FACTORS ASSOCIATED WITH NON-ADHERENCE TO MEDICATION IN ELDERLY WITH HYPERTENSION

Hipertansiyonu olan yaşlı bireylerde ilaç uyumu ve ilişkili faktörler

Gülçin Elmas AKINCI[1] (iD)**, Cihad DÜNDAR[2]** (iD)

Abstract

Non-adherence to medication, estimated to be approximately 10%–60%, is quite common in the elderly and is an important cause of morbidity. In this study, we aimed to determine the rates of non-adherence to antihypertensive medications and related factors in the elderly. This cross-sectional study was conducted in primary health care facilities in Samsun, Turkey, during May and June 2017, involving a face-to-face interview with patients. The inclusion criteria were a diagnosis of hypertension, use of antihypertensive medication for at least one year, age 65 years and older, and ability to communicate verbally. The Hypertension Medication Adherence Scale was used to assess adherence to treatment. Multivariate logistic regression analysis was used to determine the evaluated variables related to poor adherence. The mean age of the study group was 71.8 ± 6.7 years. The frequency of non-adherence to medication was 10.9%. According to the results of the logistic regression analysis, cognitive impairment, visual impairment, having no social support for medicine intake, male gender and being single were significantly associated with non-adherence to antihypertensive medication. To improve medication adherence in primary care, simplified treatment options should be offered and a patient-oriented treatment plan should be planned.

Keywords: Hypertension, medication adherence, aged, cognitive dysfunction.

Özet

Yaklaşık %10-%60 sıklığında olduğu tahmin edilen ilaç uyumsuzluğu yaşlılarda oldukça yaygındır ve önemli bir morbidite nedenidir. Bu çalışmada yaşlı bireylerde antihipertansif ilaç tedavisine uyumsuzluğun sıklığını ve ilişkili faktörleri belirlemek amaçlanmıştır. Kesitsel olarak planlanan çalışmada veriler Samsun ilinde 2017 yılı Mayıs ve Haziran aylarında aile hekimliğine başvuran hastalar ile yüz-yüze görüşülerek toplanmıştır. En az bir yıldır antihipertansif ilaç kullanan, hipertansiyon tanılı 65 yaş ve üzeri bireyler çalışmaya dahil edilmiştir. İlaç uyumunu belirlemek için Antihipertansif İlaç Tedavisine Uyum Ölçeği kullanılmıştır. İlaç uyumsuzluğuna etki eden faktörleri araştırmak amacıyla lojistik regresyon analizi kullanılmıştır. Çalışma grubunun yaş ortalaması 71,8± 6,7 yıldır. İlaç uyumsuzluğu oranı %10,9 olarak saptanmıştır. Logistik regresyon analizi sonucunda bilişsel yetersizliği olma, görmede zorluk yaşama, ilaç alımında sosyal destek alamama, erkek cinsiyet ve bekar olma değişkenlerinin ilaç uyumsuzluğu ile ilişkili olduğu bulunmuştur. Birinci basamakta hipertansiyon kontrolü ve yönetiminde birey odaklı ve kolay anlaşılır tedavi seçenekleri değerlendirilmelidir.

Anahtar kelimeler: Hipertansiyon, ilaç uyumu, yaşlı, bilişsel yetersizlik.

1-Ankara Atatürk Sanatorium Education and Research Hospital, Health Science University, Department of Occupational Diseases. Ankara, Türkiye.
2-Ondokuz Mayis University Faculty of Medicine, Department of Public Health. Samsun, Türkiye.

Sorumlu Yazar / Corresponding Author: Uzm. Dr. Gülçin Elmas AKINCI
e-posta /e-mail: gulcinelmaserdogan@hotmail.com

