Original article

Association between health literacy and medication adherence in the elderly population with chronic disease

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Abstract

Background: Medication adherence is a key factor in the therapy of chronic diseases in older people. It is important to investigate the effect of health literacy on medication adherence in this patient population. Health literacy can be summarized as an individual's ability to understand and interpret the provided medical information and to behave appropriately based on this information.

Aim: The purpose of this study was to investigate the association between health literacy and medication adherence in older people with chronic disease.

Methods: A total of 175 patients admitted to *the family health center clinic* in Bursa, Turkey, who were older than 65 years old, were enrolled in this cross-sectional study using the convenience sampling method. *A priori* power analysis was conducted to determine the required sample size to reach 90% power. The Turkish version of the 8-item Morisky Medication Adherence Scale (MMAS-8) was used to assess medication adherence. The European Health Literacy Survey Questionnaire (HLS-EU-Q47) was used to evaluate health literacy. Disability associated with dyspnea was assessed using the Medical Research Council (MRC) dyspnea scale.

Results: The data showed that, according to dyspnea status and diagnosis, medication adherence varied. In this sample, medication adherence in elderly patients was not associated with health literacy. Instead, medication adherence was associated with the patient's disability and the course of the disease.

Discussion and conclusions: Improving health literacy may enhance the medication adherence of older people with chronic disease. The development, practice and evaluation of health literacy interventions for older people with chronic conditions are important to increase medication adherence and potentially improve patient outcomes.

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Key words: Health literacy, medication adherence, older patients, chronic disease, dyspnea

Introduction

Patient adherence is defined as the degree to which patients follow treatment recommendations prescribed by their clinician or health care provider. Adherence has been found to have positive and significant effects on treatment outcomes and it is a key factor in the therapy of chronic diseases in older people. Inadequate health literacy (HL) results in poor health outcomes (1). Adherence to medical treatment is an essential factor in ensuring appropriate pharmacological efficacy. The reasons for medication non-adherence are multifarious and can relate to factors as diverse as the health system, the patient's characteristics, treatment programs, and socioeconomic factors (2,3). Self-efficacy is also known as a significant predictor (4).

The World Health Organization defines 'health literacy' as personal characteristics and social resources that enable individuals and communities to access, understand, evaluate and use the information to make health-related decisions (5). HL can be summarized as an individual's ability to understand and interpret the provided medical information and to behave appropriately based on this information (6). The positive impact of HL on chronic diseases has been shown in many studies (7,8). It has been shown that HL levels are lower among those who indicate that their social status is low, have poor education and income levels, assess their health condition as bad, have limited activity due to health problems, and are in the older population (9). HL is independently associated with several negative health outcomes, including more inferior overall health status, hospitalization, mortality and high health care costs (10,11). Studies have found that low levels of HL are associated with poor adherence to preventive and therapeutic medical recommendations (12,13).

Aim

The purpose of this cross-sectional study was to investigate the association between HL and medication adherence in older people with chronic disease.

Methods

A total of 175 patients admitted to the family health center clinic in Bursa, Turkey, who were older than 65 years old, who could speak and understand Turkish, who had no cognitive disease and agreed to take part in this study between May and October 2018, were enrolled in this cross-sectional study using the convenience sampling method. *A priori* power analysis was conducted to determine the required sample size to reach 90% power. The ethics committee of Uludag University approved the study. Informed consent was obtained from all individual participants included in the study.

Demographic characteristics, history of smoking and alcohol usage, education level, employment status, comorbid diseases, dyspnea status and the number of drugs used with and without prescription were evaluated. The study was carried out via face-to-face interviews between patients and clinicians.

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Modified Medical Research Council dyspnea scale: The Medical Research Council (MRC) dyspnea scale is an established simple questionnaire for quantifying disability associated with dyspnea. The degree of dyspnea was quantified using the modified MRC (mMRC) questionnaire. The mMRC questionnaire is a 5-point scale and asks patients to rate dyspnea from 0 (absent) to 4 (dyspnea when dressing/undressing) (14).

Morisky Medication Adherence Scale: The Turkish version of the 8-item Morisky Medication Adherence Scale (MMAS-8) was used to assess medication adherence. The MMAS-8 has proved to be a valuable resource to address adherence concerns, such as forgetting to take medications or discontinuing medications without guidance. The self-reported scale consists of seven items answered with a "yes" or "no," and one on a 5-point Likert scale (from "never" to "always"). Each question measures specific medication behavior. Total MMAS-8 scores range from 0 to 8. High adherence is an MMAS-8 score of 8, medium adherence is 6 or 7, and less than 6 is low adherence. If a patient scores higher on the scale, they are evaluated as more adherent. If they score lower on the scale, they are presumed to be struggling with medication adherence. The validity and reliability of the Turkish version of the scale have been demonstrated by Oğuzülgen *et al.* (15).

