Self-care behavior mediates the relationship between health literacy and blood pressure in older adults with hypertension.

Tran Quang Huy, [1], Nguyen Thi Nguyet, [2], Nguyen Minh Nguyet, [3], Pham Van Truong, [4]

ABSTRACT

Objective

To test the mediating role of self-care behavior in the relationship between health literacy and BP control in older adults with hypertension.

Material and methods

A cross-sectional study design was used. We enrolled 220 older adult patients with hypertension at one teaching hospital in Vietnam. Logistic regression and linear regression were conducted to test the mediation effect of self-care behavior in the relationship between health literacy and BP control.

Results and discussion

Self-care behavior mediated the relationship between health literacy and BP control. The significant coefficient of path a (β = 0.019, p < .001), and path c (β = -0.054, p < .001) suggested a significant effect of health literacy on self-care behavior, and a significant total effect of health literacy on BP control, while the non-significant coefficient of path b (β = -0.012, p = .577) suggested a non-significant effect of self-care behavior on BP control. Additionally, the significant coefficient of path c' (β = -0.053, p < .001) suggested a mediation model, that is, self-care behavior mediated the relationship between health literacy and BP control.

Conclusion

Self-care behavior is observed as a mediating factor in the relationship between health literacy and blood pressure (BP) control among older adults with hypertension in Vietnam.

Keywords

Mediator; health literacy; hypertension; self-care behavior; older adults.

INTRODUCTION:

Hypertension is a leading preventable cause of death globally.[1] It was predicted that 1.13 billion people worldwide have hypertension; however, less than 20% of people with hypertension have the disease under control.[2] In the United States, hypertension affects 45.6% of adults, impacting over a quarter of the adult population.[3] It ranks as the third most substantial precursor to early mortality and disability in England.[4] Meanwhile, in Vietnam, hypertension is emerging as a notable concern for public health, with almost 20% of the populace experiencing hypertension in the year 2017.[5]

Self-care is crucial for managing hypertension and involves a patient's ability to engage in health prevention, promotion, and disease management.[6] Insufficient self-care conduct has been associated with unfavorable health consequences, escalated healthcare expenditures, and complications tied to hypertension.[7] Health

1. Tran Quang Huy, Ph.D, Nursing Faculty, Dai Nam University, Hanoi, Vietnam
2. Nguyen Thi Nguyet, PhD , VNU University of Medicine and Pharmacy, Vietnam National University, Hanoi, Vietnam
3. Nguyen Minh Nguyet, MSc, Tam Anh Hospital, Hanoi, Vietnam.
4. Pham Van Truong, PhD, Department of Nursing, Kusumi Hospital, Hung Yen, Vietnam and Department of Nursing, Duy Tan University, Da Nang, Vietnam.

Correspondence

Pham Van Truong, Department of Nursing, Kusumi Hospital, Hung Yen, Vietnam. Email: truongpham9@gmail.com

literacy plays a vital role in self-care, with higher levels of health literacy associated with better blood pressure control.[8,9] Limited health literacy may impede self-care routines, resulting in hospital readmissions and challenges in comprehending health-related information. Improving health literacy has been shown to enhance self-care behavior in patients with chronic conditions such as diabetes. [8,10] Furthermore, self-care is impacted by variables including formal education, knowledge about hypertension, and social support.[11] Recognized as the primary treatment and preventive measure for hypertension, self-care is considered the significant importance in its management. [12]

Taken together, self-care behavior may mediate the association between health literacy and BP control. However, the mediator role of self-care behavior in the relationship between health literacy and BP control has not been studied in older adults with hypertension. Given the high and rising prevalence of hypertension in Vietnam, actions to improve the self-care behavior of the Vietnamese population with hypertension are imperative. To our knowledge, no study to-date has tested the mediating role of self-care behavior in the relationship between health literacy and BP in older adults with hypertension.

METHODS AND MATERIALS

Study design

A cross-sectional design was used in this study.

Population and samples

Population

The target population was Vietnamese older adults with hypertension.