Introduction

High blood pressure is a leading cause of cardiovascular disease, leading to premature death worldwide. Global average blood pressure has remained stable or decreased slightly over the past four decades, due to the widespread use of antihypertensive drugs. In contrast, the number of individuals with high blood pressure has increased, particularly in low- and middle-income countries (LMICs) (1). In recent years, deadly consequences of high blood pressure have been increasing in parallel with this increase and thus high blood pressure has become one of the leading preventable causes of death (2). With the epidemiologic transformation, diagnosis, treatment and complications of chronic diseases affecting especially older individuals constitute a significant burden on the healthcare system with the contribution of non-adherence to medication (3, 4, 5). Despite increasing prevalence, hypertension awareness, treatment and blood pressure control rates are low in LMICs (1). It is known that medication non-adherence in individuals contributes to poorly controlled blood pressure. It has been shown that an effective and inclusive intervention to increase medication adherence in LMICs leads to a significant decrease in the high blood pressure of individuals and provides blood pressure control in long-term follow-up (6, 7). The World Health Organization (WHO) has defined adherence as "the extent to which a person's behavior in taking medication, dieting and/or making lifestyle changes corresponds to the agreed recommendations of a health care provider" (8). WHO has defined five different conditions associated with poor adherence: social and economic factors, condition-related factors, treatment-related factors, patient-related factors and health system/health team-related factors (8). Although the importance of medication adherence is known, nonadherence to medication with a frequency varying between 7-50% continues to be an important challenge in the management of high blood pressure (2, 9, 10). Today, the global disease burden of chronic diseases, especially in elderly individuals, is increasing, thus health behaviors in this age group are important. Knowledge of the factors affecting medication adherence and their contribution to medication non-adherence will provide support in developing programs for local intervention. In this study, we aimed to determine the rates of non-adherence to antihypertensive medication and related factors in the elderly. It is thought that the findings obtained from the study can contribute to the literature by identifying the determinants of medication non-adherence in elderly patients.

Material and Method

Samsun is a coastal city in the North Anatolian region with a population of 1.5 million. Health services in this city are qualitatively similar to those provided in other cities in Turkey. This cross-sectional study was conducted in Atakum, which is the second largest district in Samsun, with a population of 200,000. There were 15 primary care centers, with 43 family physicians working in these primary care centers. The sample size of the study should consist of elderly individuals with hypertension, but this number is not known; therefore, data from TurkStat and TEKHARF study were used to calculate the sample size. In the 2011 TEKHARF study, the prevalence of hypertension over 65 years of age was found to be 68%, and the sample size was calculated according to this data in our study, in which individuals over 65 years of age

with hypertension constituted the population (11). The minimum required sample size was determined to be 355, considering a 5% margin of error, a 95% confidence level, and an assumed medication non-adherence rate of 50% among the 9,389 hypertensive individuals aged 65 years and over in this district.

Participants

The study data were collected from elderly patients through face-to-face interviews during their visit to their family physicians from May to June 2017. In this study, the elderly category involved patients aged 65 and older. The criteria for inclusion in the study were as follows: (i) a diagnosis of hypertension, (ii) the use of antihypertensive medications for at least one year, (iii) ≥ 65 years old, and (iv) the ability to communicate verbally. After informing the elderly patients about the study, informed consent was obtained from them. The participants were recruited from all 15 primary care centres, and 8-10 patients per family physician's region attending the centre were interviewed, no probability sampling was used. Individuals who could not complete the interviews were excluded from the study. A total of 358 elderly patients with hypertension who answered the questionnaires were included in the study. The response rate was 89%.

All procedures performed in studies involving human participants were in accordance with the ethical standards of the institutional and/or national research committee and with the 1964 Helsinki Declaration and its later amendments or comparable ethical standards. Informed consent was obtained from all participants included in the study. The study was approved by the The Clinical Research Ethics Committee of Ondokuz Mayıs University (KAEK:2017/123).

Sociodemographic data form

A sociodemographic questionnaire prepared by the researchers was used to determine the age, gender, marital status, educational status, health problems, and medication use characteristics of the patients. The patients who answered "yes" to the question "Is there anyone who reminds or warns you about antihypertensive medication time points or who provides regular care for taking your medicine on time?" were classified as "has social support for medicine intake." Those who lived with other people in the same house and yet had no aid in taking medication were classified as "has no social support for medicine intake." The assessment of visual and hearing impairment was based on the patient's statement.

Measures

The Hypertension Medication Adherence Scale, developed by Morisky et al. (12), was used to assess adherence to medication. Demirezen adapted the scale to the Turkish population. Cronbach's α value of 0.82 was found. The total score on the scale ranged from 1 to 13, with a total of 1–7 points defined as "adherent to medication" and 8 or more points defined as "non-adherent to medication" (13).