European Health Literacy Survey Questionnaire: The Turkish version of the European Health Literacy Survey Questionnaire (HLS-EU-Q47) was used to assess HL. The European Health Literacy Survey (HLS-EU-Q47) consists of 47 questions with a score of 1 to 4 (1=very difficult, 2=difficult, 3=easy, 4=very easy). This scale uses the patient's perception of the difficulty of behavior for each question. Survey questions were divided into subgroups as follows: health care (questions 1-16), disease prevention (questions 17-31), and health improvement (questions 32-47). At the end of the survey, patients who had scored 0-25 points were regarded as having insufficient adherence; 25-33 points indicated problematic adherence; 33-42 points showed sufficient adherence; and those with 42-50 points had excellent adherence. The validity and reliability of the Turkish version of the scale have been demonstrated by Abacigil *et al.* (16).

Statistical analysis: The sample size calculation was performed according to the correlation between HL and medication adherence reported by Lee *et al.* (17). Based on the correlation coefficient value (r=0.25), the sample size of at least 164 participants was estimated for the power of 0.90 and alpha of 0.05. *A priori* power analysis was conducted with GPower 3.1 (www.gpower.hhu.de/). Finally, 175 participants were included in the study when the limitations of the study were taken into consideration. A Kolmogorov–Smirnov test was used to assess whether the variables followed a normal distribution. Variables were reported as mean ± standard deviation (minimum: maximum) or median (minimum: maximum) values. According to the normality test result, parametric independent samples t-tests or non-parametric Mann–Whitney U tests were used for between-group comparisons. Categorical variables were compared using the Pearson chi-square test or Fisher-Freeman-Halton test. Risk factors that were thought to affect poor compliance with medication adherence were examined using binary logistic regression analysis. The Cronbach alpha coefficient examined the internal consistency of the HL scale. Reliability coefficients of the HL scale and sub-scales were found to be $\alpha = 0.88$ for health care, $\alpha = 0.92$ for disease prevention, $\alpha = 0.86$ for health promotion, and $\alpha = 0.93$ for the general scale. SPPS (IBM Corp. Released 2012. IBM SPSS Statistics for Windows, Version 21.0. Armonk, NY: IBM Corp) software was used to perform statistical analysis, and $p<0.05$ was set as the statistical significance.

Results

A total of 175 patients were enrolled in this study. The demographic characteristics of the participants are shown in Table 1. The mean age was 72.49±5.72 years, ranging from 65 to 90, and 48.6% (n=85) of patients were male. The results indicated that 67 patients (38.28%) did not adhere to their medication regime.

Table 1: **Socio-demographic characteristics of participants**

Characteristics	n=175
Age (year)	72.49±5.72 (65:90)
Gender (F/M)	90 (51.4%)/85 (48.6%)
Smoking	
Smoker	26 (14.9%)
Non-smoker	149 (85.1%)
Employment status	
Unemployed	85 (48.6%)
Retired	61 (34.9%)
Employed	29 (16.6%)
Alcohol usage	8 (4.6%)
Education	
Primary	158 (90.3%)
High school	14 (8%)
University	3 (1.7%)

Data are presented as mean ± standard deviation (minimum: maximum) and n (%)

Table 2 shows the results of the HLS-EU-Q47. Overall, HL was insufficient for 80% of patients, problematic for 14.3%, sufficient for 4.6%, and excellent for 1.1%. When the subgroups were examined, health care HL

was insufficient for 28% of patients, problematic for 41.1%, sufficient for 25.7%, and excellent for 5.1%. Disease prevention HL was insufficient for 85.7% of patients, problematic for 9.1%, sufficient for 4.6%, and excellent for 0.6%. Finally, health improvement HL was insufficient for 85.1% of patients, problematic for 12%, sufficient for 0.6%, and excellent for 2.3%.

