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***Basic Study***

**Self-efficacy for managing hypertension and comorbid conditions**

Lee MJ *et al*. self-efficacy for managing hypertension

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**Abstract**

***Background***

Self-efficacy is defined an individual’s belief in completing necessary actions to achieve the desired goal. For individuals with hypertension and other chronic conditions, self-efficacy has been an essential factor to predict adherence to treatment behaviors.

***Aim***

To examine self-efficacy for managing chronic conditions in individuals with hypertension.

***Methods***

A total of 1087 individuals with chronic conditions in two groups (hypertension and non-hypertension groups) were selected in this study. The two groups’ self-efficacy for managing chronic conditions were investigated using the five domains of patient reported outcomes measurement information system self-efficacy for managing chronic conditions measures (PROMIS-SE); daily activities, emotions, medication and treatment, social interactions, and symptoms. Also, the relationships between self-efficacy and other health-related outcomes for the hypertension group were examined using structural equation modeling.

***Results***

Among 1087 participants, 437 reported having hypertension. The hypertension and non-hypertension groups were statistically different in self-efficacy for managing daily activities [F (1, 598) = 5.63, *p <* 0.05]. Structural equation modeling indicated that for individuals with hypertension, two domains of PROMIS-SE (managing daily activities and emotions) significantly predict global physical health (*p <* 0.001 and *p <* 0.01 sequentially), and one domain (managing emotions) significantly predicts mental health (*p <* 0.001). Hypertension patients’ general quality of life was significantly predicted by global physical health (*p <* 0.001) and mental health (*p <* 0.001).

***Conclusion***

The hypertension group reported deficits in self-efficacy in managing daily activities as compared to the non-hypertension group. In this hypertension group, self-efficacy functioned as an indirect predictor of general quality of life, mediated by global physical and mental health.

**Key words*:*** Hypertension; Self-efficacy; Self-management; Chronic conditions

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**Core tip:** Self-efficacy is an essential factor for predicting treatment adherence, but individuals with hypertension report deficits in self-efficacy for managing hypertension and other comorbid conditions. This study compared self-efficacy for managing chronic conditions between patients with hypertension and patients with other chronic conditions. Also, structural relationships of self-efficacy for managing hypertension and comorbid conditions with other health-related outcomes were examined. This study indicates that deficits in self-efficacy is particularly true for self-efficacy in managing daily activities. Self-efficacy functions as an indirect factor, mediated by global physical and mental health, to predict quality of life.

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**INTRODUCTION**

Chronic conditions, such as hypertension, require consistent symptom management and treatment adherence. However, according to the Centers for Disease Control and Prevention, approximately 24% of adults with hypertension do not engage in self-care practices (*i.e.*, takes medications) to control their blood pressure[1]. Farley *et al*[2] reported that for each 10% increase in adherence to hypertension treatment, 14000 adult lives could be saved annually in the United States. Adherence to self-managing treatment behaviors has been associated with age, gender, marital status, emotional well-being, knowledge of hypertension medication and management, and self-efficacy[3–6]. Among these variables, self-efficacy has been a critical predictor or mediator of adherence to treatment behaviors for hypertension and other chronic conditions[5,7-9].

Self-efficacy is defined as an individual’s belief in performing a required course of actions to accomplish a given outcome[10]. Self-efficacy is a consistent predictor of behavioral maintenance and was shown to improve with health educational programs[11,12]. Studies show that self-efficacy is a determinant of participation in self-management of hypertension[5,6]. In addition, in a study of individuals with hypertension conducted by Schoenthaler *et al*[13], the negative influence of depression on medication adherence was mediated by self-efficacy, such that when self-efficacy was controlled, the relationship between depression and medication adherence became nonsignificant. Therefore, enhancing self-efficacy for managing hypertension is important to foster self-management of hypertension.

Hypertension is associated with many medical comorbidities (*e.g.*, cerebrovascular disease, cardiovascular diseases). Therefore, patients with hypertension often manage multiple comorbid conditions[14]. Accordingly, when examining self-efficacy for managing hypertension, the overall aspect of self-efficacy for managing chronic conditions should be considered beyond hypertension management. The patient reported outcomes measurement information system self-efficacy for managing chronic conditions measures (PROMIS-SE) are the non-disease-specific and domain-specific self-efficacy measure for managing chronic conditions therefore might be most appropriate for capturing the multidimensional aspects of self-efficacy for managing chronic conditions in patients with hypertension who often need to manage multiple chronic conditions. PROMIS-SE includes a total of 137 items in five self-efficacy domains. These domains are self-efficacy for managing daily activities, emotions, medications and treatments, social interactions, and symptoms.

Thus, the purpose of this study is to investigate self-efficacy for managing chronic conditions in individuals with hypertension. The study aims are to compare domain- and item-level self-efficacy for managing chronic conditions between patients with hypertension and patients with other chronic conditions; and identify structural relationships between self-efficacy for managing hypertension and comorbid conditions and other health-related outcomes.

