

# Relationship Between Polypharmacy and Geriatric Syndromes in Older Nursing Home Residents

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## Abstract

**Objective:** Our aim is to determine the prevalence of polypharmacy and the relationship between polypharmacy and geriatric syndromes as well as comorbidity in older nursing home residents (NHR).

**Materials and Methods:** This observational and cross-sectional study was conducted with 217 adults  $\geq 60$  years of age who had Katz index of Independence in activities of daily living score over 4 points and were institutionalized at nursing care home from March to April 2019. Polypharmacy was defined as the daily use of 5 or more medications. Geriatric syndromes include dementia, depression, urinary incontinence (UI), malnutrition, falls, mobility problems, hearing loss, vision impairment.

**Results:** The prevalence of polypharmacy among NHR was 61.8%. By univariate analysis, polypharmacy was associated with chronic diseases such as heart disease, chronic obstructive pulmonary disease (COPD) and diabetes mellitus, and with geriatric syndromes such as dementia, depression, UI, and mobility problems ( $p < 0.05$ ). In the multivariate analyses, depression [odds ratio (OR) = 9.57; 95% confidence interval (CI), 2.73-33.60] and mobility problems (OR = 4.88; 95% CI, 1.80-13.25) increased polypharmacy by 9.6 and 4.9-fold respectively.

**Conclusion:** Comorbidity and geriatric syndromes play an important role in the development of polypharmacy. Monitoring polypharmacy is often necessary as well as giving complex medication regimens for NHR.

**Keywords:** Activities of daily living, comorbidity, geriatric syndromes, nursing homes, polypharmacy

## Introduction

Polypharmacy is becoming increasingly prevalent in older adults each year, particularly in nursing home residents (NHR). Older adults without disabilities can easily access health services to prescribe medications. The lack of assessment of patient's prior medications by each specialist is the main reason for widespread polypharmacy among NHR. Consequently, the risk of polypharmacy increases along with an increased number of hospital admissions and comorbidities.

Polypharmacy does not have a generally accepted definition (1,2). Similarly, it was defined by the World Health Organization as followed: "Polypharmacy is the concurrent use of multiple medications. Although there is no standard definition, polypharmacy is often defined as the routine use of five or more medications. This includes over-the-counter, prescription and/

or traditional and complementary medicines used by a patient" (3). The most common definition for polypharmacy is the use of five or more medications (1). According to this definition, the prevalence of polypharmacy ranged from 38.1% to 91.2% in NHR (2,4,5). The prevalence of polypharmacy varied based on numerical definitions of polypharmacy, dependence of NHR, age, and level of care (1).

Polypharmacy increases as the number of comorbidities increases (6). Polypharmacy was found to be associated with heart disease, functional decline, stroke, geriatric syndromes, including cognitive impairment, depression, poor nutrition, and falls (7-9). Polypharmacy in long-term care facilities was associated with comorbid conditions; circulatory diseases, digestive disorders, endocrine and metabolic disorders, genitourinary disorders, musculoskeletal disabilities, neurological motor dysfunction,

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pulmonary diseases (5,10). As a result, polypharmacy was associated with the number of hospitalizations, length of stay, emergency department admission and all-cause hospitalization (2). Chang et al. (11) demonstrated an association between polypharmacy and mortality, regardless of chronic conditions.

Understanding the factors associated with polypharmacy is important to reduce negative outcomes of comorbidities. The relationship between polypharmacy and geriatric syndromes has been investigated generally in the community dwelling older outpatients in Turkey (12-17). In addition, research in nursing homes usually focused on the association of polypharmacy with sarcopenia in Turkey (18,19). Based on this background, the aim of this study is to determine the prevalence of polypharmacy and the relationship between polypharmacy and geriatric syndromes as well as comorbidities in older NHR.

## Materials and Methods

### Study population

This observational and cross-sectional study was conducted with 217 adults,  $\geq 60$  years of age who were institutionalized at nursing care home from March to April 2019. The NHRs who had Katz index of independence in activities of daily living (KATZ-ADL) score below 5 points were excluded (20). No sampling was done because it was planned to include all eligible NHRs in this study.

### Assessments

Data were collected using a structured questionnaire by researchers through face-to-face interviews with NHRs and the responsible nurses of them. Patients' data about number of chronic diseases and prescribed drugs; falls (in the last year); the presence of urinary incontinence (UI); visual impairment; hearing loss; walking disability (the use of a cane, crutches, walking frame); malnutrition; admission to the hospital in the last six months, were noted. Polypharmacy was defined as the daily use of 5 or more medications (1,21), and NHRs were separated into groups by polypharmacy status as non-polypharmacy and polypharmacy.