Table 2: **Health literacy scores and distribution of subgroups**

	Insufficient	Problematic	Sufficient	Excellent
Overall HL (Q 1-47)	80%	14.3%	4.6%	1.1%
Health care HL (Q 1-16)	28%	41.1%	25.7%	5.1%
Disease prevention HL (Q 17-31)	85.7%	9.1%	4.6%	0.6%
Health improvement HL (Q 32-47)	85.1%	12%	0.6%	2.3%

HL: Health literacy

There was no difference in age, gender or education levels between the groups in terms of medication adherence (p=0.254, p=0.429, and p=0.503, respectively). There was a difference among employment status groups in terms of medication adherence (p=0.018) (Table 3). Although medication adherence was higher in retired workers than in the working group (p=0.011), there was no difference in terms of medication adherence between employed and unemployed participants (p=0.444). The non-adherence rate in the unemployed group was higher than in the retired group (p=0.018).

Table 3: **Association of medication adherence status with demographic factors and educational levels**

	Medication adherence	
	Good (n=108)	**Bad (n=67)**
Age (year)	72.10±5.52 (65:88)	73.12±6.03 (66:90)
p-value	0.254[a]	
Gender		
Female	53 (49.1%)	37 (55.2%)
Male	55 (50.9%)	30 (44.8%)
p-value	0.429[b]	
Education		
Primary	97 (89.8%)	61 (91%)
High school	10 (9.3%)	4 (6%)
University	1 (0.9%)	2 (3%)
p-value	0.503[c]	
Employment status		
Employed	14 (13%)	15 (22.4%)
Retired	46 (42.6%)	15 (22.4%)
Unemployed	48 (44.4%)	37 (55.2%)
p-value	0.018[b]	

Data are presented as mean ± standard deviation (minimum: maximum) and n (%)
a: Independent samples t test, b: Pearson chi-square test, c: Fisher-Freeman-Halton test

Medication adherence did not differ according to the HL scale in general or its subgroups (Table 4). The data showed that according to the mMRC dyspnea scale, medication adherence varied. In the subgroup analysis, it was found that the rate of non-adherence in Stage 0 was lower than in Stage 2, Stage 3, and Stage 4 (p=0.014, p=0.022, and p=0.025, respectively). The use of non-prescription antibiotics was found to be higher in the group with poor medication adherence (p<0.001). There was no difference in medication adherence between the groups according to the number of comorbid diseases or the number of medications used (p=0.108 and p=0.098, respectively) (Table 5). When the patients taking four or more drugs were evaluated as a polypharmacy group, there was no difference in terms of medication adherence and HL levels (p=0.324 and p=0.290, respectively). The data showed that the rate of medication non-adherence could be higher in patients with asthma and arrhythmia than in patients with another comorbid disease (p=0.008 and p=0.045, respectively).

Table 4: **Relationship between health literacy and medication adherence**

Health literacy		Medication adherence	
		Good (n=108)	**Bad (n=67)**
Overall	*Insufficient*	86 (79.6%)	54 (80.6%)
	Problematic	16 (14.8%)	9 (13.4%)
	Sufficient	6 (5.6%)	2 (3%)
	Excellent	0	2 (3%)
	p-value	0.341[c]	
	Score	19.33 (10.28:40)	18.79 (7.80:43.62)
	p-value	0.275[d]	
Health care	*Insufficient*	28 (25.9%)	21 (31.3%)
	Problematic	48 (44.4%)	24 (35.8%)
	Sufficient	26 (24.1%)	19 (28.4%)
	Excellent	6 (5.6%)	3 (4.5%)
	p-value	0.666[b]	
	Score	28.13 (12.50:45.83)	29.17 (12.50:43.75)
	p-value	0.958[d]	
Disease prevention	*Insufficient*	95 (88%)	55 (82.1%)
	Problematic	10 (9.3%)	6 (9%)
	Sufficient	2 (1.9%)	6 (9%)
	Excellent	1 (0.9%)	0
	p-value	0.124[c]	
	Score	12.22 (0:43.33)	8.89 (0:37.78)
	p-value	0.122[d]	
Health improvement	*Insufficient*	94 (87%)	55 (82.1%)
	Problematic	11 (10.2%)	10 (14.9%)
	Sufficient	1 (0.9%)	0
	Excellent	2 (1.9%)	2 (3%)
	p-value	0.666[c]	
	Score	16.67 (6.25:48.81)	16.67 (5.21:50)
	p-value	0.483[d]	

Data are presented as n (%)
b: Pearson chi-square test, c: Fisher-Freeman-Halton test, d: Mann–Whitney U test

Table 5: **Association of medication adherence status with dyspnea status, comorbidities, number of drugs used, and use of drugs without a prescription**