**Materials and Methods**

This retrospective study was a secondary analysis of data from the PROMIS-SE original validation study[15,16]. The dataset includes patients from a clinical practice at the University of Maryland Neurology Care Center (patients with neurologic conditions) and individuals from a national online recruitment company, Op4G (patients with general chronic medical conditions) from April 2013 to April 2014. Data was collected from a total of 1087 patients with chronic conditions, with 837 patients comprising the neurology sample. For the online sample, 250 subjects were randomly selected among approximately 250000 identified subjects with chronic conditions in the Op4G database. Participants were asked to respond to PROMIS-SE items based on all chronic conditions they experience. For the purpose of this study, participants were divided into two groups, hypertension and non-hypertension, based on self-report.

Inclusion criteria for the study sample were: (1) 18 years of age or older; (2) community residence; and (3) having at least one common chronic condition such as arthritis, depression, coronary artery disease, heart attack, stroke, and other conditions (Table 1). At the University of Maryland Neurology Care Center, participants were diagnosed with one of the following chronic neurologic conditions: epilepsy, multiple sclerosis, Parkinson’s disease, peripheral neuropathy, and stroke. For additional data collections methods and procedures, please see Hong *et al*[15] and Gruber‑Baldini *et al*[16].

This study was approved by the institutional review boards of the Medical University of South Carolina (#Pro00033397), the University of Florida (#261-2010), and the University of Maryland (#HP- 000432550).

***PROMIS-SE***

The PROMIS-SE measure comprise at total of 137 items from five domain item banks; daily activities (DA; 35 items), emotions (EM; 25 items), medications and treatments (MT; 26 items), social interactions (SS; 23 items), and symptoms (SX; 28 items). The 5-point Likert scale for all items was: (1) not at all confident; (2) a little confident; (3) somewhat confident; (4) quite confident; and (5) very confident. Appendix provides all of the items in the PROMIS-SE. Participants’ PROMIS-SE domain scores were calculated separately for each domain using the graded response model from item response Theory. Patient scores are provided in T-scores (a mean of 50 with a standard deviation of 10) based on the distribution of the US clinical sample with chronic conditions. These T-scores are described as Tclin scores. Detailed information on PROMIS-SE’s psychometric data and its scoring system, is provided in our previous publications[15–18].

***PROMIS global health measure***

The PROMIS Global Health measure consists of ten items that are designed to assess global physical, mental, and social health of generic, rather than disease-specific populations[19]. For this study, we used scores for the global physical v1.0 (Item Global 03: In general, how would you rate your physical health?, item Global 06: To what extent are you able to carry out your everyday physical activities such as walking, climbing stairs, carrying groceries, or moving a chair?, item Global 07: How would you rate your pain on average?, and item Global 08: How would you rate your fatigue on average?) and mental health v1.2a (Item Global 04: In general, how would you rate your mental health, including your mood and your ability to think and item Global 05: In general, how would you rate your satisfaction with your social activities and relationships?)[19,20]. A single item, in general, would you say your quality of life is… was used to assess general quality of life. The rating scale for this item was: excellent, very good, good, fair or poor.

***Statistical analysis***

Participants were divided into two groups (hypertension and non-hypertension). These two groups’ self-efficacy for managing chronic conditions were compared at the domain- and item-levels. At the domain level, we compared the average Tclin scores across the five PROMIS-SE domains between the two groups. Higher Tclin scores represent higher self-efficacy levels for any given domain. At the item level, based on the two groups’ average ratings for all 137 items, items with a large difference between the two groups were identified. Multivariate analysis of variance (MANOVA) was conducted to test for statistical differences in self-efficacy for managing chronic conditions between individuals with hypertension and without hypertension. When MANOVA results were significantly different, univariate analysis of variance (ANOVA) was conducted for each domain to examine the main effect. We randomly selected 300 individuals for each group (*n* = 600 total) in order to prevent disproportionate numbers between the groups.

In addition, structural equation modeling was conducted to examine the relationships between self-efficacy and other health-related outcomes, such as global physical health, global mental health, and general quality of life for the hypertension group using PROMIS global health measure. Since previous studies have shown these five domains are correlated[6,16], we allowed the domains to be correlated in the model. Maximum likelihood estimation with robust standard errors (MLR) was used as the estimator to calculate coefficients. The three health-related outcomes were regressed on those five PROMIS-SE domains simultaneously using 80% of randomly selected data (full model, Figure 1). Then, we excluded the non-significant predictors and re-tested fitness of the model with the remaining 20% of our data (unused) and confirmed the structural model of self-efficacy on other health-related outcomes. In order to assess the fit, the following criteria were used: CFI and TLI (> 0.95 good, > 0.90 acceptable), RMSEA (< 0.06 good, < 0.08 acceptable), and SRMR (< 0.05 good, < 0.08 acceptable)[21]. Statistical programs R 3.5.0, R studio version 1.0.136 (R Core Team, Cary, Vienna, Austria), and various packages (dplyr, tidyr, splitstackshape, lavaan, and semPlot) were used for all computational processes[22–27].