Sample

Participants were recruited from the outpatient department in one teaching hospital in Vietnam. The inclusion criteria were as follow: (1) Aged 60 years of age and older; (2) Received a diagnosis of hypertension based the 2018 European Society of Cardiology/ European Society of Hypertension guidelines; (3) Have received treatments for hypertension and regular follow-up care for at least 6 months; (4) Have no severe complications of hypertension such as stroke, myocardial infarction and chronic kidney disease during data collections that prevent them from participating in the study; (5) Able to speak, write and understand Vietnamese.

Exclusion criteria included serious cognitive or physical impairments, and mental incapacity.

Sample size

Based on the study of Hoe (2008), a sample size above 200 participants could provide sufficient statistical power for path analyses.[13] We recruited 220 participants to allow for a 10% dropout rate.

Measurements

Demographic data

Demographic data included age, gender, education level, employment status, weight, height, time since diagnosis with hypertension, smoking habit, and insurance type.

Blood pressure measurement

BP measurements were taken twice at rest using a digital sphygmomanometer (Omron HEM-7130). The first was taken after the participant seated and rested for at least 3-5 minutes, and the second was taken 1-2 minutes after the first. Participants were asked to avoid caffeine, smoke cigarette, and exercise at least 30 minutes before BP measurement. The mean of the two values were used as the BP value.[14]

Blood pressure control status

BP control status was categorized as controlled and uncontrolled based on the 2018 European Society of Cardiology/ European Society of Hypertension guidelines.[15] Participants with SBP of less than 140 mmHg and DBP of less than 90 mmHg were classified as the controlled group (CG) whereas those whose SPB $\geq$ 140 mmHg or DBP $\geq$ 90mmHg were classified as the uncontrolled group (UG).

Hypertension self-care profile behavior questionnaire

The HTN-SCPB questionnaire was developed by Han et al. (2014).[16] The Vietnamese version of the HTN-SCPB questionnaire has been validated in the Vietnamese adults with hypertension.[17] The Vietnamese version of the HTN-SCPB questionnaire consists of 20 items in 5 domains, including Advanced Self-Management Skills subscale (6 items), Adverse Health Behaviors subscale (2 items), Medication Adherence subscale (2 items) subscale, Diet-Related Knowledge Regarding Hypertension subscale (8 items), and Information Skills subscale (2 items). The Cronbach's α coefficient of the Vietnamese HTN-SCPB was .793 in this study.

Short form of health literacy questionnaire 12 items

Health literacy was measured using the validated Vietnamese version of the HLS-SF12.[18] This questionnaire consists of 3 subscales: Health Care, Disease Prevention, and Health Promotion. Each subscale has 4 different levels regarding health information: accessing, understanding, appraising, and applying information relevant to health. Each item is scored on a 4-point Likert scale from 1 (very difficult) to 4 (very easy). A health literacy index can be calculated from 0 to 50 by using the formula [health literacy index = (mean-1) x (50/3)], 0 was the lowest health literacy, 50 was the highest score of the health literacy. The mean of items for each participant can be calculated ranging from 1 to 3. In this study, the Cronbach's α coefficient of the Vietnamese HLS-SF12 was .969.

Procedures

The study was approved by the IRB of one teaching hospital in Vietnam (HĐĐĐ 01022021-680/QĐBV) on 1st February 2021. Written informed consent was obtained after subjects verbally agreed to take part in the study. The research assistant reviewed the patient's medical history via chart review after permission was obtained from the study site. Demographic data, the HTN-SCPB questionnaire, and the HLS-SF12 questionnaire were collected. Questionnaires were administered via face-to-face interviews on an individual bias.

Statistical analyses

Chi-square and independent t-test were used to examine the correlations between demographic variables and BP status. Independent t-test was conducted to compare scores of the HTN-SCPB and HLS-SF12 according to BP status. Additionally, logistic regression and linear regression were used to test the mediation effect of self-care behavior according to Iacobucci (2012): (1) logistic regression to evaluate path coefficient of the health literacy on BP control; (2) simple linear regression to evaluate path coefficient of the health literacy on self-care behavior; and (3) multivariable logistic regression to evaluate path coefficients of the health literacy and self-care behavior on BP control.

