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Original article

Prevalence of Polypharmacy and Factors Associated with it Among Saudi Older Adults – Results from the Saudi National Survey for Elderly Health (SNSEH)

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ABSTRACT

Background and Objectives: The percentage of Saudi older adults (SOA) is increasing over time. With advanced age, the prevalence of chronic diseases and multiple disabilities are increasing. This leads to increase utilization of multiple medications. The objectives of this study were to describe medication utilization, determine the prevalence of polypharmacy (PP) and factors associated with it among SOA.
Methods: This cross-sectional study was conducted among community-dwelling SOA aged ≥ 60 years old using the Saudi National Survey for Elderly Health (SNSEH). The survey was conducted between 2006 and 2007 by the Ministry of Health on a nationally representative sample of SOA. The data included demographics, socioeconomic and health information such as diseases and medications. Polypharmacy was defined as the concurrent use of medications from ≥ 5 therapeutic classes. A modified Poisson multivariable regression was used to study factors associated with PP controlling for confounders. All analyses were done using STATA 14.
Results: The study included 2,946 SOA; 50.4% were males, 60.9% were 60–70 years old, and 69.6% were illiterate. The most common medications used among SOA were: Paracetamol (67%), joint pain medications and NSAIDs (50% each), anti-diabetic and multivitamins and minerals (47% each). PP was identified in (51.5%) of participants. The most medication associated with PP were: Paracetamol (79.9%), multivitamins and minerals (71.6%), steroid and DMARDs (70.1%), NSAIDs (66.4%), anti-diabetic and anti-hypertensive (61.3%). Higher risk of PP was associated with diabetes (RR: 1.863; 95% CI: 1.686–2.059), hypertension (RR: 1.829; 95% CI: 1.624–2.060), having pain (RR: 2.282; 95% CI: 1.918–2.713), urinary incontinence (RR: 1.389; 95% CI: 1.238–1.560; ref: no urinary incontinence) or suggestive depression (RR: 1.379; 95% CI: 1.259–1.512). Similarly, compared to low income (<2500 SAR), higher incomes were more likely to have PP. On the other hand, compared to the central region, southern and northern regions were less likely to have PP (RR = 0.741; 95% CI: 0.652–0.843 and RR: 0.736; 95% CI: 0.596–0.908, respectively). Severe cognitive impairment was associated with a lower risk of PP (RR: 0.708; 95% CI: 0.501–1.000).

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Conclusion: The prevalence of PP among a nationally representative SOA was very high, i.e., 51.5%. Higher risk of PP was associated with many factors such as region, income, diabetes, hypertension, musculoskeletal pain, urinary incontinence, and depression. PP leads to many negative implications such as drug interactions, combined side effects, hospitalization, and death. Therefore, raising the knowledge of health care providers on the consequences of PP and providing medication therapy management services may help decrease the negative consequences of PP and improve therapy outcomes.

1. Introduction

The World Health Organization (WHO) defines older adult population as "individuals who are aged 60 years old or over" WHO, 2002). There has been significant growth in the older population in recent years, proportional to the total population growth worldwide. The reasons for this increase include the longer life expectancy (which was about 42 years in 1950, increased to 74 years by 2010, and is predicted to be 82 years by 2050) due to advanced health care and medical technology, changes to healthy lifestyles, more awareness and education, good hygiene, immunization against life-threatening infections by vaccination programs, access to moving away from smoking and unhealthy food, and improvements in safety at home and work, and due to decrease in fertility rates among younger groups (Bloom et al., 2010; Bureau, 2013; United Nations, 2015; United Nations Population Division, 2002; United Nations Department of Economic and Social Affairs, 2012; WHO, 2015) According to the WHO, the world will include 1.2 billion people aged 60 and over by the year 2025 and will reach 1.9 billion by 2050. The proportion of older adults was 5.8 % in 2000 and is expected to reach 8.7% by 2025 and 15.0 % by 2050. For individuals aged 80 or more, this percentage is projected to grow from 1% in 2004 to 4% by 2050 of the world population. Across the world populations, women are still living more than men by 5–10 years (Abdul Salam, 2013; Abusaaq, 2015; General Authority for Statistics. Kingdom of Saudi Arabia, 2017; General Authority for Statistics. Kingdom of Saudi Arabia, 2018; R. M. o. E. a. P. Kingdom of Saudi Arabia, 1974, 1992, 2004, 2012; Review, 2017). By the end of 2050, the population in Saudi Arabia will reach 40 million, with older adults contributing about 25% of the overall population (Khoja et al., 2018).

