Original Article

Medication Adherence Among Geriatric Patients with Chronic Diseases while living alone

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Abstract

Background: Adherence to treatment, a public health issue, is of specific importance in chronic disease treatments. Medication non-adherence is a common and vital public health problem, specifically among the geriatric people. The aim of this study is to assess medication adherence among geriatric patients with chronic diseases while living alone.

Methods: A cross-sectional study was conducted among 114 who targeted outpatient geriatrics and suffer from chronic diseases In health centers. Data collection by using a structured questionnaire via face-to-face interviews.

Results: A total of 114 patients were assessed for medication adherence. The present study reveal that the relation between participants' sociodemographic characteristics and who provides medication to the elderly. particularly, there is highly statistical significant with gender, marital status, educational level and monthly income. Moreover, the current study demonstrate the relation between participants' clinical characteristics related to chronic diseases and Who provides medication to the elderly. There was highly statistical significant with obesity, asthma, GERD cardiac disease and osteoarthritis.

Conclusion: The geriatric population with chronic diseases while living alone had a good level of adherence. To promote better medication adherence, patients must have a good understanding of their disease and strong beliefs about the medications prescribed.

Keywords: Medication Adherence, Geriatric Patients, chronic diseases, living alone

Introduction

The increase in life expectation and the aging of the world people have been paralleled by an alarming progress in the worldwide load of chronic conditions [(1)]. The number will be increasing from one

billion in 2019 to 21 billion by 2050 [2]. In Saudi Arabia, the most recent elderly survey by General Authority for Statistics revealed that the elderly represents 4. 19% of the total Saudi population, [3] and are estimated to reach 18.4% by 2050 [4]. Additionally, the number of people living alone seems to be higher with increased age [5]. In the case of elderly living alone, family support is absent, resulting in a greater chance of sustained condition of chronic diseases, both physically and mentally [6-8]. Definitely, the level of physical and mental health of elderly living alone is lower than those living with family members [6, 9].In chronic diseases that necessitate long-term treatment, low medication adherence usually leads to poor clinical consequence, drug-related side effects, and increased social health care costs [10, 11]. Furthermore, it has been established that the appropriate use of medication is one of the important main factors for the self-management of most chronic diseases [12]. Thus, the management for people with chronic diseases is fundamental to minimize their impact, improve health outcomes, prevent further disability, and reduce healthcare costs [13]. Most common preventable chronic diseases in Saudi Arabia related to lifestyle and strongly correlated with ageing are hypertension, diabetes type 2, dyslipidemia and obesity [2].

Adherence to treatment is a key component of chronic disease management [14]. According to the World Health Organization (WHO), a series of factors was patients' ability to follow treatment recommendations correctly [15]. Therefore, it is important to improve medication adherence in patients with chronic diseases to minimize early deaths and social burden [16, 17]. Medication non-adherence is a common and significant public health issue. A previous study has shown that up to 50% of patients with chronic diseases do not take their medication as prescribed [18].7 This suboptimal adherence can worsen medical conditions, reduce the quality of life, and increase mortality and morbidity [16]. In older patients, the magnitude of the problem is even greater. It is estimated that around 10% of geriatrics hospitalizations are due to medication non- adherence [19], and the rate of non-adherence in older adults as high as 75% [20]. Several efforts have been made in recent years to determine the most influential factors of adherence. Most research has focused on a single-dimension, usually patient-related factors [21] and have not taken into account the WHO framework. Other studies have focused on a single-disease, such as diabetes [22], coronary heart disease [23], and asthma [24], or on a particular drug therapy [25], an approach which limits the utility of the findings to the condition under study. To identify facilitators of adherence among chronic-disease patients, it is necessary to consider more than a single chronic condition and account for interaction of factors in a more multi-dimensional approach. Assessment of the patients' compliance with the treatment regimen is vital. However, there is no standard method for assessing medication adherence. Self-reported medication adherence questionnaires are one of the acceptable tools [26]. So, this study aim to assess medication adherence among geriatric patients with chronic diseases while living alone.

Materials and Methods

Design and Setting

A cross-sectional study was conducted between August and October 2022. A total of 114 elderly people aged 65 years or older who suffered from chronic disease and visited the clinics at King Saud University Medical City.