RESULTS

Participant characteristics

This study included 220 older adults with hypertension with a mean age of 72.0 years and a SD of 7.0. Most of the participants (55.0%) were female, and the majority of them (73.6%) were retirees. Above half of the participants (57.7%) were not smoking and most of them (79.5%) had insurance. The demographic characteristics of the participants in the UG and CG are presented in Table 1. No statistically significant between-group differences in demographics were observed.

As can be seen in Table 11, the total and subscale scores of the HTN-SCPB were not significantly different between the CG and the UG (All $p > .05$). However, the total and subscale scores of the health literacy index were significantly different between the CG and the UG (All $p < .05$).

Mediation analyses

The results of mediation analyses are shown in the Figure 1. The significant coefficient of path a ($\beta = 0.019$, $p < .001$), and path c ($\beta = -0.054$, $p < .001$) suggested a significant effect of health literacy on self-care behavior, and a significant total effect of health literacy on BP control, while non-significant coefficient of path b ($\beta = -0.012$, $p = .577$) suggested a non-significant effect of self-care behavior on BP control. Additionally, the significant coefficient of path c' ($\beta = -0.053$, $p < .001$) suggested a mediation model, that is, self-care behavior mediated the relationship between health literacy and BP control.

DISCUSSION

The study was to examine how self-care actions mediate the connection between health literacy and blood pressure regulation among older individuals dealing with hypertension. The results showed that health literacy was significantly associated with both self-care behavior and BP control. However, self-care behavior was not significantly correlated with BP control. Notably, the mediation analysis highlighted that self-care behavior plays a significant intermediary role in the association between health literacy and BP control. These findings emphasize the need for interventions focusing on improving health literacy and self-directed management to achieve BP control in the older adults with hypertension.

Awareness and control of blood pressure are low in Vietnam and other Southeast Asian countries, particularly among individuals over 65 years of age in

Vietnam.[19] The country's development and adoption of a more Western lifestyle, including sedentary behavior and Western dietary patterns, have contributed to increased rates of overweight, obesity, and high BP. Lower socioeconomic status and educational attainment are associated with a higher prevalence of elevated BP. Consistent with previous studies, our research demonstrated significant differences in health literacy scores between different groups, with health literacy strongly correlated to BP control status .[20,21] The Vietnamese government has introduced initiatives and policies aimed at enhancing awareness, healthcare capabilities, and management systems.[22] Insufficient knowledge about hypertension significantly contributes to the disregard of high blood pressure. Among older adults dealing with hypertension, those who possess adequate knowledge tend to be more proactive, adept at analyzing health information, and dedicated to self-care practices. Notably, our study focused on older adults on older adults who have been managing hypertension for an extended period, implying that longer exposure to the condition could augment behaviors, motivation, and confidence in self-care. Hence, healthcare providers should prioritize newly diagnosed older adults dealing with hypertension.

Health literacy has positive effects on health outcomes, including improved blood pressure control.[23] Our study found a significant association between health literacy, self-care behavior, and blood pressure control, which is consistent with previous research.[8,21,24,25] Low health literacy levels can hinder patient participation in educational interventions, resulting in missed benefits and delays in adopting timely self-care behaviors.[26] Implementing a structured intervention to identify patients with low health literacy and provide hypertension self-care training can improve blood pressure control in the hypertensive population. Southeast Asian countries, particularly Vietnam, have low health literacy, with the lowest scores among six Asian nations. [18,27] Our study focused on older adults with hypertension reveals lower health literacy than a prior Vietnamese study, likely due to our older mean age of 72 versus their 55-64 age range.[28] Our sample also had lower education and employment, aligning with lower health literacy among less educated and unemployed individuals. To enhance health literacy in older hypertensive individuals, interventions must consider their readiness levels.

Most importantly, the results presented that self-care behavior mediated the relationship between health literacy and BP control. This suggests that health literacy had not only a direct effect on BP control, but also an indirect effect on BP control through improving self-care behavior. The meditation result highlights the importance of addressing self-care behavior in the management of hypertension. Self-care behavior is essential for the prevention and control of BP. Patients with lower hypertension self-care scores significantly increased the risk for various complications of uncontrolled BP.[30,31] Our findings suggest that researchers should to evaluate self-care behavior when performing a health literacy intervention for improving BP control in older adults with hypertension.