With the changing demographics and an increase in the older population in the last few decades, the prevalence of chronic diseases and multiple illnesses, multimorbidity, is becoming higher in the older population (Salive, 2013). Hypertension, diabetic mellitus, lipid abnormalities, and ischemic heart disease are the most common chronic diseases in the older population. The rising prevalence of multimorbidity leads to the application of multiple disease-specific guidelines and targeting disease-specific goals leading to greater utilization of multiple medications and seeking more frequent follow-ups at healthcare centers for monitoring and refills (Ahlawat et al., 2015; Al-Ghanim, 2010; Al-Modeer et al., 2013; Al-Shaali and Al Jaziri, 2015; Al Qahtani et al., 2015; Alballa et al., 1993; Elamin et al., 2015; Gupta et al., 2013; Jaspinder et al., 2014; Mallet etal., 2007; Naughton et al., 2006; Wu et al., 2013). Polypharmacy (PP) is defined as the "administration of multiple medications at the same time and/or the administration of more medications than is clinically indicated, often represents an unnecessary use of medication" (Mallet et al., 2007). There is no universal definition of PP with regards to the actual number of medications taken by an individual, but most of the new studies have defined PP as concurrent use of five or more medications (Al-Hashar et al., 2016; Banerjee et al., 2011; Chang et al., 2020; Organization, 2004). Polypharmacy is prevalent among older adults (Salih et al., 2013). More than 30% of patients aged 65 years or older were taking five or more drugs and 53.6% when OTC drugs were considered (Banerjee et al., 2011; Junius-Walke et al., 2006; Qato et al., 2008). Polypharmacy, when used judiciously, is valuable and fundamental for the best care in some patients. Still, it can also be associated with negative health consequences such as potential inappropriate prescribing, adverse drug events (dizziness, confusion, nausea, constipation, incontinence, and falling), drug interactions, non-adherence to medications, higher health care costs, decreased physical functioning, cognition, and quality of life (Hajjar et al., 2007; Mangoni and Jackson, 2004; Salih et al., 2013; Statistics, 2006; Ziere et al., 2006). All these negative consequences can result in hospitalizations and can also be life-threatening (Fulton and Riley Allen, 2005; Laatikainen et al., 2016). This leads to a significant burden on both social and economic conditions and is one of the biggest challenges facing health systems globally in the 21st century (Pruitt and Epping-Jordan, 2002).

Little information about PP in the Saudi older adults (SOA) population and their health needs are known. Most of the studies conducted in SOA were either based on a small sample size from a single healthcare center (Gupta et al., 2013), focused on studying the effect or use of one medication, or considered only one clinical condition (Ahlawat et al., 2015). Consequently, understanding and studying the characteristics of SOA and their medication utilization is needed for medical and educational purposes. In a previous study conducted among the nationally-representative SOA population, the authors looked at medication utilization, but its prevalence and associated factors were not reported (Khoja et al., 2018). The objectives of this study were to describe the medication utilization among SOA, determine the prevalence of PP and the factors associated with it among SOA. This current study will provide baseline data of the older population for future comparison studies and help generate new interventions that aim to improve the quality of life (QOL) for millions of older adults.

2. Methods

2.1. Data source and study design

This is a cross-sectional study that is using the Saudi National Survey for Elderly Health (SNSEH). The SNSEH is a nationwide, representative, population-based survey of SOA $\geq$ 60 years of age. The survey was conducted by the Ministry of Health (MOH) between June 2006 and June 2007 to guide a national healthcare model development for older adults.