Sample Size and Study Population

The sample size was calculated, assuming 50% prevalence, 95% confidence interval (CI), and 5% margin of error. Based on this, 114 patients were required for the study. A random sampling technique was utilized to select study participants from a list of elderly patients following up in the outpatient clinics In health centers. Patients were recruited according to the following criteria: aged 60 years and above, having one or more of diseases such as Diabetes; Hypertension; Dyslipidaemia and

obesity for more than one year, having visited a clinic at least twice, taking at least one medication for chronic disease, and able to communicate in Arabic.

The following exclusion criteria the patient who has diseases that may affect their ability to answer the study questionnaire such as cognitive impairment, dementia, psychiatric disorders, hearing or vision loss. All patients provided written informed consent. Ethical approval was obtained from the Institutional Review Board (IRB). The data collection sheet was strictly observed to ensure participants' confidentiality throughout the study using the anonymous unique serial number for each subject. Furthermore, the analysis was encrypted and carried out anonymously. Data collection by using a structured questionnaire via face-to-face interviews. All participants provided a written informed consent after their clinic visits. The purposes of the study were explained to participants. Those who agreed to participate were asked to complete the questionnaire. The study used the Statistical Package of Social Sciences (SPSS) (v. 26.0) to process the data gathered in this study.

Results

Table (1) Participants' Characteristics

Total of 114 patients participated in this study. Table 1 shows the sociodemographic characteristics of the study participants. More than half (61.4%) of study participants have age between 60-70 years. Most of the patients were males (70.2%), married (71.9%), and had obtained University education or higher (33.3%). The majority of the patients currently do not work (73.7%) and had a monthly income less than SAR 5000) (40. 4%). In addition, it was found that about (84.2%), of the study participants were living with their families, whereas (15.8%) were living alone. Regarding smoking, the majority of study participants were (63.2%) non smoker.

Table 1 Participants' Sociodemographic Characteristics. (N= 114)

	N	%
Age		
60-70	70	61.4
70-80	32	28.1
>80	12	10.5
Gender		
Female	34	29.8
Male	80	70.2
Marital status		
Married	82	71.9
Widowed	24	21.1
Divorced	8	7.0
Living status		
With family	96	84.2
Alone	18	15.8
Educational		
Illiterate	18	15.8
Read and write	20	17.5
School education	22	19.3
Post-secondary diploma	16	14.0
University education or higher	38	33.3
Currently working		
No	84	73.7
Yes	30	26.3
Monthly income		

	N	%
Less than 5000 SAR	46	40.4
5000 – less than 10000 SAR	28	24.6
10,000 less than 15,000 SAR	18	15.8
More than 15,000 SAR	22	19.3
Smoking		
No	72	63.2
Yes	12	10.5
Previously	30	26.3

Table 2 showed the clinical characteristics of the participants. In relation to chronic diseases, hypertension (HTN) was the highest chronic condition (78.9%). Diabetes mellitus (DM)was the second most common chronic disease reported in the study sample (68.4%), followed by dyslipidemia, obesity and osteoarthritis were the same percent (40.4%) and cardiac disease was (33.3%) . While,the lowest chronic condition were hypothyroid, asthma, Gastroesophageal reflux disease (GERD), and Osteoporosis (21.1%, 10.5%, 15.8%, and 5.3%) respectively. Concerning the number of medications taken by the patients was more than half taken five or more per day (57.9%). Also, the daily frequency was (35.1%, 36.8)respectively for no and one frequency. Most of the patients were taking their medications by themselves (57.9%). Regarding cost of medication, the majority of study participants were free (73.7%).