### Geriatric Syndromes

#### Functional status

To evaluate functional status, KATZ-ADL scale was used. KATZ-ADL assesses six functions, including dressing, feeding, going to toilet, continence, bathing and transferring. A score of 4 and below indicates functional impairment (20). The NHR who had KATZ-ADL score below 5 points were excluded.

#### Dementia

The cognitive function of all NHRs is routinely assessed by clinical judgment annually and as needed; NHRs are referred

to a neurologist as required. So, participants with a diagnosis of dementia and taking anti-dementia drugs were assessed as having dementia.

#### Depression

The presence of depression is assessed by the 15 item geriatric depression scale short-form in NHRs every six months; NHRs are referred to a psychiatrist as required. Participants with a diagnosis of depression and taking antidepressant treatment were assessed as having depression.

#### Falls

A fall was defined as "an unexpected event in which the participant comes to rest on the ground, floor, or lower level" (22). Falls history over the past 12 months has been noted.

#### UI

UI was defined as the unintentional passing of urine independent of the amount. Participants taking medication for UI were also included.

#### Visual impairment

Visual impairment was defined as wearing glasses or a decreased ability to see. We assessed visual impairment by clinical judgment.

#### Hearing loss

Hearing loss was defined as the use hearing aids or the inability to hear as well as an individual with normal hearing.

#### Mobility problems and using mobility aids

The presence of mobility problems was considered as existent if unsteady walking, difficulty in sitting and standing, difficulty in walking and moving, requiring use of mobility aids or falls were present. The use of a cane, crutches, and walking frame were noted as using mobility aids.

#### Malnutrition

Malnutrition is assessed by the mini nutritional assessment in NHRs every six months. Participants who received oral nutritional supplements based on a score 7 and lower MNA, were recorded as having malnutrition.

#### Statistics

Data analyses were performed using SPSS version 25.0 for Windows. Normality was assessed by Kolmogorov-Smirnov's test. Normally distributed quantitative variables were expressed by mean  $\pm$  standard deviations, and those without normal distribution are expressed by median and minimum-maximum values. Quantitative variables without normal distribution were expressed by mean  $\pm$  standard deviations in the table if they have statistical significance. Qualitative variables were

expressed as frequency and percentages. Chi-square (X<sup>2</sup>) test and Fisher's Exact test were used in the analysis of qualitative variables. The t-test and Mann-Whitney U test were used in the analysis of quantitative variables where available. Multiple logistic regression analysis was performed for multivariate analysis. Logistic Regression model was performed for variables which showed significant relationships with univariate analysis. A value of p<0.05 was accepted as statistically significant.

### Results

Of the NHRs, 54 (24.9%) were in the 60-69 age group, 85 (39.2%) in the 70-79 age group and 78 (35.9%) in the 80 and over age group. Median (min-max) of age was 76 (61-110). Median (min-max) of medication number of all NHRs was 6 (0-17), 3 (0-4) in non-polypharmacy group, 7 (5-17) in polypharmacy group. Prevalence of polypharmacy was 61.8% in this study. The polypharmacy group had a higher hospital admission rate in last 6 months and a higher comorbidity prevalence than the non-polypharmacy group. There was no relationship between polypharmacy and other socio-demographic characteristics. Descriptive of the groups are shown in Table 1.

Of the NHRs, 38 (17.5%) had at least one chronic disease, 43 (19.8%) had two chronic diseases and 136 (62.7%) had three or more chronic diseases. The most common diseases were hypertension (58.5%), cardiovascular system diseases (27.2%) and benign prostatic hyperplasia (22.6%), followed by chronic obstructive pulmonary disease (COPD) and diabetes mellitus (DM) (19.4%). Falls, malnutrition, hearing loss, and vision impairment were not associated with polypharmacy. Comorbidity status according to polypharmacy is given in Table 2.

Thirteen (6%) participants took one drug, fifty-nine (27.2%) participants took two-four drugs, hundred and five (48.4%) participants took five-nine drugs, and twenty-nine (13.3%) participants ten or more drugs. The most used drugs in both groups were angiotensin-converting enzyme inhibitor&angiotensin-2 receptor blocker, antiplatelet drugs, and diuretics. The most used drugs in NH are given in Table 3.

All chronic diseases, except geriatric syndromes, were significantly associated with polypharmacy in univariate and multivariate analysis. Depression was found to be a better independent predictor of polypharmacy in NHRs compared with other co-morbidities (odds ratio: 9.57; 95% confidence interval: 2.73-33.6; p<0.001) (Table 4). However, the depression had wide confidence intervals. In terms of geriatric syndromes, dementia and UI were not associated with polypharmacy in the multivariate analysis (Table 4).