2.2. Survey tool

All participants had to be $\geq$ 60 years of age, i.e., the current retirement age in the country, and have Saudi citizenship to be included in the survey. The survey is described in detail in a previous article (Khoja et al., 2018). Briefly, in addition to demographic information, the survey contains questions about selected common comorbidities, medications use, physical examination findings, home safety concerns, social network, and social services nearby the participants' residence. During the household visits, the surveyors recorded information on an individual's socio-

demographic status, physical health perceptions, illnesses, health conditions and their effects on functioning, smoking history, nutrition, Activities of Daily Living (ADL), cognitive and mental screening questions, a geriatric depression scale, sleep apnea scale, alternative medicines consumption, caregiver strains, utilization of preventive services and periodic health evaluations, health services utilization, and general physical clinical examinations (Khoja et al., 2018). The survey project was approved and funded by the Saudi MOH. Trained research teams performed the interviews and collected the data. Informed consent was provided to each participant included in the survey. Personal data such as national identification number, medical record number, and contact information were kept in a secure system with limited access. Additionally, participants' identifiers were removed from the data before sharing. Furthermore, the research and ethical committee at the MOH had oversight of all aspects related to human subject protection.

2.3. Measures

Subjects were asked about the use of medications during the last six months. All medications were classified based on their therapeutic classes. Since many adults take paracetamol and/or aspirin, these two drugs were classified separately to reduce the over-reporting of pain killers and NSAIDs. Chronic conditions were coded using the International Classification of Diseases 10th Revision (ICD-10). The data were collected using a structured interview technique and validated questionnaire items. Structured data forms were also used for obtaining the clinical history, physical examination, and clinical investigation information. During the questionnaire development, the research team considered previous validated surveys pertaining to older adults such as the Survey of Health, Aging, and Retirement in Europe (SHARE), the Questionnaire on Health and Long-Term Care for the Elderly, and the Questionnaire of Community Care for Elderly People in the Eastern Mediterranean Countries. PP was defined as the concurrent use of $\geq$ 5 therapeutic classes. All subjects reported medications that they used on a chronic basis. However, the degree of adherence could not be estimated from the survey.

2.4. Statistical analyses

For statistical analyses, the cohort was described using frequencies and percentages for categorical variables. Since PP was common among the SOA, modified Poisson multivariable regression was used to assess the association between PP and its factors to avoid the overestimation that the corresponding multivariable logistic regression will cause (Zou, 2004). To assess the model's goodness of fit, the Hosmer-Lemeshow test and C-statistic test of the corresponding logistic regression analysis were used (Hosmer et al., 1997). Missing data were less than 2.5% of the whole data; therefore, multiple imputations were performed (Fox-Wasylyshyn and El-Masri, 2005; Schafer, 1999; Sterne et al., 2009). All analyses were adjusted by the standardized survey weight and done using STATA 14 (“StataCorp. 2015. Stata Statistical Software: Release 14. College Station, TX: StataCorp LP.,”).

2.5. Ethical Approval

The study was approved by the institutional review board at The Imam Mohammad Bin Saud Islamic University (HAPO-01-R-011).

3. Results

The baseline characteristics of the overall study population are shown in Table 1. The study included 2,946 SOA, out of which 50.4% were males, and 60.9% were aged 60–70 years old. The distribution of the participants according to different geographic regions of Saudi Arabia was: Western: 31.1%, Southern: 25.1%, Central: 23.2%, Eastern: 13.7%, and Northern: 6.9%. With regards to other demographic factors, almost 70% were illiterate, had an income of < 5000 SAR (80.7%), had a monogamous marital status (57.2%), and were living in urban areas (80.1%).

Regarding comorbidities, the majority of the participants were either overweight or obese (69.6%) and had musculoskeletal pain (81.5%), while 50.4% had diabetes and 64.5% had hypertension. As assessed by the Short Portable Mental Status Questionnaire (SPMSQ), 82% of the participants had normal cognition, followed by 11.9%, 4.0%, and 2.2% with mild, moderate, and severe cognitive impairment. Most of the participants did not have depression (73.3%), but in 24.2% and 2.6% of the participants, they either had a suggestive depression or depression, respectively, as assessed by Geriatric Depression Scale (GDS) (Aljawadi et al., 2018).

