of tests. Psychometrika 1951;16:297–334.

[17] Terwee CB, Bot SDM, de Boer MR, et al. Quality criteria were proposed for measurement properties of health status questionnaires. J Clin Epidemiol 2007;60:34–42.

[18] Enderlein G. Heiss, J. L.: The Design and Analysis of Clinical Experiments. Wiley, New York – Chichester – Brisbane – Toronto – Singapore 1986, 432 S., £38.35. Biom J 1988;30:304.

[19] Clark LA, Watson D. Constructing validity: basic issues in objective scale development. Psychol Assess 1995;7:309–19.