The Mini-Mental State Examination (MMSE) used in the evaluation of cognitive functions was developed by Folstein et al., was used for the elderly who graduated from at least primary school (14). The Turkish version of the revised MMSE, which was revised by Yildiz et al. (15), was used for illiterate elderly. The validity and reliability studies of both tests were conducted in Turkish society. The cut-off point of the tests was 24 in educated and illiterate elderly.

Statistical analysis

The data obtained from the study were analyzed using the SPSS package program.

The conformity of continuous variables to the normal distribution was evaluated using the Kolmogorov–Smirnov test. In the statistical analysis, since the study data did not conform to

normal distribution, the median values were compared and the Mann-Whitney U test was used for significance.

Binary logistic regression analysis was applied to evaluate the relationship between independent variables and non-adherence to antihypertensive medication. Variables such as gender, age, marital status, educational status, having someone to help with medication intake, comorbidity, duration of hypertension diagnosis, single/multiple hypertension medication use, visual and hearing difficulties, and cognitive status, which were found to be associated with non-adherence to antihypertensive drug treatment by reviewing the literature, were included in the logistic regression model. The results are presented with odds ratio values and confidence intervals (95% CI). Statistical significance was accepted as 0.05.

Results

A total of 358 elderly patients with high blood pressure, including 153 (42.7%) males and 205 (57.3%) females, participated in the study. The mean age of the males was 71.9 ± 6.6 years, and the mean age of the females was 71.6 ± 6.8 years. No significant difference was found between the mean ages (p>0.05). Among the participants, 86% completed primary school. The frequency of non-adherence to antihypertensive medication was 10.9% in participants in the survey. This rate was 11.8% in males and 10.2% in females; no significant difference was observed between the genders (p>0.05). According to the age groups, the highest non-adherence to antihypertensive medication was in the group of 80 years and over (30.0%); a significant difference was found between the age groups (p<0.001). The prevalence of non-adherence to antihypertensive medication was found to be high in the elderly who were single (20.5%), illiterate (21.2%), and did not have social support (11.8%) (Table 1).

Table 1: Distribution of adherence to antihypertensive medication in the elderly by sociodemographic characteristics.

Characteristics	Adherence to medication						X^2; p*
	Yes		No		Total		
Gender	n	%	n	%	n	%	
Male	135	88.2	18	11.8	153	42.7	0.21; 0.648
Female	184	89.8	21	10.2	205	57.3	
Age Groups (year)							
65-69	161	94.2	10	5.8	171	47.8	
70-74	80	88.9	10	11.1	90	25.1	**23.6; <0.001**
75-79	43	91.5	4	8.5	47	13.1	
80+	35	70.0	15	30.0	50	14.0	
Marital Status							
Married	230	93.5	16	6.5	246	68.7	**15.6; <0.001**
Single	89	79.5	23	20.5	112	31.3	
Education Status							
Illiterate	52	78.8	14	21.2	66	18.4	**8.9; 0.003**
Educated	267	91.4	25	8.6	292	81.6	
Social support							
Yes	103	91.2	10	8.8	113	31.6	0.7; 0.399
No	216	88.2	29	11.8	245	68.4	
Total	**319**	**89.1**	**39**	**10.9**	**358**	**100.0**	

Chi-square

Overall, 36% of the study population had cognitive impairment, which was higher in females (40.5%) than in males (30.1%). The frequency of non-adherence to antihypertensive medication was statistically significant and high in patients with cognitive dysfunction, a 10-year history of hypertension, vision impairment, and hearing loss (Table 2).

In the multivariate logistic regression analysis, some variables were significantly associated with non-adherence to antihypertensive medication, such as cognitive impairment (OR; 95%CI: 8.5; 3.1-23.2), reduced vision (5.3; 1.7-16.4), having no social support for medicine intake (5.0; 1.9-13.6), male gender (2.9; 1.2-7.4), and being single (3.0; 1.2-7.6) (Table 3).

Table 2: Distribution of adherence to antihypertensive medication in the elderly by clinical characteristics.