**Results**

Among 1087 participants, 437 reported having hypertension (617: non-hypertension and 33: missing). The hypertension group (M = 57.8, SD = 12.5) were significantly older than the non-hypertension groups (M = 50.7, SD = 15.3); t (1036) = -7.8, *p <* 0.001. Also, individuals with hypertension (M = 5.2, SD = 2.5) had significantly more comorbid conditions (5.2: including hypertension and 4.2: excluding hypertension) as compared to individuals with no hypertension (M = 2.9, SD = 2.0) on average; *t* (1052) = -16.7, *p <* 0.001. The most common comorbid chronic conditions for individuals with hypertension were arthritis or rheumatism (202, 46%), depression (160, 37%), neuropathy (142, 32%), anxiety (141, 32%), and diabetes (138, 32%), whereas depression (197, 32%), anxiety (172, 28%), migraines or severe headaches (163, 26%), arthritis or rheumatism (160, 26%), and epilepsy (128, 21%) were most common for individuals without hypertension. As expected, risk factors associated with hypertension were more prominent in hypertension groups (*i.e.*, angina, coronary artery disease, myocardial infarction, stroke, heart failure). In addition, the two groups were statistically significantly different in education [**2 (1, *N* = 1052) = 5.4, *p <* 0.05] and in employment status [**2 (1, *N* = 1054) = 7.1, *p <* 0.01]. For detailed information on comorbid conditions and demographics of two groups, please see Tables 1 and 2.

***Comparing hypertension and non-hypertension groups***

Average Tclin scores for each domain of PROMIS-SE for hypertension and non-hypertension groups ranged from 49.2 to 50.4 and 49.6 to 51.1, respectively. As compared to the non-hypertension group, the hypertension group had lower average Tclin scores in DA (-1.9), MT (-0.4), and SX (-0.1) and higher average Tclin scores in EM (+0.7) and SS (+0.4). Accordingly, among the top fifteen PROMIS-SE items with the most substantial differences between the two groups (higher for the non-hypertension group), thirteen items belonged to DA. Item DA13 (exercise vigorously for 10 min) showed the largest difference (0.68) between the hypertension and non-hypertension groups. DA17 (climb one flight of stairs) had the second largest difference (0.32) and DA12 (exercise moderately for 10 min) came in third (0.31). On the other hand, the hypertension group’s average ratings were higher for all items in EM except for EM03 (relax body to reduce anxiety; 0.05; Supplementary 1).

A one-way MANOVA identified a statistically significant difference in self-efficacy between hypertension and non-hypertension groups [Wilks’ λ = .973, F (5, 594) = 3.261, *p <* 0.001]. According to the follow-up univariate ANOVAs for each domain of the PROMIS-SE, significant univariate main effects for the hypertension group were obtained for DA [F (1, 598) = 5.63, *p <* 0.05], but not for all other domains; EM [F (1, 598) = 1.17, *p =* 0.28], MT [F (1, 598) = 0.24, *p =* 0.62], SS [F (1, 598) = 0.13, *p =* 0.72], and SX [F (1, 598) = 0.09, *p =* 0.76].

***Structural relationship between self-efficacy and other health-related outcomes***

Our full model explained 59.8%, 60.6%, and 46.5% of the variance in general quality of life, global physical health, and global mental health sequentially. Four out of five PROMIS-SE domains significantly predicted global physical health (DA: *p <* 0.001, EM: *p <* 0.05, MT: *p <* 0.001, SS: *p =* 0.304, and SX: *p <* 0.001). For global mental health, three PROMIS-SE domains were significant predictors (DA: *p <* 0.001, EM: *p <* 0.001, MT: *p =* 0.128, SS: *p <* 0.01, and SX: *p =* 0.526). General quality of life was significantly predicted by both global physical health (*p <* 0.001) and global mental health (*p <* 0.001), but none of the five PROMIS-SE domains significantly directly predicted general quality of life (DA: *p =* 0.818, EM: *p =* 0.388, MT: *p =* 0.342, SS: *p =* 0.224, and SX: *p =* 0.770). Following the results of the full model, the five PROMIS-SE domains as direct predictors of general quality of life, SS as a direct predictor of global physical health, and MT and SS as direct predictors of global mental health were removed in the revised model. The full model was “just” identified; CFI (1), TLI (1), RMSEA (0), and SRMR (0), respectively.

In this revised model, we tested the effect of self-efficacy on general quality of life with global physical health and mental health fully mediating (indirect effect only) this relationship with the unused sample (Figure 2). Our revised model demonstrated excellent fit to our data; CFI (0.997, > 0.95 good), TLI (0.990, > 0.95 good), RMSEA (0.044, < 0.06 good), and SRMR (0.015, < 0.05 good) respectively. The revised model explained 55.5 %, 50.5 %, and 54.5 % of the variance in general quality of life, global physical health, and global mental health, consecutively. Global physical health and mental health significantly predicted general quality of life (*p <* 0.001). It was noted that two PROMIS-SE domains (DA: *p <* 0.001 and EM: *p <* 0.01) significantly predicted global physical health (DA: *p <* 0.001) and one domain (EM: *p <* 0.001) predicted global mental health. Figure 2 and Table 4 provide the structure of the revised model and its corresponding statistical results.

**Discussion**

According to the World Health Organizations’ report on chronic condition care, patients with hypertension have poor self-management skills, including managing prescribed medications. The report recommends the study of hypertension self-management skills to effectively control this life-long disease[28]. Among factors contributing to managing hypertension, self-efficacy is a significant component in adherence to self-management activities[5,6]. This study investigated self-efficacy domains for managing chronic conditions in individuals with hypertension and other comorbid conditions. Our results show that, compared to individuals with other chronic conditions, those with hypertension have significantly lower levels of self-efficacy for managing daily activities (DA), while their self-efficacy levels for managing emotions (EM), medications and treatment (MT), social interaction (SS) and symptoms (SX) were similar to our reference group of individuals with chronic conditions. Further, we found that self-efficacy is an indirect predictor of general quality of life in participants with hypertension and a direct predictor for their global physical and mental health.