Table (2) Participants' Clinical Characteristics

	N	%
Chronic diseases		
Dyslipidemia	46	40.4
Hypertension	90	78.9
Diabetes mellitus	78	68.4
Obesity	46	40.4
Hypothyroid	24	21.1
Asthma	12	10.5
GERD	18	15.8
Cardiac disease	38	33.3
Osteoarthritis	46	40.4
Osteoporosis	6	5.3
Number of Medications taken/day		
1-2	16	14.0
3-4	32	28.1
5 or more	66	57.9
Frequency of all medications/day		
No	40	35.1
One	42	36.8
Two	22	19.3
Three	10	8.8
Method of taking medications		
Tablet	114	100.0
Drops	4	3.5
Injection	32	28.1
Capsule	72	63.2

	N	%
Inhaler	8	7.0
Cream	38	33.3
Patches	10	8.8
All medications are taken by		
Prescription	72	63.2
Without doctor's prescription	2	1.8
Both	40	35.1
When did you start taking treatment		
From 2 to less than 5 years	20	17.5
From 5 years or more	94	82.5
Who is providing your medication		
By myself	66	57.9
A family member	36	31.6
caregiver	12	10.5
Cost of your medication		
Free	84	73.7
Cheap	10	8.8
Expensive	20	17.5

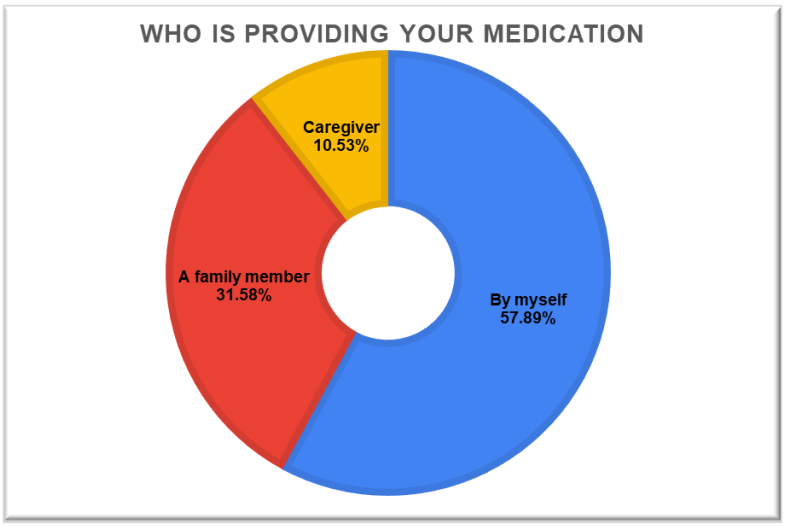

Figure (1) Who provides medication to the elderly

The results in (Figure 1) represent who provides medication to the elderly, the most of study participants had recived medications by them self (57.89%) and by family member (31.58%). While, the lowest percentage was recived medications by caregivers.

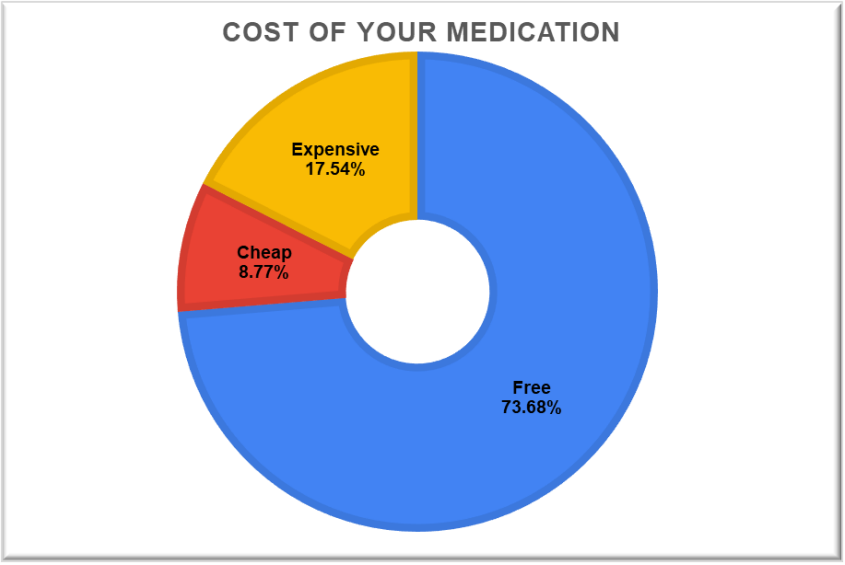

Figure (2) Cost of medications for the elderly

The results in (Figure 2) denote cost of medications for the elderly, the greatest of study participants were free medications (73.68%). While, expensive medications were (17.54%).