Strengths and Limitations

There existed several limitations, included: first, we used the HLS-SF12 questionnaire, which has been validated in the general population in Vietnam instead of using a hypertension-specific health literacy questionnaire, therefore hypertension-related health literacy in our sample of older adults with hypertension was uncertain. Second, generalizability could be limited because this study was conducted in one outpatient department, and a convenience sampling method was adopted. Third, the cross-sectional nature of the study design was unable to explain the causal relationship between health literacy and BP control. Finally, the type and number of hypertension medications were not assessed in this study. Nevertheless, we only enrolled participants who had received treatments of hypertension and follow-up care for at least 6 months to minimize the differential effects that various medications might have on our results.

Conclusion and implications for nursing practice

The present study supported the mediator role of self-care behavior in the relationship between health literacy and BP control in older adults with hypertension. Future research should investigate the effects of health literacy interventions on both clinical and patient-reported outcomes of older adults with hypertension by taking into consideration of participants' level of self-care behavior.

Acknowledgements

Conflict of Interest

The authors report no conflicts of interest in this work.

Contribution

Authorship TQH, PVT, NMN, and NTN contributed equally to the experimentation. TQH, NTN and PVT wrote and edited the article. All authors read and approved the final manuscript.

**Table 1:** Demographic Characteristics According to Blood Pressure Status (N = 220)

Variables	Total	Blood pressure status		P
		Controlled (165)	Uncontrolled (55)	
Age in years, mean (SD)	72.0 (7.0)	71.96 (6.8)	72.09 (7.1)	.91[a]
Gender, n (%) Male Female	99 (45.0) 121 (55.0)	70 (42.4) 95 (57.6)	29 (52.7) 26 (47.3)	.41[b]
Employment, n (%) Yes No (retirees)	58 (26.4) 162 (73.6)	46 (27.9) 119 (72.1)	12 (21.8) 43 (78.2)	.48[b]
Education level, n (%) ≤ 12 years > 12 years	136 (61.8) 84 (38.2)	102 (61.8) 63 (38.2)	34 (61.8) 21 (38.2)	.57[b]
Smoking habit, n (%) Yes No	93 (43.3) 127 (57.7)	66 (4.0) 99 (6.0)	27 (49.1) 28 (5.9)	.38[b]
Insurance, n (%) Yes No	175 (79.5) 45 (2.5)	131 (79.4) 34 (2.6)	44 (8.0) 11 (2.0)	.55[b]
BMI, mean (SD)	22.8 (3.0)	22.75 (3.1)	22.9 (2.7)	.68[a]
Duration of hypertension, mean (SD)	8.2 (4.2)	8.13 (4.1)	8.56 (4.6)	.52[a]

Note. SD = standard deviation.

Table 2: Self-Care Behavior and Health Literacy According to Blood Pressure Status (N=220)

Variable	Blood pressure status		T	p^*
	Controlled (n=165)	Uncontrolled (n=55)		
Self-care behavior *Total, mean (SD)*	45.38 (7.83)	45.95 (7.36)	-0.46	.643
Subscale Advanced self-management skills, mean (SD)	14.31 (3.29)	14.18 (3.17)	0.25	.822
Adverse health behaviors, mean (SD) Medication adherence, mean (SD)	5.38 (2.07)	5.63 (2.08)	-0.79	.434
Diet-related knowledge regarding hypertension, mean (SD) Information skills, mean (SD)	3.6 (1.47) 18.75 (3.76) 3.35 (1.31)	3.63 (1.63) 19.18 (3.48) 3.31 (1.33)	-0.15 -0.76 0.21	.881 .432 .838
Health literacy *Total, mean (SD)* *Subscale*	22.05 (12.95)	21.08 (11.55)	0.49	.023
Health care, mean (SD)	24.09 (13.03)	23.86 (11.8)	0.12	.013
Health promotion, mean (SD)	18.59 (12.67)	16.97 (11.64)	9.84	.001
Disease prevention, mean (SD)	23.48 (14.47)	22.42 (12.97)	0.48	.025