The most common (top 5) medications utilized by the SOA in the past 6 months were: paracetamol (67%), joint pain medications and NSAIDs (50% each), anti-diabetic and multivitamins and minerals (47% each; Fig. 1). PP was identified in (51.5%) of participants. The most common medications associated with PP were: paracetamol (79.9%), multivitamins &minerals (71.6%), joint pain medications, specifically, steroids and DMARDs (70.1%), NSAIDs (66.4%), and anti-diabetic and anti-hypertensives (61.3%). On bivariate analysis between PP status and demographic and clinical factors, PP was significantly associated with age ($p = 0.047$), gender ($p = 0.001$), geographical region, education level, BMI, diabetes, hypertension, musculoskeletal pain, urinary incontinence, visual impairment, depression ($p < 0.001$ for each) and hearing impairment ($p = 0.012$) (Table 1).

On controlling for confounding factors by multivariate analysis using a modified Poisson regression model, the risk of PP was significantly higher among those who had income SAR 5,000–7,499 (RR: 1.230; 95% CI: 1.072–1.412; ref: SAR < 2,500) and SAR 7,500–9,999 (RR: 1.238; 95% CI: 1.015–1.511; ref: SAR < 2,500); had diabetes (RR: 1.863; 95% CI: 1.686–2.059; ref: no diabetes); had hypertension (RR: 1.829; 95% CI: 1.624–2.060; ref: no hypertension); had musculoskeletal pain (RR: 2.282; 95% CI: 1.918–2.713; ref no pain); had urinary incontinence (RR: 1.389; 95% CI: 1.238–1.560; ref: no urinary incontinence) or had suggestive depression (RR: 1.379; 95% CI: 1.259–1.512; ref: no depression; Table 2). On the other hand, the risk of PP was significantly lower in those from southern (RR = 0.741; 95% CI: 0.652–0.843; ref: central region) or northern geographic regions of Saudi Arabia (RR: 0.736; 95% CI: 0.596–0.908; Table 2). Severe cognitive impairment was associated lower risk of PP (RR: 0.708; 95% CI: 0501–1.000).

4. Discussion

In this study, the prevalence of PP was 51.5% among the SOA which was close to other studies. For instance, Balkhi et al. reported PP among adult patients to be 46% (Balkhi, 2021), while a study conducted in a university medical hospital of Alkharj reported PP among 41% of the patients (FI Al-Saikhan, 2014). Similarly, some studies reported a higher prevalence of PP compared to this study. For example, one study conducted among SOA in Riyadh in 2016 reported PP of 66% (Balkhi et al., 2018), and another study conducted in 2009 at the King Abdulaziz Medical City, Riyadh, reported a PP of 89% (Salih et al., 2013). Though all these studies used a similar definition of PP (i.e., use of five or more concurrent medications), the differences in the prevalence of PP across studies can be explained by differences in the study methodology, study population, and healthcare settings in which these studies were conducted. For instance, the study by Salih et al. (2013) included

Table 1
Univariable and bivariable analyses of the polypharmacy among Saudi older adults (N = 2,946).