Table (3) demonstrate the relation between participants' sociodemographic characteristics and who provides medication to the elderly. There was highly statistical significant with gender, marital status, educational level and monthly income.

Table (3) the relation between participants' Sociodemographic Characteristics and Who provides medication to the elderly.

			Who is providing your medication			Total	Chi-Square	
			By myself	A family member	caregiver		X^2	P-value
Age	60-70	N	46	18	6	70	5.538	0.236
		%	69.7%	50.0%	50.0%	61.4%		
	70-80	N	16	12	4	32		
		%	24.2%	33.3%	33.3%	28.1%		
	>80	N	4	6	2	12		
		%	6.1%	16.7%	16.7%	10.5%		
Gender	Female	N	12	14	8	34	12.960	0.002*
		%	18.2%	38.9%	66.7%	29.8%		
	Male	N	54	22	4	80		
		%	81.8%	61.1%	33.3%	70.2%		
Marital status	Married	N	52	24	6	82	13.898	0.008*
		%	78.8%	66.7%	50.0%	71.9%		
	Widowed	N	8	12	4	24		
		%	12.1%	33.3%	33.3%	21.1%		
	Divorced	N	6	0	2	8		
		%	9.1%	0.0%	16.7%	7.0%		
Living status	With family	N	54	32	10	96	0.929	0.628
		%	81.8%	88.9%	83.3%	84.2%		

			Who is providing your medication			Total	Chi-Square	
			By myself	A family member	caregiver		X^2	P-value
	Alone	N	12	4	2	18		
		%	18.2%	11.1%	16.7%	15.8%		
Educational	Illiterate	N	6	10	2	18	23.413	0.003*
		%	9.1%	27.8%	16.7%	15.8%		
	Read and write	N	10	10	0	20		
		%	15.2%	27.8%	0.0%	17.5%		
	School education	N	10	6	6	22		
		%	15.2%	16.7%	50.0%	19.3%		
	Post-secondary diploma	N	12	2	2	16		
		%	18.2%	5.6%	16.7%	14.0%		
	University education or higher	N	28	8	2	38		
		%	42.4%	22.2%	16.7%	33.3%		
Currently working	No	N	46	28	10	84	1.482	0.477
		%	69.7%	77.8%	83.3%	73.7%		
	Yes	N	20	8	2	30		
		%	30.3%	22.2%	16.7%	26.3%		
Monthly income	Less than 5000 SAR	N	22	16	8	46	26.293	0.000*
		%	33.3%	44.4%	66.7%	40.4%		
	5000 – less than 10000 SAR	N	12	14	2	28		
		%	18.2%	38.9%	16.7%	24.6%		
	10,000 less than 15,000 SAR	N	16	0	2	18		
		%	24.2%	0.0%	16.7%	15.8%		
	More than 15,000 SAR	N	16	6	0	22		
		%	24.2%	16.7%	0.0%	19.3%		

Table (**4)** demonstrate the relation between participants' clinical characteristics related to chronic diseases and Who provides medication to the elderly. There was highly statistical significant with obesity, asthma, GERD cardiac disease and osteoarthritis.

Table (**4)** the relation between participants' clinical characteristics related to chronic diseases and Who provides medication to the elderly.

		Who is providing your medication			Total	Chi-square	
		By myself	A family member	caregiver		X^2	P-value
Dyslipidemia	N	28	12	6	46	1.326	0.515
	%	42.4%	33.3%	50.0%	40.4%		
Hypertension	N	52	28	10	90	0.177	0.915
	%	78.8%	77.8%	83.3%	78.9%		
Diabetes mellitus	N	40	28	10	78	4.738	0.094
	%	60.6%	77.8%	83.3%	68.4%		
Obesity	N	20	22	4	46	9.405	0.009*
	%	30.3%	61.1%	33.3%	40.4%		

		Who is providing your medication			Total	Chi-square	
		By myself	A family member	caregiver		X^2	P-value
Hypothyroid	**N**	12	8	4	24	1.339	0.512
	%	18.2%	22.2%	33.3%	21.1%		
Asthma	**N**	6	2	4	12	5.784	0.021*
	%	9.1%	5.6%	33.3%	10.5%		
GERD	**N**	4	10	4	18	11.449	0.003*
	%	6.1%	27.8%	33.3%	15.8%		
Cardiac disease	**N**	16	18	4	38	6.833	0.033*
	%	24.2%	50.0%	33.3%	33.3%		
Osteoarthritis	**N**	20	20	6	46	6.698	0.035*
	%	30.3%	55.6%	50.0%	40.4%		
Osteoporosis	**N**	2	2	2	6	2.825	0.244
	%	3.0%	5.6%	16.7%	5.3%		