Clinical characteristics	Adherence to medication				Total		X^2	p
	Yes		No					
Comorbid disease	n	%	n	%	n	%		
No	70	92.1	6	7.9	76	21.2	0.89	0.344
Yes	249	88.3	33	11.7	282	78.8		
Duration of diagnosis of hypertension (years)								
1-9	110	94.0	7	6.0	117	32.7	**4.3**	**0.038**
≥10	209	86.7	32	13.3	241	67.3		
Daily dose of medication								
One	187	89.5	22	10.5	209	58.4	0.07	0.792
More than one	132	88.6	17	11.4	149	41.6		
Reduced vision								
No	147	96.1	6	3.9	153	42.7	**13.4**	**<0.001**
Yes	172	83.9	33	16.1	205	57.3		
Reduced hearing								
No	177	93.7	12	6.3	189	52.8	**8.5**	**0.004**
Yes	142	84.0	27	16.0	169	47.2		
Cognitive impairment								
No (MMT Score ≥24)	220	96.1	9	3.9	229	64.0	**31.7**	**<0.001**
Yes (MMT Score<24)	99	76.7	30	23.3	129	36.0		
Total	**319**	**89.1**	**39**	**10.9**	**358**	**100.0**		

Discussion

Hypertension is a chronic disease that requires lifelong treatment. However, despite antihypertensive medication, studies have shown that blood pressure is not adequately controlled (1). Non-adherence to antihypertensive medication, which significantly affects treatment success, is a public health problem that increases the morbidity, mortality, and health expenditures of patients (5, 16). In the study group, 10.9% of the participants had non-adherence to antihypertensive medication. In other studies on this subject, nonadherence to antihypertensive medication in the elderly ranged between 7% and 50% (2, 9, 10). The fact that non-adherence to medication was demonstrated in different studies at different frequencies, there are different reasons for the varied rates, such as measurement method, place of residence, and cognitive status. In some studies, the rural–urban characteristics of the place where individuals live also affected medication adherence (17, 18).

Table 3: Odds Ratios of related factors with non-adherence to medication in the elderly based on logistic regression model.

Variables	Non adherence (%)	OR (95% CI)	p value
Gender			
Female	10.2	1	
Male	11.8	2.9 (1.16-7.43)	**0.022**
Age groups (year)			
65-69	5.8	1	
70-74	11.1	1.4 (0.51-4.06)	0.504
75-79	8.5	0.7 (0.17-2.67)	0.569
80+	30.0	1.7 (0.49-6.00)	0.404
Marital status			
Married	6.5	1	
Single	20.5	3.0 (1.17-7.62)	**0.022**
Education status			
Educated	8.6	1	
Illiterate	21.2	2.2 (0.87-5.72)	0.094
Social support			
Yes	8.8	1	
No	11.8	5.1 (1.87-13.70)	**0.001**
Comorbid disease			
No	7.9	1	
Yes	11.7	0.9 (0.29-2.54)	0.772
Duration of diagnosis of hypertension (years)			
1-9	6.0	1	
≥10	13.3	1.1 (0.42-3.15)	0.797
Daily dose of medication			
One	10.5	1	
More than one	11.4	1.3 (0.54-3.14)	0.552
Reduced vision			
No	3.9	1	
Yes	6.1	5.3 (1.72-16.40)	**0.004**
Reduced hearing			
No	6.3	1	
Yes	16.0	1.1 (0.43-3.00)	0.804
Cognitive impairment			
No	3.9	1	
Yes	23.3	8.5 (3.10-23.20)	**<0.001**

In our study, the frequency of non-adherence was lower than in previous studies, and adherence to antihypertensive medication was evaluated according to the statement. This could be related to the fact that the study was conducted in an urban area.

We found that non-adherence to antihypertensive medication was 2.9 times more prevalent in males. Many studies have shown that non-adherence to antihypertensive medication was high in men (17- 20). The frequency of having a helper in medication in women more than in men could be a factor increasing medication adhere.