Confidence in managing daily activities can be affected in individuals with decreased mobility and overall physical function. In our study, demographic differences between groups could account for the differences found in this domain. The hypertension group was on average seven-years-older and had approximately two more chronic conditions than the reference clinical sample. Aging is significantly associated with decreased physical abilities[29], abilities to perform daily tasks independently[30], and disability[31]. Having more chronic conditions is likely to result in lower physical function. It has been estimated that approximately 25% of persons with chronic conditions have some physical limitations and that physical disability increases with increasing numbers of coexisting chronic conditions[32–34]. Also, known risk factors for the development of hypertension, including obesity, physically inactivity, unhealthy diet, and alcohol/tobacco consumption[35] are associated with poor physical function and can potentially influence individuals’ beliefs in their capacity to perform daily tasks.

Other self-efficacy domains assessed by PROMIS-SE (managing emotions, medications and treatment, social interaction and symptoms) were equally affected across the hypertension and non-hypertension groups. In our previous paper, we did not find statistical differences among five chronic neurologic conditions in three PROMIS-SE domains; managing emotions, medications and treatment, and social interaction[17]. These suggests individuals with chronic conditions have similar perceptions of their abilities to manage their conditions. Since our groups had different types and number of chronic conditions, we were not able to examine the unique impact of hypertension on self-efficacy for disease management. Further studies are needed to see if differences exist that can potentially result in targeted interventions.

Our study indicates that self-efficacy for managing hypertension and comorbid conditions has an indirect effect on the general quality of life of these individuals. More than half of the variance in global physical and mental health is predicted by two domains of PROMIS-SE (managing daily activities and emotions) and one domain (managing emotions) sequentially, and global physical and mental health directly predict the general quality of life for patients with hypertension. This result supports that two domains of self-efficacy for managing chronic conditions (DA and EM) play a substantial role in the general quality of life of individuals with hypertension. Improving self-efficacy for managing chronic conditions has been recommended in patients with chronic pain for reducing disability[36], patients with epilepsy for improving general quality of life[37], patients with chronic kidney disease for encouraging self-care[38], and patients with spinal cord injury for reducing depressive conditions[39]. The hypertension literature has focused on the role of self-efficacy for managing medication adherence[40,41]. Based on our results, further studies are needed to isolate the specific role of self-efficacy for managing daily activities and emotions in this population in order to develop domain-specific interventions that maximize quality of life.

As with any retrospective analysis, this study relied on existing data, not collected to address our research questions. Critical variables such as length and severity of each chronic condition that could influence our study result were not included in our study. Further, we relied on a single item to represent general quality of life. Though the literature supports single item scales to assess quality of life[42–44], we acknowledge important limitations when assessing such a complex construct with a single item. Many aspects of quality of life including life trajectories, goals, expectations, disease dependency, and culture need to be considered since they influence individuals’ perception of their quality of life[45–48]. These are difficult to capture with a single item. Other studies have found self-efficacy to be a direct predictor of health-related quality of life[49–52]. Our study indicates an indirect relationship between self-efficacy domains and the broader perception of quality of life. Further investigation is needed to elucidate the relationship between self-efficacy domains and health-related quality of life in individuals with hypertension.

While we attempted to minimize group selection bias, we found significant differences in age, number of chronic conditions, and other demographic variables that could influence our results. Future studies are needed to investigate the unique impact of hypertension on the perceived ability of individuals to manage the condition.

In conclusion, individuals with hypertension report deficits in self-efficacy to manage their condition and other comorbidities. This was particularly true for self-efficacy in managing daily activities. In this hypertension group, self-efficacy functioned as an indirect factor, mediated by global physical and mental health, to predict general quality of life.

**ARTICLE HIGHLIGHTS**

***Research background***

Consistent symptom management and treatment adherence are necessary for managing chronic conditions. Self-efficacy has been an influential predictor and mediator of adherence to treatment behaviors for patients with chronic conditions, such as hypertension. Patients with hypertension often manage multiple comorbid conditions since hypertension is often associated with numerous other medical conditions (*e.g.*, cerebrovascular disease, cardiovascular diseases). However, self-efficacy for managing hypertension and comorbid conditions has not been thoroughly examined.

***Research motivation***

Effectively improving self-efficacy for managing hypertension and comorbid conditions is critical for self-management of hypertension. Investigating self-efficacy for managing hypertension and comorbid conditions and its relationships to other health-related outcomes will allow clinicians and researchers to design therapeutic interventions tailored to patients with hypertension. Further, differences in self-efficacy domains and items may help develop targeted interventions to improve self-efficacy in this patient population.

***Research objectives***

Objectives of this study are to examine self-efficacy for managing chronic conditions in patients with hypertension and compare it to patients with other chronic conditions. We identified the structural model explaining the relationship of self-efficacy for managing hypertension with other health-related outcomes at the domain level.