Discussion

Medication adherence is a serious element in treating chronic diseases, and non-adherence among elderly patients is a problem facing health care providers. In previous studies on elderly people with chronic diseases, high need or low concerns for medication were associated with high adherence [27-29]. Other studies report that measuring adherence and patient compliance is quite difficult and is patient-dependent most of the time [30-33]. Hence, this study aimed to assess medication adherence among elderly chronic disease while living alone in Saudi Arabia and factors influencing their medication adherence.

The present study reveal that the relation between participants' sociodemographic characteristics and who provides medication to the elderly. particularly, there is highly statistical significant with gender, marital status, educational level and monthly income. Moreover, the current study demonstrate the relation between participants' clinical characteristics related to chronic diseases and Who provides medication to the elderly. There was highly statistical significant with obesity, asthma, GERD cardiac disease and osteoarthritis. This due to most of the study paticipants were males, married, and had obtained University education or higher. This study naturally included people who were living alone. These findings rates are higher than those in previous studies that used different medication adherence assessment tools [34, 35].

One similar study in Saudi Arabia used the same tool to assess diabetic patients, reporting that a third of patients were (highly adherent 35.8%), (22.6% were good), (34.9% were partial), and (4.7% of patients had low medication adherence) [36]. Although a few of enrolled participants were smokers in this study, however, smoking was found to be a significant predictor of medication adherence, this finding was also reported by other similar studies [37]. Gender show males were more adherent than females. However, in general, the effect of gender on the rate of adherence to medication in other research studies is inconsistent. Some researchers found that female patients have better adherence [38]. While other studies could not find a relationship between gender and adherence to medication [39].

The education level may play a positive role in improving medication adherence by understanding the nature of their disease and the importance of treatment. This study show the correlation between educational status and medication adherence. These findings are consistent with studies have shown a positive correlation between educational status and adherence level [40, 41]. Although few patients were working in this study participants, there was a significant positive correlation with adherence. Similar positive correlations were found in some previous studies [42, 43]. One of the factors that may

determine the affordability for the health care services and medication adherence is the financial status of the study subjects or their family and health insurance coverage. In this study, the monthly income had statistically significant difference in the different levels of adherence. This finding may be because patients usually do not need to pay for their medications in government hospitals. Family support plays a beneficial role in the treatment and medication adherence [44]. In this study, we asked the patients if they take medications by themselves or with the assistance of family members. The results show a significant correlation between family help in giving medication and the level of adherence. Similar findings were also noticed in different studies [35, 45].

Conclusion

A high level of adherence to medication was found among the geriatric population with chronic diseases in our study. However, this cannot be generalized to all geriatric population in Saudi Arabia. In addition, on the basis of the associated factors, an educational program for healthcare professions in primary care clinics should be developed and modified to deliver an appropriate message for the assessment of adherence to medication and address the associated factors.

Recommendation

The study recommend that researchers use more than one assessment tool, subjective and objective measurement, to better assess medication adherence levels among geriatric populations and understand factors that may trigger non-adherence.