We observed that non-adherence to antihypertensive medication was higher in participants aged 80 years and over. Some studies have reported different results on the effects of age on treatment adherence (19- 21). In these studies, medication adherence showed a bimodal curve from middle age to older age. Relatively younger older adults with hypertension do not pay enough attention to medication adherence, as they have not yet encountered complications of hypertension (21). However, as age progresses, the frequency of comorbidity increases, the number of visits to health institutions becomes more frequent, and

the number of encounters with health personnel and the reasons for non-adherence decrease. In older ages (80 and over), as shown in this study, non-adherence to medication increased again due to reasons such as physical disabilities and cognitive disorders (20). In our study, non-adherence to medication due to physical deficiencies and cognitive impairment increased in elderly.

The results of the logistic regression analysis showed that non-adherence to medication was three times higher in single elderly. In some studies examining the relationship between marital status and non-adherence to medication, non-adherence was found to be significantly more common in single individuals, whereas other studies found it to be more common in married people. There are also studies suggesting that marital status did not affect medication adherence (19, 22- 24). In this study, the rate of medication non-adherence was significantly higher in single individuals. In married individuals, encouragement and reminders from their spouses could have contributed positively to treatment adherence.

In the study group, non-adherence to antihypertensive medication was found to be low in the illiterate elderly. Kamran et al. (22) determined that there was no significant difference in terms of medication adherence according to educational status. Studies have also shown that elderly patients who have low levels of education are more non-adherent to antihypertensive medication (20, 24). Other factors that have a negative effect on medication adherence, such as cognitive impairment, visual impairment, and hearing difficulties, are also predicted to have an adverse effect on medication adherence. In previous studies, the frequency of non-adherence to antihypertensive medication was found to be significantly higher in the elderly who stated that they had difficulty seeing and hearing (21, 25). In our study, the risk of non-adherence was found to be five times higher in elderly patient who stated

that they had visual impairment. It was considered that these elderly patients had difficulty perceiving the treatment warnings of both the health personnel and their relatives and were unable to see or read the visual directions of using the medication.

Family members can support elderly people with high blood pressure in a variety of ways, including following up on their health, sharing information and encouraging adherence to diet, physical exercise and treatment (24). In the literature, social support has been shown to be a strong and independent variable for treatment adherence (6, 17). In this study, similarly, individuals without social support were found to have poor adherence to treatment. Increasing social support may have positive effects on treatment success by increasing medication adherence.

In this study, nonadherence to treatment was found to be higher in the elderly with chronic diseases who were followed up with high blood pressure in accordance with similar studies (18, 27). The reason why medication non-adherence is more common in patients with chronic diseases may be the increase in other physical disabilities and mental comorbidities in older ages. In addition, the number of medications taken daily is also known to affect adherence to treatment, and single-dose treatment is recommended for adherence to antihypertensive treatment (17, 20). According to the results of the study, adherence to treatment was found to be higher in the elderly who were prescribed a single daily dose of pills (18, 20, 26). Therefore, simplified treatment options should be considered first in elderly with comorbidities who are followed up in primary care (27).

Nonadherence to antihypertensive treatment is higher in those with a diagnosis of hypertension of 10 years or more compared to those with a diagnosis of hypertension of 1-9 years. Similarly, in the study by Kasar ve ark., it was found that the frequency of medication nonadherence was higher in the group

with a longer duration of hypertension diagnosis (28). In some studies, it was found that those who received long-term treatment had higher compliance with treatment (17). The difference in the literature may be due to the distribution of physical and mental comorbidities in the study group. In this study, those with hypertension for 10 years or more were mostly elderly and cognitively impaired. Therefore, the higher rate of non-adherence to antihypertensive medication in the elderly with hypertension for a longer period may be explained by the fact that cognitive impairment was higher in this group.

Elderly with cognitive impairment were found to be eight times more likely to be non-adherent to medication than those without cognitive impairment. In previous studies, identified that the negative effects of cognitive impairment in understanding the treatment recommendations and plan may have negative contributions to treatment adherence with difficulties in areas such as tides in memory, treatment

knowledge, and health literacy (20, 21). These may be explained as the reason why medication non-adherence is more common in the elderly with cognitive impairment.

This study has some limitations. First, the data were limited to elderly who visited the primary healthcare facility. Thus, elderly who were not registered with family physicians, who were not socially insured, and who were too poor or disabled to visit a family physician could not be evaluated. Second, all the parameters used for the evaluation of adherence to antihypertensive medication were based on the data obtained from the self-report of the elderly. This could cause some bias based on remembering in the data. Treatment adherence may have been overestimated due to the method of measurement. Finally, due to the nature of the cross-sectional studies, it was not easy to determine cause and effect, since the factors were investigated, and the outcomes were questioned during the same period.