***Research methods***

A total of 1087 individuals with chronic conditions were selected in this study. Individuals with chronic conditions were grouped into hypertension and non-hypertension group. Differences in self-efficacy for managing chronic conditions between the two groups were examined at domain-and item-level using five domains of patient-reported outcomes measurement information system self-efficacy for managing chronic conditions measures (PROMIS-SE). Also, the associations between five domains of PROMIS-SE and other health-related outcomes such as global physical health, global mental health, and general quality of life were investigated using structural equation modeling for the hypertension group.

***Research results***

A total of 437 reported having hypertension (617: non-hypertension and 33: missing). Statistical differences in self-efficacy for managing chronic conditions between hypertension and non-hypertension groups were identified in the self-efficacy for managing daily activities domain. Also, for hypertension patients, self-efficacy for managing daily activities and emotions were significant predictors of global physical health. For global mental health, only one domain, self-efficacy for managing emotions was a significant predictor. Overall, both global physical and mental health statistically significantly predicted hypertension patients’ general quality of life.

***Research conclusions***

The hypertension group had lower self-efficacy for managing daily activities as compared to the non-hypertension group. For individuals with hypertension, self-efficacy for managing daily activities and emotions were indirect predictors for their general quality of life, mediated by global physical and mental health.

***Research perspectives***

Future studies are encouraged to examine specific roles of these two domains of self-efficacy for managing hypertension and comorbid conditions on global physical and mental health, and general quality of life in order to provide domain specific interventions that effectively enhance those outcomes.

**REFERENCES**

1 **Yoon SS**, Burt V, Louis T, Carroll MD. Hypertension among adults in the United States, 2009-2010. *NCHS Data Brief* 2012; **(107)**: 1-8 [PMID: 23102115]

2 **Farley TA**, Dalal MA, Mostashari F, Frieden TR. Deaths preventable in the U.S. by improvements in use of clinical preventive services. *Am J Prev Med* 2010; **38**: 600-609 [PMID: 20494236 DOI: 10.1016/j.amepre.2010.02.016]

3 **Tibebu A**, Mengistu D, Bulto LN. Adherence to prescribed antihypertensive medications and associated factors for hypertensive patients attending chronic follow-up units of selected public hospitals in Addis Ababa, Ethiopia. *Int J Health Sci (Qassim)* 2017; **11**: 47-52 [PMID: 29085268]

4 **Trivedi RB**, Ayotte B, Edelman D, Bosworth HB. The association of emotional well-being and marital status with treatment adherence among patients with hypertension. *J Behav Med* 2008; **31**: 489-497 [PMID: 18780175 DOI: 10.1007/s10865-008-9173-4]

5 **Warren-Findlow J**, Seymour RB, Brunner Huber LR. The association between self-efficacy and hypertension self-care activities among African American adults. *J Community Health* 2012; **37**: 15-24 [PMID: 21547409 DOI: 10.1007/s10900-011-9410-6]

6 **Lee JE**, Han HR, Song H, Kim J, Kim KB, Ryu JP, Kim MT. Correlates of self-care behaviors for managing hypertension among Korean Americans: a questionnaire survey. *Int J Nurs Stud* 2010; **47**: 411-417 [PMID: 19863959 DOI: 10.1016/j.ijnurstu.2009.09.011]

7 **Wu JR**, Song EK, Moser DK. Type D personality, self-efficacy, and medication adherence in patients with heart failure-A mediation analysis. *Heart Lung* 2015; **44**: 276-281 [PMID: 25979573 DOI: 10.1016/j.hrtlng.2015.03.006]

8 **Qi BB**, Resnick B. Reliability and validity of the Chinese versions of self-efficacy and outcome expectations for osteoporosis medication adherence scales in Chinese immigrants. *J Nurs Meas* 2014; **22**: 472-488 [PMID: 25608433 DOI: 10.1891/1061-3749.22.3.472]

9 **Spruill TM**, Ogedegbe G, Harrold LR, Potter J, Scher JU, Rosenthal PB, Greenberg JD. Association of medication beliefs and self-efficacy with adherence in urban Hispanic and African-American rheumatoid arthritis patients. *Ann Rheum Dis* 2014; **73**: 317-318 [PMID: 23904474 DOI: 10.1136/annrheumdis-2013-203560]

10 **Bandura A**. Self-efficacy: The exercise of control. W.H. Freeman and Company, New York, 1997. Available from: URL: https://www.scirp.org/reference/ReferencesPapers.aspx?ReferenceID=2459882

11 **Lorig KR**, Sobel DS, Ritter PL, Laurent D, Hobbs M. Effect of a self-management program on patients with chronic disease. *Eff Clin Pract* 2001; **4**: 256-262 [PMID: 11769298]

12 **Strecher VJ**, DeVellis BM, Becker MH, Rosenstock IM. The role of self-efficacy in achieving health behavior change. *Health Educ Q* 1986; **13**: 73-92 [PMID: 3957687 DOI: 10.1177/109019818601300108]

13 **Schoenthaler A**, Ogedegbe G, Allegrante JP. Self-efficacy mediates the relationship between depressive symptoms and medication adherence among hypertensive African Americans. *Health Educ Behav* 2009; **36**: 127-137 [PMID: 18077654 DOI: 10.1177/1090198107309459]

14 **Noh J**, Kim HC, Shin A, Yeom H, Jang SY, Lee JH, Kim C, Suh I. Prevalence of Comorbidity among People with Hypertension: The Korea National Health and Nutrition Examination Survey 2007-2013. *Korean Circ J* 2016; **46**: 672-680 [PMID: 27721859 DOI: 10.4070/kcj.2016.46.5.672]