Note. * Independent *t*-test; SD = standard deviation.
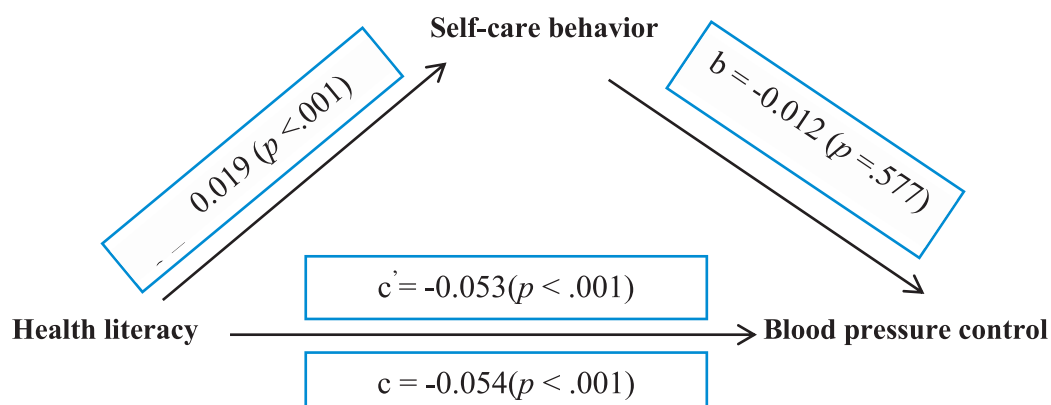
Figure 1: The Mediation Model of Health Literacy, Self-Care Behavior and Blood Pressure Control

References

1. Salem H, Hasan DM, Eameash A, et al. Worldwide prevalence of hypertension: a pooled meta-analysis of 1670 studies in 71 countries with 29.5 million participants. *Journal of the American College of Cardiology.* 2018; **71**(11_Supplement), A1819-A1819. https://doi.org/https://doi.org/1.1016/S0735-1097(18)32360-X

2. World Health Organization. Country Office for Thailand. Hypertension care in Thailand: best practices and challenges, *2019*. Bangkok: World Health Organization. *Country Office for Thailand*. Retrived from: https://apps.who.int/iris/handle/10665/330488.

3. Benjamin, Emelia J et al. *"Heart Disease and Stroke Statistics-2019 Update: A Report From the American Heart Association."* 2019; **139**(10): e56-e528. doi:10.1161/CIR.0000000000000659

4. Public Health England. *Hypertension prevalence estimates in England*, 2017: Estimated from the Health Survey for England. Retrieved from: https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/873605/Summary_of_hypertension_prevalence_estimates_in_England__1_.pdf.

5. Meiqari L, Essink D, Wright P, Scheele F. *Prevalence of Hypertension in Vietnam: A Systematic Review and Meta-Analysis. Asia Pac J Public Health*. 2019 Mar;**31**(2):101-112. doi: 10.1177/1010539518824810. Epub 2019 Jan 24. PMID: 30678477; PMCID: PMC6463272.

6. Gebrezgi MT, Trepka MJ, Kidane EA. *Barriers to and facilitators of hypertension management in Asmara, Eritrea: patients' perspectives. J Health Popul Nutr*. 2017 Apr 13;**36**(1):11. doi: 10.1186/s41043-017-0090-4. PMID: 28407794; PMCID: PMC5390439.

7. Demikhov O, Dehtyarova I, Rud O, Khotyeev Y, Kuts L, Cherkashyna L, Demikhova N, & Orlovskiy A. Arterial hypertension prevention as an actual medical and social problem. *Bangladesh Journal of Medical Science*. 2020;**19**(4), 722–729. https://doi.org/10.3329/bjms.v19i4.46632.

8. Barati M, Bayat F, Asadi, ZA, et al. *Relationship between Health Literacy and Self-Care Behaviors in Hypertensive Patients*. Journal of Education and Community Health. 2020; **7**(2), 89-96. https://doi.org/1.29252/jech.7.2.89

9. Rastegar M, Mahmoodi Z, Esmaelzadeh Saeieh S, Sharifi N, Kabir K. *The Effect of Health Literacy Counselling on Self-Care in Women after Mastectomy: a Randomized Clinical Trial. J Caring Sci*. 2020 Mar 1;**9**(1):39-45. doi: 10.34172/jcs.2020.007. PMID: 32296658; PMCID: PMC7146726.