References

1. Christensen K, Doblhammer G, Rau R, Vaupel JW. Ageing populations: the challenges ahead. Lancet. 2009;374:1196–208 doi.org/10.1016/S0140-6736 (09)61460-4.
2. World Health Organization. Ageing and health; 2018. Available from: https://www.who.int/news-room/fact-sheets/detail/ageing-and-health.
3. Saquib N, Saquib J, Alhadlag A, et al. Chronic disease prevalence among elderly Saudi men. Int J Health Sci. 2017;11(5):11–16.
4. Khoja AT, Aljawadi MH, Al-Shammari SA, et al. The health of Saudi older adults; results from the Saudi National Survey for Elderly Health (SNSEH).. Saudi Pharm J. 2018;26:292–300. doi:10.1016/j.jsps.2017.11.008
5. Administration for Community of Living [homepage on the Internet]. A Profile of Older Americans: 2016. Available from: https://www.acl.gov/aging-and-disability-in-america/data-andresearch/profile-older-americans.
6. Kharicha K, Iliffe S, Harari D, Swift C, Gillmann G, Stuck AE. Health risk appraisal in older people 1: are older people living alone an "at-risk" group? Br J Gen Pract. 2007;57(537):271–276.
7. Barat I, Andreasen F, Damsgaard EM. Drug therapy in the elderly: what doctors believe and patients actually do. Br J Clin Pharmacol. 2001;51(6):615–622.
8. McInnis GJ, White JH. A phenomenological exploration of loneliness in the older adult. Arch Psychiatr Nurs. 2001;15(3):128–139.
9. Lau DT, Kirby JB. The relationship between living arrangement and preventive care use among community-dwelling elderly persons. Am J Public Health. 2009;99(7):1315–1321.
10. Ownby RL. Medication adherence and cognition medical, personal and economic factors influence level of adherence in older adults. Geriatrics. 2006;61(2):30–35.
11. World Health Organization. Noncommunicable Diseases Country Profiles 2011. Geneva: World Health Organization Press; 2011.
12. Horne R, Weinman J. Patients' beliefs about prescribed medicines and their role in adherence to treatment in chronic physical illness. J Psychosom Res. 1999;47(6):555–567.
13. Lorig KR, Ritter P, Stewart AL, Sobel DS, Brown BW Jr, Bandura A, et al. Chronic disease self-management program: 2-year health status and health care utilization outcomes. Med Care. 2001;39:1217–23.
14. Bodenheimer T, Lorig K, Holman H, Grumbach K. Patient self-management of chronic disease in primary care. Jama. 2002;288:2469–75. https://doi.org/ 10.1001/jama.288.19.2469.
15. Sabaté E. Adherence to long-term therapies: evidence for action. Switzerland: World Health Organization; 2003
16. Sabaté E. Adherence to Long-Term Therapies: Evidence for Action. Geneva: World Health Organization Press; 2003. 8.