15 **Hong I**, Velozo CA, Li CY, Romero S, Gruber-Baldini AL, Shulman LM. Assessment of the psychometrics of a PROMIS item bank: self-efficacy for managing daily activities. *Qual Life Res* 2016; **25**: 2221-2232 [PMID: 27048495 DOI: 10.1007/s11136-016-1270-1]

16 **Gruber-Baldini AL**, Velozo C, Romero S, Shulman LM. Validation of the PROMIS® measures of self-efficacy for managing chronic conditions. *Qual Life Res* 2017; **26**: 1915-1924 [PMID: 28239781 DOI: 10.1007/s11136-017-1527-3]

17 **Shulman LM**, Velozo C, Romero S, Gruber-Baldini AL. Comparative study of PROMISⓇ self-efficacy for managing chronic conditions across chronic neurologic disorders. *Qual Life Res* 2019; **28**: 1893-1901 [PMID: 30915674 DOI: 10.1007/s11136-019-02164-2]

18 **Lee MJ**, Romero S, Velozo CA, Gruber-Baldini AL, Shulman LM. Multidimensionality of the PROMIS self-efficacy measure for managing chronic conditions. *Qual Life Res* 2019; **28**: 1595-1603 [PMID: 30806873 DOI: 10.1007/s11136-019-02116-w]

19 **Hays RD**, Bjorner JB, Revicki DA, Spritzer KL, Cella D. Development of physical and mental health summary scores from the patient-reported outcomes measurement information system (PROMIS) global items. *Qual Life Res* 2009; **18**: 873-880 [PMID: 19543809 DOI: 10.1007/s11136-009-9496-9]

20 **Hays RD**, Schalet BD, Spritzer KL, Cella D. Two-item PROMIS® global physical and mental health scales. *J Patient Rep Outcomes* 2017; **1**: 2 [PMID: 29757325 DOI: 10.1186/s41687-017-0003-8]

21 **Hu L,** Bentler PM. Cutoff criteria for fit indexes in covariance structure analysis: Conventional criteria versus new alternatives. *Struct Equ Modeling* 1999; **6**: 1–55 [DOI: 10.1080/10705519909540118]

22 **R Foundation for Statistical Computing;** Vienna, Austria: 2014. R: A language and environment for statistical computing. 2018. Available from: URL: https://cran.r-project.org/

23 **Wickham H,** Henry L, Wickham MH. Package ‘tidyr.’ 2019. Available from: URL: https://github.com/tidyverse/tidyr

24 **Wickham H**. Data manipulation with dplyr. R user conference. 2014. Available from: URL: http://dplyr.tidyverse.org, https://github.com/tidyverse/dplyr

25 **Mahto A**. Splitstackshape: Stack and reshape datasets after splitting concatenated values. R package version; 2014. Available from: URL: http://github.com/mrdwab/splitstackshape

26 **Rosseel Y**. lavaan: An R package for structural equation modeling and more Version 0.4-9 (BETA) [Internet]. Ghent University; 2011. Available from: URL: http://byrneslab.net/classes/lavaan\_materials/lavaanIntroduction4-9.pdf

27 **Epskamp S,** Epskamp MS, MplusAutomation S. Package ‘semPlot.’ 2019. Available from: URL: https://github.com/SachaEpskamp/semPlot

28 **World Health Organization**. Adherence to long-term therapies: Evidence for action. 2003. Available from: URL: https://www.who.int/chp/knowledge/publications/adherence\_report/en/

29 **Adamo DE**, Alexander NB, Brown SH. The influence of age and physical activity on upper limb proprioceptive ability. *J Aging Phys Act* 2009; **17**: 272-293 [PMID: 19799100 DOI: 10.1123/japa.17.3.272]

30 **Demura S**, Sato S, Minami M, Kasuga K. Gender and age differences in basic ADL ability on the elderly: comparison between the independent and the dependent elderly. *J Physiol Anthropol Appl Human Sci* 2003; **22**: 19-27 [PMID: 12672979 DOI: 10.2114/jpa.22.19]

31 **Dunlop DD**, Hughes SL, Manheim LM. Disability in activities of daily living: patterns of change and a hierarchy of disability. *Am J Public Health* 1997; **87**: 378-383 [PMID: 9096537 DOI: 10.2105/ajph.87.3.378]

32 **Anderson G,** Horvath J. Chronic conditions: Making the case for ongoing care. Partnership for Solutions. Johns Hopkins University; 2002. Available from: url: http://www.partnershipforsolutions.org/DMS/files/chronicbook2002.pdf

33 **Verbrugge LM**, Lepkowski JM, Imanaka Y. Comorbidity and its impact on disability. *Milbank Q* 1989; **67**: 450-484 [PMID: 2534562 DOI: 10.2307/3350223]

34 **Patel KV**, Peek MK, Wong R, Markides KS. Comorbidity and disability in elderly Mexican and Mexican American adults: findings from Mexico and the southwestern United States. *J Aging Health* 2006; **18**: 315-329 [PMID: 16614346 DOI: 10.1177/0898264305285653]