10. Dahal PK, Hosseinzadeh H. *Association of health literacy and diabetes self-management: a systematic review. Aust J Prim Health*. 2019 Jan;**25**(6):526-533. doi: 10.1071/PY19007. PMID: 31710832.

11. Wondmieneh A, Gedefaw G, Getie A, Demis A. *Self-Care Practice and Associated Factors among Hypertensive Patients in Ethiopia:* A Systematic Review and Meta-Analysis. *Int J Hypertens*. 2021; **9**:5582547. doi: 10.1155/2021/5582547. PMID: 33898063; PMCID: PMC8052173.

12. Unger T, Borghi C, Charchar F, Khan NA, Poulter NR, Prabhakaran D, Ramirez A, Schlaich M, Stergiou GS, Tomaszewski M, Wainford RD, Williams B, Schutte AE. *2020* International Society of Hypertension global hypertension practice guidelines. *J Hypertens*. 2020;Jun;**38**(6):982-1004. doi: 10.1097/HJH.0000000000002453. PMID: 32371787.

13. Hoe, SL. Issues and procedures in adopting structural equation modelling technique. *Journal of Quantitative Methods*. 2008; **3** (1): 76-83. Research Collection School Of Information Systems.

14. Muntner P, Shimbo D, Carey RM, Charleston JB, Gaillard T, Misra S, Myers MG, Ogedegbe G, Schwartz JE, Townsend RR, Urbina EM, Viera AJ, White WB, Wright JT Jr. Measurement of Blood Pressure in Humans: A Scientific Statement From the American Heart Association. Hypertension. 2019 May;**73**(5):e35-e66. doi: 10.1161/HYP.0000000000000087. PMID: 30827125.

15. Whelton PK, Carey RM, Aronow WS, Casey DE Jr, Collins KJ, Dennison Himmelfarb C, DePalma SM, Gidding S, Jamerson KA, Jones DW, MacLaughlin EJ, Muntner P, Ovbiagele B, Smith SC Jr, Spencer CC, Stafford RS, Taler SJ, Thomas RJ, Williams KA Sr, Williamson JD, Wright JT Jr. *2017 ACC/AHA/AAPA/ABC/ACPM/AGS/APhA/ASH/ASPC/NMA/PCNA* Guideline for the Prevention, Detection, Evaluation, and Management of High Blood Pressure in Adults: Executive Summary: A Report of the American College of Cardiology/American Heart Association Task Force on Clinical Practice Guidelines. Circulation. 2018 Oct 23;**138**(17):e426-e483. doi: 10.1161/CIR.0000000000000597. PMID: 30354655.

16. Han HR, Lee H, Commodore-Mensah Y, Kim M. *Development and validation of the Hypertension Self-care Profile: a practical tool to measure hypertension self-care*. J Cardiovasc Nurs. 2014 May-Jun;29(3):E11-20. doi: 10.1097/JCN.0b013e3182a3fd46. PMID: 24088621; PMCID: PMC3972381.

17. Van Truong P, Lin MY, Chiu HY, Hou WH, Tsai PS. *Psychometric Properties and Factorial Structure of Vietnamese Version of the Hypertension Self-care Profile Behavior Scale. J Cardiovasc Nurs*. 2021 Sep-Oct 01;**36**(5):446-453. doi: 10.1097/JCN.0000000000000770. PMID: 33273251.

18. Duong TV, Nguyen TTP, Pham KM, Nguyen KT, Giap MH,

Tran TDX, Nguyen CX, Yang SH, Su CT. Validation of the Short-Form Health Literacy Questionnaire (HLS-SF12) and Its Determinants among People Living in Rural Areas in Vietnam. *Int J Environ Res Public Health.* 2019 Sep 11;**16**(18):3346. doi: 10.3390/ijerph16183346. PMID: 31514271; PMCID: PMC6765800.