Conclusions

In conclusion, especially elderly hypertensive patients with cognitive impairment should be closely monitored, disabilities such as visual and hearing difficulties should be rehabilitated. The importance of social support in chronic diseases such as hypertension that

require long-term treatment and follow-up should be taken into consideration. A patient-oriented approach should be adopted in the elderly followed up in primary care and simplified treatment options should be considered.

References

1. Mills KT, Stefanescu A, He J. The global epidemiology of hypertension. Nat Rev Nephrol. 2020;16(4):223-37. doi:10.1038/s41581-019-0244-2.
2. MA Papadakis. Disease Prevention and health promotion, In: Maxine A. Papadakis, Stephen J. McPhee, Michael W. Rabow, Kenneth R. McQuaid (Eds). Current medical diagnosis and treatment 2023. McGraw-Hill Education; 2023. pp.1-14.
3. Yoon S, Kwan YH, Yap WL, Yap WL, Lim ZY, Phang JK, et al. Factors influencing medication adherence in multi-ethnic Asian patients with chronic diseases in Singapore: A qualitative study. Front Pharmacol. 2023; 14:1124297. doi:10.3389/fphar.2023.1124297.

4. Konstantinou P, Kassianos AP, Georgiou G, Andreas P, Papageorgiou A, Almas I, et al. Barriers, facilitators, and interventions for medication adherence across chronic conditions with the highest nonadherence rates: a scoping review with recommendations for intervention development. Transl Behav Med. 2020;10:1390–8. doi:10.1093/tbm/ibaa118.

5. Cutler RL, Fernandez-Llimos F, Frommer M, Benrimoj C, Garcia-Cardenas V. Economic impact of medication non-adherence by disease groups: A systematic review. BMJ Open. 2018; 8(1):e016982. doi:10.1136/bmjopen-2017-016982.

6. Shahin W, Kennedy GA, Stupans L. The association between social support and medication adherence in patients with hypertension: A systematic review. Pharmacy Practice. 2021;9(2):2300. doi:10.18549/PharmPract.2021.2.2300.

7. He J, Irazola V, Mills KT, Poggio R, Beratarrechea A, Dolan J, et al. Effect of a Community Health Worker-Led Multicomponent Intervention on Blood Pressure Control in Low-Income Patients in Argentina: A Randomized Clinical Trial. JAMA. 2017;318(11):1016–25. doi:10.1001/jama.2017.11358.

8. World Health Organization. (2003). Adherence to long-term therapies: Evidence for action. World Health Organization. Available from: https://iris.who.int/handle/10665/42682

9. Peh, KQE, Kwan YH, Goh H, Ramchandani H, Phang JK, Lim ZY, et al. An adaptable framework for factors contributing to medication adherence: Results from a systematic review of 102 conceptual frameworks. J. Gen. Intern Med. 2021;36(9):2784–95. doi:10.1007/s11606-021-06648-1.

10. Emre N, Edirne T, Ozsahin A, Çoban N, Yanık A. The Relationship Between Adherence to Medication and Quality of Life and Health Perception in Hypertensive Patients. Turkish Journal of Family Medicine and Primary Care 2020;14(3):436-42. doi:10.21763/tjfmpc.725974.

11. Ünal B, Ergör G,editors. Türkiye kronik hastalıklar ve risk faktörleri çalışması. Sağlık Bakanlığı, 909, Ankara; 2013.

12. Morisky DE, Green LW, Levine DM. Concurrent and predictive validity of a self reported measure of medication adherence Med Care. 1986;24(1):67-74. doi:10.1097/00005650-198601000-00007.

13. Demirezen E. Türkiye'de ve Almanya'da yaşayan antihipertansif ilaç kullanan Türklerde ilaç tedavisine uyum. İstanbul Üniversitesi Sağlık Bilimleri Enstitüsü, Hemşirelik Programı Doktora Tezi, İstanbul, 2006.