35 **Centers for Disease Control and Prevention**. Behaviors That Increase Risk for High Blood Pressure. 2018. [cited 2019 Jun 28]. Available from: URL: https://www.cdc.gov/bloodpressure/behavior.htm

36 **Arnstein P**. The mediation of disability by self efficacy in different samples of chronic pain patients. *Disabil Rehabil* 2000; **22**: 794-801 [PMID: 11194620 DOI: 10.1080/09638280050200296]

37 **Amir M**, Roziner I, Knoll A, Neufeld MY. Self-efficacy and social support as mediators in the relation between disease severity and quality of life in patients with epilepsy. *Epilepsia* 1999; **40**: 216-224 [PMID: 9952270 DOI: 10.1111/j.1528-1157.1999.tb02078.x]

38 **Wu SF**, Hsieh NC, Lin LJ, Tsai JM. Prediction of self-care behaviour on the basis of knowledge about chronic kidney disease using self-efficacy as a mediator. *J Clin Nurs* 2016; **25**: 2609-2618 [PMID: 27364760 DOI: 10.1111/jocn.13305]

39 **Craig A**, Tran Y, Siddall P, Wijesuriya N, Lovas J, Bartrop R, Middleton J. Developing a model of associations between chronic pain, depressive mood, chronic fatigue, and self-efficacy in people with spinal cord injury. *J Pain* 2013; **14**: 911-920 [PMID: 23707693 DOI: 10.1016/j.jpain.2013.03.002]

40 **Gozum S**, Hacihasanoglu R. Reliability and validity of the Turkish adaptation of medication adherence self-efficacy scale in hypertensive patients. *Eur J Cardiovasc Nurs* 2009; **8**: 129-136 [PMID: 19046930 DOI: 10.1016/j.ejcnurse.2008.10.006]

41 **Ogedegbe G**, Mancuso CA, Allegrante JP, Charlson ME. Development and evaluation of a medication adherence self-efficacy scale in hypertensive African-American patients. *J Clin Epidemiol* 2003; **56**: 520-529 [PMID: 12873646 DOI: 10.1016/S0895-4356(03)00053-2]

42 **Siebens HC**, Tsukerman D, Adkins RH, Kahan J, Kemp B. Correlates of a Single-Item Quality-of-Life Measure in People Aging with Disabilities. *Am J Phys Med Rehabil* 2015; **94**: 1065-1074 [PMID: 25888654 DOI: 10.1097/PHM.0000000000000298]

43 **Conway L**, Widjaja E, Smith ML. Single-item measure for assessing quality of life in children with drug-resistant epilepsy. *Epilepsia Open* 2018; **3**: 46-54 [PMID: 29588987 DOI: 10.1002/epi4.12088]

44 **Sloan JA**, Aaronson N, Cappelleri JC, Fairclough DL, Varricchio C; Clinical Significance Consensus Meeting Group. Assessing the clinical significance of single items relative to summated scores. *Mayo Clin Proc* 2002; **77**: 479-487 [PMID: 12004998 DOI: 10.4065/77.5.479]

45 **Gill TM**, Feinstein AR. A critical appraisal of the quality of quality-of-life measurements. *JAMA* 1994; **272**: 619-626 [PMID: 7726894 DOI: 10.1001/jama.1994.03520080061045]

46 **Karimi M,** Brazier J. Health, health-related quality of life, and quality of life: What is the difference? *Pharmacoeconomics* 2016; **34**: 645–649 [PMID: 26892973 DOI: 10.1007/s40273-016-0389-9]

47 **Aaronson N**, Alonso J, Burnam A, Lohr KN, Patrick DL, Perrin E, Stein RE. Assessing health status and quality-of-life instruments: attributes and review criteria. *Qual Life Res* 2002; **11**: 193-205 [PMID: 12074258 DOI: 10.1023/A:1015291021312]

48 **Coons SJ**, Rao S, Keininger DL, Hays RD. A comparative review of generic quality-of-life instruments. *Pharmacoeconomics* 2000; **17**: 13-35 [PMID: 10747763 DOI: 10.2165/00019053-200017010-00002]

49 **Mohamadian H**, Eftekhar H, Rahimi A, Mohamad HT, Shojaiezade D, Montazeri A. Predicting health-related quality of life by using a health promotion model among Iranian adolescent girls: a structural equation modeling approach. *Nurs Health Sci* 2011; **13**: 141-148 [PMID: 21595808 DOI: 10.1111/j.1442-2018.2011.00591.x]

50 **Loo DW**, Jiang Y, Koh KW, Lim FP, Wang W. Self-efficacy and depression predicting the health-related quality of life of outpatients with chronic heart failure in Singapore. *Appl Nurs Res* 2016; **32**: 148-155 [PMID: 27969020 DOI: 10.1016/j.apnr.2016.07.007]

51 **Fry PS**. Predictors of health-related quality of life perspectives, self-esteem, and life satisfactions of older adults following spousal loss: an 18-month follow-up study of widows and widowers. *Gerontologist* 2001; **41**: 787-798 [PMID: 11723347 DOI: 10.1093/geront/41.6.787]

52 **Goldstein-Leever A**, Peugh JL, Quinn CT, Crosby LE. Disease Self-Efficacy and Health-Related Quality of Life in Adolescents With Sickle Cell Disease. *J Pediatr Hematol Oncol* 2018 [PMID: 30499909 DOI: 10.1097/MPH.0000000000001363]