19. Oliva, Raymond V. A review on the status of hypertension in six Southeast Asian countries. *Hypertension Journal*. 2019; **5**(2): 45-48.

20. Linh DN & Wang JT. *Hypertension Knowledge, Perceived Social Support and Self-care Behavior among Patients with Hypertension in Vietnam*. 2020. Retrieved from: http://14.131.94.7/handle/987654321/745.

21. Ahmad WMAW, Adnan MN, Rahman NA, Ghazali FMM, AzlidaAleng N, Badrin ZMY, & Alam MK. A predictive hypertension model for patients with dyslipidemia and type 2 diabetes mellitus: a robust hybrid methodology. *Bangladesh Journal of Medical Science*. 2023; **22**(2): 422–431. https://doi.org/10.3329/bjms.v22i2.65007.

22. Ministry of Health. *Hypertension and treating high blood pressure*. 2017. Retrived from: https://moh.gov.vn/en_US/web/ministry-of-health

23. Wannasirikul P, Termsirikulchai L, Sujirarat D, Benjakul S, Tanasugarn C. Health literacy, medication adherence, and blood pressure level among hypertensive older adults treated at primary health care centers. *Southeast Asian J Trop Med Public Health*. 2016 Jan;**47**(1):109-20. PMID: 27086432.

24. Warren-Findlow J, Coffman MJ, Thomas EV, Krinner LM. *ECHO: A Pilot Health Literacy* Intervention to Improve Hypertension Self-Care. *Health Lit Res Pract.* 2019 Dec 5;**3**(4):e259-e267. doi: 10.3928/24748307-20191028-01. PMID: 31893258; PMCID: PMC6901363.

25. RobatSarpooshi D, Mahdizadeh M, Alizadeh Siuki H, Haddadi M, Robatsarpooshi H, Peyman N. The Relationship Between Health Literacy Level and Self-Care Behaviors in Patients with Diabetes. *Patient Relat Outcome Meas*. 2020 May 5;**11**:129-135. doi: 10.2147/PROM.S243678. PMID: 32440244; PMCID: PMC7211311.

26. Robat Sarpooshi D, Taghipour A, Mahdizadeh M, Peyman N. Enablers of and Barriers to Effective Diabetes Self-Care in Iran: A Qualitative Study. *Patient Relat Outcome Meas*. 2020 Apr 17;**11**:109-118. doi: 10.2147/PROM.S241170. PMID: 32368166; PMCID: PMC7174193.

27. Rajah R, Hassali MAA, Murugiah MK. A systematic review of the prevalence of limited health literacy in Southeast Asian countries. *Public Health*. 2019 Feb;**167**:8-15. doi: 10.1016/j.puhe.2018.09.028. Epub 2018 Dec 10. PMID: 30544041.

28. Van Hoa H, Giang HT, Vu PT, Van Tuyen D, Khue PM. Factors Associated with Health Literacy among the Elderly People in Vietnam. *Biomed Res Int*. 2020 Mar ;**25**:3490635. doi: 10.1155/2020/3490635. PMID: 32309429; PMCID: PMC7139882.

29. Bayati T, Dehghan A, Bonyadi F, Bazrafkan L. Investigating the effect of education on health literacy and its relation to health-promoting behaviors in health center. *J Educ Health Promot*. 2018 Oct 29;**7**:127. doi: 10.4103/jehp.jehp_65_18. PMID: 30505855; PMCID: PMC6225398.

30. Nam HJ, Yoon JY. Linking Health Literacy to Self-Care in Hypertensive Patients with Physical Disabilities: A Path Analysis Using a Multi-Mediation Model. *Int J Environ Res Public Health*. 2021 Mar 24;**18**(7):3363. doi: 10.3390/ijerph18073363. PMID: 33805083; PMCID: PMC8036339.

31. Niriayo YL, Ibrahim S, Kassa TD, Asgedom SW, Atey TM, Gidey K, Demoz GT, Kahsay D. Practice and predictors of self-care behaviors among ambulatory patients with hypertension in Ethiopia. *PLoS One*. 2019 Jun 26;**14**(6):e0218947. doi: 10.1371/journal.pone.0218947. PMID: 31242265; PMCID: PMC6594646.