### Discussion

In this study, we aimed to determined the relationship between polypharmacy and comorbidities, especially geriatric

syndromes, in NHR without functional impairment. Prevalence of polypharmacy was 61.8% and polypharmacy was increased with depression and mobility problems.

There was a significant difference between the polypharmacy group and non-polypharmacy group in scores of Katz ADL. A cross-sectional, observational study conducted by 1002 community-dwelling older women showed that the use of five or more medications resulted in risk of decreasing instrumental ADL (IADL) score (23). A similar outcome was found by combining ADL and IADL (24). Furthermore, studies have found the negative association between ADL score and polypharmacy in chronic diseases (25-27). Also, there were a few studies that have not demonstrated the relationship between polypharmacy and functional decline in NH (28,29). Consequently, health professionals should be aware of the association between polypharmacy and functional decline.

Polypharmacy could be an indicator of an individual's underlying medical condition. There is heterogeneity among

**Table 1. Descriptive statistics of study participants**

	Non polypharmacy (n=83, 38.2%)	Polypharmacy (n=134, 61.8%)	p
<b>Age (years)</b>	74 (63-110)	77 (61-95)	0.19
<b>Gender</b>			0.21
M (n, %)	49 (59%)	69 (51.5%)	
F (n, %)	34 (41%)	65 (48.5%)	
<b>Education level</b>			0.18
Illiterate (n, %)	4 (4.8%)	15 (11.2%)	
Literate (n, %)	2 (2.4%)	7 (5.2%)	
1 to 11 years (n, %)	42 (50.6%)	63 (47%)	
12 years and above (n, %)	10 (12.1%)	8 (6%)	
Missing	25 (30.1%)	41 (30.6%)	
<b>Marital status (n, %)</b>			0.44
Single	17 (20.7%)	28 (20.7%)	
Married	9 (11%)	6 (4.4%)	
Divorced or widow	56 (67.1%)	97 (72.6%)	
Missing	1 (1.2%)	3 (2.2%)	
<b>Length of stay in institution (n, %)*</b>			0.48
0-6 months	4 (4.8%)	8 (5.97%)	
Above 6 months	79 (95.2%)	125 (93.3%)	
Missing		1 (0.75%)	
Hospital admission in the last 6 months (mean ± SD)	1.22±1.55	2.80±3.13	<b>&lt;0.001</b>
Comorbidities (mean ± SD)	1.87±1.23	3.87±1.45	<b>&lt;0.001</b>

\*Fisher's Exact test, SD: Standard deviation, the bold values indicate the number for statistical significance

**Table 2. Comorbidities and geriatric syndromes according to polypharmacy status**

Comorbidities	Non polypharmacy (n=83, 38.2%)	Polypharmacy (n=134, 61.8%)	p
KATZ score (median, min-max)	6 (5-6)	6 (5-6)	<b>0.017</b>
Diabetes mellitus	8 (9.6%)	34 (25.4%)	<b>0.004</b>
Arrhythmia	2 (2.4%)	20 (14.9%)	<b>0.003</b>
Cardiovascular disease	9 (10.8%)	50 (37.3%)	<b>&lt;0.001</b>
Heart failure	1 (1.2%)	15 (11.2%)	<b>0.006</b>
Malignancy*	1 (1.2%)	9 (6.7%)	0.054
COPD	6 (7.2%)	36 (26.9%)	<b>&lt;0.001</b>
Hypertension	37 (44.6%)	90 (67.2%)	<b>0.001</b>
Benign prostatic hyperplasia	13 (15.7%)	36 (26.9%)	0.055
Thyroid disease	4 (4.8%)	28 (20.9%)	<b>0.001</b>
Peripheral vascular disease	1 (1.2%)	14 (10.4%)	<b>0.01</b>
Parkinson disease	3 (3.6%)	6 (4.5%)	0.76
<b>Geriatric syndromes</b>			
Dementia	4 (4.8%)	19 (14.2%)	<b>0.03</b>
Depression	4 (4.8%)	33 (24.6%)	<b>&lt;0.001</b>
Urinary incontinence	5 (6%)	22 (16.4%)	<b>0.02</b>
Malnutrition*	0	3 (2.2%)	0.23
Falls*	5 (6%)	7 (5.2%)	0.51
Mobility problems	9 (10.8%)	42 (31.3%)	<b>0.01</b>
Using mobility aids	10 (12%)	39 (29.1%)	<b>0.003</b>
Hearing loss	12 (14.5%)	25 (18.7%)	0.42
Vision impairment	21 (25.3%)	35 (26.1%)	0.89