14. Folstein MF, Folstein SE, McHugh PR. "Mini-mental state": A practical method for granding the cognitive state of patients for the clinican. J Psychiatr Res.1975;12(3):189-98. doi:10.1016/0022-3956(75)90026-6.

15. Yildiz GB, Ozcelik EU, Kolukisa M, Isık AT, Gürsoy E, Kocaman G, et al. Validity and Reliability Studies of Modified Mini Mental State Examination (MMSE-I) For Turkish Illiterate Patients with Diagnosis of Alzheimer Disease. Turkish Journal of Psychiatry. 2016;27(1):41-6. PMID:27369684.

16. Roebuck MC, Kaestner RJ, Dougherty JS. Impact of Medication Adherence on Health Services Utilization in Medicaid. Medical Care. 2018;56(3):266-73. doi:10.1097/MLR.0000000000000870.

17. Jingjing P, Bin H, Lian W, Yarong L. The Effect of Social Support on Treatment Adherence in Hypertension in China, Patient Prefer Adherence. 2021;15:1953-61. doi:10.2147/PPA.S325793.

18. Ma C. A cross-sectional survey of medication adherence and associated factors for rural patients with hypertension. Appl Nurs Res. 2016;31:94-9. doi:10.1016/j.apnr.2016.01.004.

19. Mollaoglu M, Solmaz G, Mollaoglu M. Adherence to therapy and quality of life in hypertensive patients. Acta clinica Croatica Acta Clin Croat. 2015;54(4):438-44. PMID:27017717

20. Chudiak A, Uchmanowicz I, Mazur G. Relation between cognitive impairment and treatment adherence in elderly hypertensive patients. Clin Interv Aging. 2018;6(13):1409-18. doi:10.2147/CIA.S162701.

21. Calderón-Larrañaga A, Diaz E, Poblador-Plou B, Gimeno-Feliu LA, Abad-Díez JM, Prados-Torres A. Non-adherence to antihypertensive medication: the role of mental and physical comorbidity. Int J Cardiol. 2016;207:310-6. doi:10.1016/j.ijcard.2016.01.069.

22. Kamran A, Ahari SS, Biria M, Malpour A, Heydari H. Determinants of patient's adherence to hypertension medications: application of health belief model among rural patients. Ann Med Health Sci Res. 2014;4(6):922-7. doi:10.4103/2141-9248.144914.

23. Alhaddad IA, Hamoui O, Hammoudeh A, Mallat S. Treatment adherence and quality of life in patients on antihypertensive medications in a Middle Eastern population: adherence. Vasc Health Risk Manag. 2016;27(12):407-13. doi:10.2147/VHRM.S105921.

24. Uchmanowicz B, Chudiak A, Uchmanowicz I, Rosińczuk J, Froelicher ES. Factors influencing adherence to treatment in older adults with hypertension. Clin Interv Aging. 2018;28(13):2425-41. doi:10.2147/CIA.S182881.

25. Cárdenas-Valladolid J, Martín-Madrazo C, Salinero-Fort MA, de-Santa Pau EC, Abánades-Herranz JC, de Burgos-Lunar C. Prevalence of adherence to treatment in homebound elderly people in primary health care. Drugs Aging. 2010;27(8):641-51. doi:10.2165/11537320-000000000-00000.

26. Abegaz TM, Shehab A, Gebreyohannes EA, Bhagavathula AS, Elnour AA. Nonadherence to antihypertensive drugs: A systematic review and meta-analysis. Medicine (Baltimore). 2017;96(4):e5641. doi:10.1097/MD.0000000000005641.

27. Del Pinto R, Desideri, G, Ferri C, Agabiti Rosei E. Real-world Antihypertensive Treatment Patterns, Treatment Adherence, and Blood Pressure Control in the Elderly: An Italian Awareness-raising Campaign on Hypertension by Senior Italia FederAnziani, the Italian Society of Hypertension and the Italian Federation of General Practitioners. High Blood Press Cardiovasc Prev. 2021;28:457–66. doi:10.1007/s40292-021-00465-7.

28. Kasar Sayın K, Karadakovan A. Elderly individuals investigation of antihypertensive drugs use error. Turk J Card Nur. 2017;8(15):20-7. doi:10.5543/khd.2017.39200.