	Medication adherence	
	Good (n=108)	**Bad (n=67)**
mMRC*		
Grade 0	34 (82.9%)	7 (17.1%)
Grade 1	41 (66.1%)	21 (33.9%)
Grade 2	16 (45.7%)	19 (54.3%)
Grade 3	15 (50%)	15 (50%)
Grade 4	2 (28.6%)	5 (71.4%)
p-value	0.002[b]	
Use of drugs without a prescription		
Yes	5 (4.6%)	17 (25.4%)
No	103 (95.4%)	50 (74.6%)
p-value	<0.001[b]	
Number of comorbidities	2 (1:5)	2 (1:5)
p-value	0.108[d]	
Number of drugs used	3 (1:12)	3 (1:10)
p-value	0.098[d]	

Data are presented as n (%) and median (minimum: maximum)
b: Pearson chi-square test, d: Mann–Whitney U test

Logistic regression analysis of factors that may affect medication adherence revealed that the risk of non-adherence increased 8.70 (95% CI: 1.42-53.34; p=0.019) times for unemployed patients and 4.10 (95% CI: 1.14-14.78; p=0.031) times for employed patients, compared with the retired group. The multivariate analysis also revealed that the risk of non-adherence was 21.05 (95% CI: 1.12-395.56; p=0.042) times higher for patients with primary education than for patients with university education. According to the mMRC dyspnea scale, being in Stage 2 compared to being in Stage 0 increased the risk of non-adherence 5.57 (95% CI: 1.66-18.74; p=0.005) times, while being in Stage 4 compared to being in Stage 0 increased the

risk of non-adherence 16.37 (95% CI: 1.23-217.23; p=0.034) times. The use of non-prescription antibiotics increased the risk of non-adherence 10.02 (95% CI: 2.72-36.93; p=0.001) times (Table 6).

Table 6: **Independent risk factors affecting non-adherence risk**

Predictor	Wald	OR (95% CI)	p-value
Gender (Ref. cat: Male)			
Female	0.80	0.48 (0.09:2.44)	0.371
Employment status (Ref. cat: Retired)			
Unemployed	5.47	8.70 (1.42:53.34)	0.019
Employed	4.65	4.10 (1.14:14.78)	0.031
Smoking (Ref. cat: Non-smoker)			
Smoker	3.19	2.96 (0.90:9.72)	0.074
Education (Ref. cat: University)			
Primary	4.14	21.05 (1.12:395.56)	0.042
High school	0.32	0.56 (0.07:4.13)	0.571
Number of drugs used	0.78	0.86 (0.61:1.21)	0.379
Number of comorbidities	0.37	1.21 (0.65:2.28)	0.546
mMRC (Ref. cat: Grade 0)			
Grade 1	0.97	1.78 (0.57:5.63)	0.324
Grade 2	7.71	5.57 (1.66:18.74)	0.005
Grade 3	2.05	2.89 (0.68:12.39)	0.153
Grade 4	4.49	16.37 (1.23:217.23)	0.034
Use of drugs without a prescription (Ref. cat: None)			
Yes	11.99	10.02 (2.72:36.93)	0.001
Health literacy scores			
Overall	1.12	0.01 (0:254.71)	0.289
Health care	1.14	9.43 (0.15:596.86)	0.286
Disease prevention	1.16	8.33 (0.17:408.75)	0.282
Health improvement	1.14	9.67 (0.16:603.85)	0.285
Model χ^2=50.45; p<0.001 Pseudo R^2=0.34 n=175			

Ref. cat: Reference category, OR: Odds ratio, CI: Confidence interval

Discussion

This study aimed to determine the medication adherence status of patients admitted to outpatient clinic and the effect of HL. In this study population, which consisted almost entirely of patients from a low educational background, 61.7% were reported to adhere to their medication regime, while 38.3% of the cases had non-adherence to medication. Age, gender, and education level had no effect on medication adherence, and among the retired population, medication adherence was higher. Medication adherence was not associated with polypharmacy, and there was a decrease in medication adherence in the presence of dyspnea-related disability and asthma or arrhythmia diagnoses. Overall, HL was insufficient for 80% of patients, problematic for 14.3%, sufficient for 4.6%, and excellent for 1.1%. In a study performed in Turkey, the HL index was 30.4, and it was stated that 24.5% of society was at an insufficient level, and 40.1% was at a problematic level (16). In our study, the inadequate HL level was found to be much higher due to our study population being selected from those with a low sociocultural background and elderly patients.

In the present study, although medication adherence did not differ according to the HL scale in general or its subgroups, Lee *et al.* show that HL is the strongest predictor of medication adherence (18). Aranha *et al.* also show that HL is positively associated with medication adherence (19). In contrast to other studies, we found that HL was not related to medication adherence. This may be due to the age group of patients in the research study. While increased disability may have a negative effect on the senile patient group in terms of medication adherence, the decrease in HL associated with dementia in this age group may also be a confounding factor.