COPD: Chronic obstructive pulmonary disease, the bold values indicate the number for statistical significance, \*Fisher's Exact test

**Table 3. The most commonly used drugs in nursing homes**

Drug type	Non polypharmacy (n=83, 38.2%)	Polypharmacy (n=134, 61.8%)	p
PPI	16 (19.3%)	60 (44.8%)	0.00
Antiplatelet drugs	23 (27.7%)	72 (53.7%)	0.00
ACE inhibitor or ARB	22 (26.5%)	71 (53%)	0.00
Diuretic	24 (28.9%)	65 (48.5%)	0.04
Beta blocker	13 (15.7%)	51 (38.1%)	0.00
Calcium channel blocker	10 (12%)	32 (23.9%)	0.032
Vasodilator	6 (7.2%)	33 (24.6%)	0.01
Inhaler beta mimetic	5 (6%)	36 (26.9%)	0.00
SSRI/SNRI	5 (6%)	34 (25.4%)	0.00
Vitamin supplement	5 (6.1%)	38 (28.4%)	0.00
Anticholinergic	6 (7.2%)	33 (24.6%)	0.001
Alpha blocker	10 (12%)	29 (21.6%)	0.074

ACE: Angiotensin-converting enzyme, ARB: Angiotensin II receptor blocker, SNRI: Serotonin and norepinephrine reuptake inhibitors, SSRI: Selective serotonin reuptake inhibitors, PPI: Proton pump inhibitors

studies investigating the relationship between polypharmacy and comorbidities (30). Like our study, Gocer et al. (31) found that the prevalence of polypharmacy was higher in NHR with hypertension, heart disease and COPD. In a systematic review, cognitive impairment, hypertension, and DM were the most prevalent comorbidities in long-term care residents (5). Similarly, prevalence of polypharmacy has increased with an increase in the number of chronic diseases among the community dwelling older adults (32). In a recent cross-sectional retrospective study, polypharmacy was more prevalent in geriatric outpatients with hypertension, DM, and COPD (33). As for the coexistence of heart disease, DM, COPD, the number of medications inevitably increase. Also, the use of anticholinergic drugs strengthens the association between polypharmacy and comorbidities (32). If the medication was continued although the symptoms had resolved, negative outcomes occur (34,35). As a result, medications used by older adults should be evaluated in accordance with international or national guidelines (15,36-39).

The presence of a geriatric syndrome is known to increase the risk of polypharmacy. In our study, by univariate analysis, geriatric syndromes such as dementia, depression, UI, and mobility problems were significantly associated with polypharmacy. In the multivariate analyses, depression and mobility problems were significantly associated with polypharmacy and presences of these diseases increase polypharmacy by 9.6 and 4.8-fold respectively. The Shelter study found that polypharmacy was increased by 2-fold with depression (4). Similarly, depression was independently related to presence of polypharmacy and the use of potentially inappropriate medication in geriatric outpatients (12,14). A multicenter study based on the survey of health and ageing in Europe found that polypharmacy was associated with depression, lack of finance, lower ADL score (26). On the contrary to our findings, Küçükdağlı (14) found that UI in geriatric outpatients was independently related to polypharmacy in univariate and multivariate analysis. As far as dementia is concerned, there was a similar outcome in geriatric outpatients to our study (16). Our study conducted in NHRs with a KATZ score 5 and over. As a result, the study participants were functional and potentially less frail. Polypharmacy could have been related to a broader spectrum of geriatric syndromes, if the study population had been more functionally dependent.

Polypharmacy has a negative impact on conditions affecting mobility, such as falls and functional decline (40-42). We showed that polypharmacy was associated with mobility problems, not falls. A recent cross-sectional study carried out geriatric outpatients found that polypharmacy was independently associated with poor physical performance rather than falls (33). Several studies have shown a relationship between polypharmacy and falls (2). Izza et al. (43) showed that the odds of falling increased by 1.058 times for every additional drug prescribed after adjusting for gender, age, and dementia.