17. Dunbar-Jacob J, Erlen JA, Schlenk EA, Ryan CM, Sereika SM, Doswell WM. Adherence in chronic disease. Annu Rev Nurs Res. 2000; 18:48–90.
18. Bazargan M, Smith J, Yazdanshenas H, et al. Non-adherence to medication regimens ;among older African-American adults. BMC Geriatr. 2017;17:1–12. doi:10.1186/s12877-017-0558-5
19. Iuga AO, McGuire MJ. Adherence and health care costs. Risk Manag Healthc Policy. 2014;7:35. doi:10.2147/RMHP.S19801
20. Félix IB, Henriques A. Medication adherence and related determinants in older people with multimorbidity: a cross-sectional study. Nurs Forum. 2021;56:834–843. doi:10.1111/nuf.12619
21. Molimard M, Le Gros V. Impact of patient-related factors on asthma control. J Asthma. 2008;45:109–13. https://doi.org/10.1080/02770900701815727.
22. Venditti EM, Tan K, Chang N, Laffel L, McGinley G, Miranda N, et al. Barriers and strategies for oral medication adherence among children and adolescents with Type 2 diabetes. Diabetes Res Clin Pract. 2018;139:24–31. https://doi.org/10.1016/j.diabres.2018.02.001.
23. Kripalani S, Gatti ME, Jacobson TA. Association of age, health literacy, and medication management strategies with cardiovascular medication adherence. Patient Educ Couns. 2010;81:177–81. https://doi.org/10.1016/J.PEC.2010.04.030.
24. Bidwal M, Lor K, Yu J, Ip E. Evaluation of asthma medication adherence rates and strategies to improve adherence in the underserved population at a Federally Qualified Health Center. Res Soc Adm Pharm. 2017;13:759–66.
25. Casebeer L, Huber C, Bennett N, Shillman R, Abdolrasulnia M, Salinas GD, et al. Improving the physician-patient cardiovascular risk dialogue to improve statin adherence. BMC Fam Pract. 2009;10:48. https://doi.org/10. 1186/1471-2296-10-48.
26. Alalaqi A, Lawson G, Obaid Y, et al. Adherence to cardiovascular pharmacotherapy by patients in Iraq: a mixed methods assessment using quantitative dried blood spot analysis and the 8-item morisky medication adherence scale. *PLoS One*. 2021;16(5):e0251115.
27. Schuz B, Marx C, Wurm S, et al. Medication beliefs predict medication adherence in older adults with multiple illnesses. J Psychosom Res. 2011;70(2):179–187.
28. Sirey JA, Weinberger MI, Greenfield A, Bruce ML. Medication beliefs and self-reported adherence among community-dwelling older adults. Clin Ther. 2013;35(2):153–160.
29. Rajpura JR, Nayak R. Role of illness perceptions and medication beliefs on medication compliance of elderly hypertensive cohorts. J Pharm Pract. 2014;27(1):19–24.
30. Yap AF, Thirumoorthy T, Kwan YH. Systematic review of the barriers affecting medication adherence in older adults. *Geriatr Gerontol Int*. 2016;16(10):1093– 1101. doi: 10.1111/ggi.12616
31. Chisholm-Burns MA, Spivey CA. The cost of medication nonadherence: consequences we cannot afford to accept. *J Am Pharm Assoc*. 2012;52 (6):823–826. doi: 10.1331/JAPhA.2012.11088
32. Osterberg L, Blaschke T. Adherence to medication. *N Engl J Med*. 2005;353(5):487–497. doi: 10.1056/NEJMra050100
33. Brundisini F, Vanstone M, Hulan D, et al. Type 2 diabetes patients' and providers' differing perspec;2tives on medication nonadherence: a qualitative meta-synthesis. *BMC Health Serv Res*. 2015;15(1):1–23. doi: 10.1186/s12913-015-1174-8
34. Tourkmani AM, Al Khashan HI, AlBabtain MA, et al. Medication adherence among patients in a chronic disease clinic. *Saudi Med J*. 2012;33(12):1278– 1284.
35. Shruthi R, Jyothi R, Pundarikaksha HP, et al. A study of medication compliance in geriatric patients with chronic illnesses at a tertiary care hospital. *JCDR*. 2016;10(12):FC40.
36. AlQarni K, AlQarni EA, Naqvi AA, et al. Assessment of medication adherence in Saudi patients with type II diabetes mellitus in Khobar City, *Saudi Arabia. Front Pharmacol*. 2019;10:1306.
37. Mirahmadizadeh A, Khorshidsavar H, Seif M, et al. Adherence to medication, diet and physical activity and the associated factors amongst patients with type 2 diabetes. *Diabetes Ther*. 2020;11(2):479–494.
38. Jin J, Sklar GE, Oh VM, et al. Factors affecting therapeutic compliance: a review from the patient's perspective. *Ther Clin Risk Manag*. 2008;4(1):269.
39. Gast A, Mathes T. Medication adherence influencing factors—an (updated) overview of systematic reviews. *Syst Rev*. 2019;8(1):1–7.
40. Nichols-English G, Poirier S. Optimizing adherence to pharmaceutical care plans. *JAPHA- WASHINGTON*. 2000;40(4):475.
41. MacLaughlin EJ, Raehl CL, Treadway AK, et al. Assessing medication adherence in the elderly. *Drugs Aging*. 2005;22(3):231–255.
42. Gemeda DH, Gebretsadik LA, Dejene T, et al. Determinants of non-compliance with antiretroviral therapy among adults living with HIV/AIDS: a systematic review. *JBI Evid Synth*. 2012;10(56):3596–3648.
43. Nachega JB, Uthman OA, Peltzer K, et al. Association between antiretroviral therapy adherence and employment status: systematic review and meta-analysis. *Bull World Health Organ*. 2014;93:29–41.

44. Kasznicki J, Głowacka A, Drzewoski J. Type 2 diabetic patients' compliance with drug therapy and glycaemic control. Diabetologia Doswiadczalna i Kliniczna. 2007;7(4):199.
45. Voils CI, Steffens DC, Bosworth HB, et al. Social support and locus of control as predictors of adherence to antidepressant medication in an elderly population. Am J Geriatr Psychiatry. 2005;13(2):157–165.