According to the mMRC dyspnea scale, the rate of non-adherence in Stage 0 was lower than in Stage 2, Stage 3, and Stage 4. Patients who are most severely ill with serious diseases may be at greatest risk of non-adherence to treatment. Careful coordination of maneuvers that a patient uses to activate the device with breathing, and holding the breath to perform the operating steps of the device, can be difficult for people with dyspnea.Careful coordination of

maneuvers that a patient uses to activate the device with breathing and holding the breath to perform the operating steps of the device, can be difficult for people with dyspnea. Müllerová *et al.* show that patients with medical non-adherence are more often male and have worse breathlessness on exertion (mMRC ≥2) (20). In our study, we found similar results, as non-adherence rates were higher in dyspneic patients. Patients' perceptions of their illness, their understanding of the treatment, and their relationship with the primary care provider, are critical to adherence to therapy.

We found that the use of non-prescription antibiotics was higher in the group with medication non-adherence. Although outpatient antimicrobials are largely restricted to prescription-only use, non-prescription access to antimicrobials is common in the rest of the world. Obtaining antimicrobials without prescription has been reported in 28 developing countries (21). Non-prescription antimicrobial use promotes inappropriate drug choice, dose, duration of therapy, and non-adherence. Financial reasons and the severity of illnesses were the top two reported factors for non-prescription (22). So, economic factors and disease severity should never be overlooked when assessing non-prescription.

There was no difference in medication adherence between the groups according to the number of comorbid diseases or the number of medications used. Müllerová *et al.* show that patients who report low or medium adherence more often report having two or more comorbidities compared with those reporting high adherence (20). While patients taking four or more drugs were evaluated as a polypharmacy group, there was no difference in terms of medication adherence and HL levels. Montiel-Luque *et al.* show that there is a relationship between a higher number of medicines and a lack of medication adherence with a worse quality of life (23). The reason that polypharmacy was not associated with medication adherence in this study may be due to the fact that older people in Turkish society generally do not live alone. In Turkish culture, elders live with their children, and medication can be managed by others at home. In the current study, if the elderly patients living alone had been identified, a more meaningful discussion could have been had on the issue.

The data show that the rate of medication non-adherence could be higher in patients with asthma and arrhythmia than in patients with another comorbid disease. Both medication and lifestyle non-adherence in cardiovascular disease can be severe, and for this reason, the average correlation between HL and patient adherence is higher in studies of patients with cardiovascular disease compared with studies of patients with other disease conditions. Poor adherence to asthma medication regimens has been repeatedly demonstrated in both children and adults, with rates of non-adherence commonly reported from 30% to 70% (24,25). Many asthma patients choose not to take their medication because they perceive it to be unnecessary or because they are concerned about potential adverse effects. Medication regimens for asthma care are particularly vulnerable to adherence problems because of their duration, the use of multiple medications, and the periods of symptom remission (26).

In this sample, medication adherence in elderly patients was not associated with HL. Instead, it was associated with the severity of dyspnea and the presence of the symptoms. While dyspnea-related disability increases, the decrease in medication adherence may be related to the emergence of the need for assistance in managing the patient's disease. Decreasing medication adherence in asthmatic patients shows that patients should be advised to use their medication regularly in stable periods as well as during attack episodes.

Limitations of this study

Potential limitations of this study merit consideration. Our study may exhibit recall bias due to subjects' responses to questionnaires, and this may have influenced the assessment of the status of medication adherence. Also, considering that participants may have a tendency to answer questions that depict them in a positive manner an exaggerated tendency to answer questions, the social desirability bias can also be considered within the scope of possible limitations.

Authors' contributions

All authors approved the final version of the manuscript.

Competing interests

All authors certify that they have no affiliations with or involvement in any organization or entity with any financial interest (such as honoraria; educational grants; participation in speakers' bureaus; membership, employment, consultancies, stock ownership, or other equity interest; and expert testimony or patent-licensing arrangements), or non-financial interest (such as personal or professional relationships, affiliations, knowledge or beliefs) in the subject matter or materials discussed in this manuscript. No funding was received for this research.

Ethical approval

All procedures performed in studies involving human participants were in accordance with the ethical standards of the institutional (Uludag University: 2018-4/24) research committee and with the 1964 Declaration of Helsinki and its later amendments or comparable ethical standards.

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