Variables	Polypharmacy (>5 drugs)					
	Univariate models			Multivariate model		
	OR	95% CI	p	OR	95% CI	p
CVD	4.89	2.25-10.62	<b>0.000</b>	5.71	2.22-14.66	<b>0.000</b>
Hypertension	2.54	1.45-4.47	<b>0.001</b>	2.63	1.25-5.54	<b>0.011</b>
COPD	4.71	1.89-11.76	<b>0.001</b>	7.04	2.29-21.60	<b>0,001</b>
Depression	6.45	2.19-18.98	<b>0.001</b>	9.57	2.73-33.60	<b>0.000</b>
Mobility problems	3.75	1.72-8.21	<b>0.001</b>	4.88	1.80-13.25	<b>0.002</b>
Thyroid disease	5.22	1.76-15.48	<b>0.003</b>	6.53	1.83-23.31	<b>0.004</b>
Diabetes mellitus	3.19	1.39-7.28	<b>0.006</b>	5.58	1.96-15.84	<b>0.001</b>
Arrhythmia	7.11	1.61-31.25	<b>0.009</b>	7.02	1.31-37.47	<b>0.023</b>
UI	3.06	1.11-8.44	<b>0.03</b>	2.06	0.58-7.28	0.26
Dementia	3.26	1.07-9.96	<b>0.04</b>	3.28	0.82-13.18	0.094

CVD: Cardiovascular disease, UI: Urinary incontinence, COPD: Chronic obstructive pulmonary disease, CI: Confidence interval

A study conducted to community-dwelling adults aged 55 years and over with a fall history indicated that the use of at least five daily prescribed molecules was associated with impaired timed-up and go test after adjusting for the number of comorbidities (44). The presence of the polypharmacy also is a significant risk factor for potentially inappropriate medication use. Thus, it poses a risk of geriatric syndromes (15). Some medications can increase the risk of geriatric syndrome because of their anticholinergic effects, sedative properties or by causing adverse drug reaction (45,46).

In the literature, the most used drugs in NHs were for heart disease medications (31,47). The most prevalent medications taken by all long-term care residents were gastrointestinal agent, diuretic and analgesic/antipyretic drugs in a systematic review (5). In a study conducted by 1843 NHR, they found that rate of use of cardiovascular medications (including antiplatelets, beta blockers, angiotensin-converting enzyme inhibitors, calcium channel blockers, and statins) was decreased following institutionalization over a period of one year (48). Also, in this study, the most common comorbidity was heart disease, as a result, the most frequently used drug group was cardiovascular medications.

### Study Limitations

To our knowledge, this is the first study that has recently focused on the relationship between geriatric syndromes and polypharmacy in Turkish NHs. We realized that geriatric syndrome awareness was ensured through regular screening in NH. A relevant limitation of the study was number of NHR. Also, by the reason of conducted in one nursing home, the results cannot be generalized to all the NHR. Additionally, this study does not help to determine cause and effect for certain because of having cross sectional type. NHR were not evaluated with the comprehensive geriatric assessment, previously diagnosed

health conditions were noted. Consequently, prevalence of geriatric syndromes can be even higher. Also, visual and hearing loss were assessed subjectively. Therefore, the associations between polypharmacy and visual and hearing loss might not be as well determined.

### Conclusion

Comorbidity and geriatric syndromes play a significant role in the prevalence of polypharmacy. Assessment of polypharmacy is necessary during the administration of complex medication regimens for NHR. There was a statistical difference in Katz score between polypharmacy group and non-polypharmacy groups in this study, although it was conducted among individuals who were described independent with Katz ADL. This is the first study evaluating the relationship between polypharmacy and geriatric syndromes in NHRs in Turkey. Given the scarcity of the studies on this subject and difficulty of getting permission for research in Turkish NHs, we believe that this study is valuable. Polypharmacy is common in NHs and is associated with geriatric syndromes. We believe that prevalence of the polypharmacy will increase even further as evaluated through a comprehensive geriatric assessment. With prospective studies, the effect of deprescribing on geriatric syndromes can be investigated. Also, the studies investigating the prescription cascade are needed.

### Ethics

**Ethics Committee Approval:** The study was approved by the Ege University Human Research Ethics Committee (18-11T/16), and taken approval from the Ministry of Family, Labour, and Social Services of The Republic.

**Informed Consent:** Informed consent was obtained from all participants included in the study. The study was performed in line with the principles of the Declaration of Helsinki.

**Peer-review:** Externally peer-reviewed.

## Authorship Contributions

Surgical and Medical Practices: F.Ö.K.K., E.T. Concept: F.Ö.K.K., E.T., S.Ş., Design: F.Ö.K.K., E.T., Data Collection or Processing: F.Ö.K.K., E.T., Analysis or Interpretation: F.Ö.K.K., E.T., Literature Search: F.Ö.K.K., E.T., Writing: F.Ö.K.K., E.T.

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