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**Table 1 Patient-reported chronic conditions, *n* (%)**

|  |  |  |
| --- | --- | --- |
| **Chronic conditions** | **Hypertension** | **Non-hypertension** |
| Arthritis or rheumatism | 202 (46) | 160 (26) |
| Depression | 160 (37) | 197 (32) |
| Neuropathy | 142 (32) | 113 (18) |
| Anxiety | 141 (32) | 172 (28) |
| Diabetes or high blood sugar or sugar in your urine | 138 (32) | 49 (8) |
| Sleep disorder | 135 (31) | 97 (16) |
| Stroke or transient ischemic attack | 128 (29) | 63 (10) |
| Migraines or severe headaches | 119 (27) | 163 (26) |
| Asthma | 81 (19) | 100 (16) |
| Cancer (other than non-melanoma skin cancer) | 66 (15) | 58 (9) |
| Parkinson's disease | 64 (15) | 108 (18) |
| Osteoporosis | 62 (14) | 56 (9) |
| Chest pain (angina) | 61 (14) | 37 (6) |
| Epilepsy | 54 (12) | 128 (21) |
| Multiple sclerosis | 53 (12) | 126 (20) |
| Hardening of the arteries (coronary artery disease) | 40 (9) | 21 (3) |
| Chronic lung disease, chronic bronchitis or emphysema | 33 (8) | 26 (4) |
| Spinal cord injury | 30 (7) | 20 (3) |
| Heart attack (myocardial infarction) | 30 (7) | 22 (4) |
| Kidney disease | 30 (7) | 16 (3) |
| Heart failure or congestive heart failure | 24 (5) | 14 (2) |
| Liver disease, hepatitis, or cirrhosis | 18 (4) | 19 (3) |
| Alcohol or drug problem | 16 (4) | 22 (4) |
| Human immunodeficiency virus or acquired immune deficiency syndrome | 6 (1) | 4 (1) |

**Table 2 Demographics, *n* (%)**

|  |  |  |
| --- | --- | --- |
| **Chronic conditions** | **Hypertension** | **Non-hypertension** |
| Education |  |  |
| ≤ high school | 102 (23) | 107 (17)a |
| Some college + | 334 (76) | 509 (82) |
| Missing | 1 (< 1) | 1 (< 1) |
| Marital status |  |  |
| Married | 266 (61) | 356 (58) |
| Not married | 171 (39) | 260 (42) |
| Missing | 0 (0) | 1 (< 1) |
| Income |  |  |
| ≤ $60000 | 203 (46) | 260 (42) |
| > $60000 | 212 (49) | 332 (54) |
| Missing | 22 (5) | 25 (4) |
| Employment status |  |  |
| Employed (full-time or part-time) | 163 (37) | 282 (46)b |
| Unemployed | 274 (63) | 335 (54) |
| Age (mean ± SD, yr) | 57.8 ± 12.5 | 50.7 ± 15.3c |
| No. of comorbid conditions (mean ± SD) | 5.2 ± 2.5 | 2.9 ± 2.0c |

a*p <* 0.05, b*p <* 0.01, c*p <* 0.001 from *t*-test for continuous variables (age and number of comorbid conditions); and from **2 from all others.

**Table 3 Average Tclin scores in patient reported outcomes measurement information system self-efficacy for managing chronic conditions measures domains (mean ± SD)**

|  |  |  |
| --- | --- | --- |
| **Domains** | **Hypertension** | **Non-hypertension** |
| SE-DA1 | 49.2 ± 8.87 | 51.1 ± 9.85 |
| SE-EM2 | 50.4 ± 9.54 | 49.7 ± 10 |
| SE-MT3 | 49.4 ± 8.82 | 49.8 ± 9.83 |
| SE-SS4 | 50 ± 9.22 | 49.6 ± 9.75 |
| SE-SX5 | 49.8 ± 9.14 | 49.9 ± 9.87 |

1managing daily activities; 2managing emotions; 3managing medications and treatments; 4managing social interactions; 5managing symptoms.

**Table 4 Parameters of the revised model**

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **Outcome** | **Predictor** | **Std. coefficient** | **Std. error** | ***Z*-value** | ***p* value** |
| General Quality of life | Global physical health | 0.430 | 0.011 | 4.053 | < 0.001 |
| Global mental health | 0.429 | 0.012 | 3.845 | < 0.001 |
| Global Physical Health | Self-efficacy DA1 | 0.637 | 0.114 | 5.662 | < 0.001 |
| Self-efficacy EM2 | 0.323 | 0.110 | 3.024 | < 0.01 |
| Self-efficacy MT3 | -0.151 | 0.111 | -1.455 | 0.146 |
| Self-efficacy SX4 | -0.042 | 0.102 | -0.399 | 0.690 |
| Global Mental Health | Self-efficacy DA1 | 0.008 | 0.105 | 0.076 | 0.940 |
| Self-efficacy EM2 | 0.538 | 0.145 | 3.732 | < 0.001 |
| Self-efficacy SS5 | 0.201 | 0.151 | 1.312 | 0.190 |

1managing daily activities; 2managing emotions; 3managing medications and treatments; 4managing social interaction; 5managing symptoms.

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**Figure 1 The full model.**

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**Figure 2 The revised model.**