Characteristics			Polypharmacy				Chi-squaredP-value
	Total (N = 2946)		No (n = 1,812)		Yes (n = 1,134)		
	Frequency	Percentage (Col)	Frequency	Percentage (Row)	Frequency	Percentage (Row)	
Age (Years)							0.047
60–65	1072	(37.7)	679	(62.6)	393	(37.4)	
66–70	697	(23.2)	445	(63.8)	252	(36.2)	
71–75	504	(16.6)	294	(57.1)	210	(42.9)	
76–80	342	(11.3)	192	(56.3)	150	(43.7)	
81–85	181	(6.1)	104	(57.5)	77	(42.5)	
86–90	101	(3.4)	63	(63.7)	38	(36.3)	
>90	49	(1.8)	35	(70.8)	14	(29.2)	
Gender							0.001
Female	1187	(49.6)	687	(57.4)	500	(42.6)	
Male	1759	(50.4)	1125	(64.8)	634	(35.2)	
Geographical regions							< 0.001
Central	753	(23.2)	417	(53.7)	336	(46.3)	
Western	874	(31.1)	537	(60.8)	337	(39.2)	
Eastern	393	(13.7)	217	(54.9)	176	(45.1)	
Southern	731	(25.1)	505	(69.6)	226	(30.4)	
Northern	195	(6.9)	136	(69.3)	59	(30.7)	
Level of education							< 0.001
Illiterate	1943	(69.6)	1165	(59.6)	778	(40.4)	
<8 years of education	705	(21.8)	431	(61.5)	274	(38.5)	
Intermediate to High school	222	(6.5)	158	(71.2)	64	(28.8)	
University or higher	76	(2.1)	58	(76.0)	18	(24.0)	
Income (SAR)							0.007
>10,000	181	(5.6)	130	(70.3)	51	(29.7)	
7,500–9,999	140	(4.2)	83	(56.0)	57	(44.0)	
5,000–7,499	318	(9.6)	176	(56.0)	142	(44.0)	
2,500–4,999	752	(24.2)	455	(60.3)	297	(39.7)	
<2,500	1555	(56.5)	968	(61.8)	587	(38.2)	
Marital Status							0.433
Monogamy	1741	(57.2)	1080	(62.1)	661	(37.9)	
Polygamy	430	(13.2)	273	(63.6)	157	(36.4)	
Widowed	584	(23.1)	340	(57.5)	244	(42.5)	
Single	115	(3.6)	73	(61.0)	42	(39.0)	
Separated	76	(2.9)	46	(60.5)	30	(39.5)	
Urban vs. Rural							0.204
Urban	2398	(80.1)	1488	(61.3)	910	(38.7)	
Rural	548	(19.9)	324	(60.3)	224	(39.7)	
Diabetes Mellitus							< 0.001
No	1448	(49.6)	1090	(74.7)	358	(25.3)	
Yes	1498	(50.4)	722	(47.7)	776	(52.3)	
Hypertension							< 0.001
No	1072	(35.5)	835	(77.9)	237	(22.1)	
Yes	1874	(64.5)	977	(51.8)	897	(48.2)	
Musculoskeletal Pain							< 0.001
No	586	(18.5)	485	(82.7)	101	(17.3)	
Yes	2360	(81.5)	1327	(56.2)	1033	(43.8)	
Urinary Incontinence							< 0.001
No	2740	(93.6)	1732	(62.6)	1008	(37.4)	
Yes	206	(6.4)	80	(39.4)	126	(60.6)	
Cancer							0.141
No	2892	(98.1)	1784	(61.3)	1108	(38.7)	
Yes	54	(1.9)	28	(52.9)	26	(47.1)	
Visual Impairment (VA)							< 0.001
Good	1774	(59.6)	1141	(63.7)	633	(36.3)	
Poor	1057	(36.5)	595	(56.3)	462	(43.7)	
Legal blindness	83	(2.7)	53	(66.5)	30	(33.5)	
Total blindness	32	(1.2)	23	(68.8)	9	(31.2)	
Hearing Impairment							0.012
No	2182	(73.4)	1371	(62.3)	811	(37.7)	
Yes	764	(26.6)	441	(57.8)	323	(42.2)	
Depression*							< 0.001
Normal (<5)	2192	(73.3)	1435	(65.2)	757	(34.8)	
Suggestive (5–10)	682	(24.2)	337	(49.2)	345	(50.8)	
Depression (>10)	72	(2.6)	40	(57.6)	32	(42.4)	
Cognitive impairment**							0.501
Normal Cognition	2474	(82)	1523	(60.9)	951	(39.1)	
Mild	312	(11.9)	194	(63.1)	118	(36.9)	
Moderate	103	(4.0)	57	(57.3)	46	(42.7)	
Severe	57	(2.2)	38	(66.7)	19	(33.3)	
BMI WHO categories							< 0.001
<18.5	50	(1.8)	34	(67.2)	16	(32.8)	

(*continued on next page*)

Table 1 (*continued*)

Characteristics			Polypharmacy				Chi-squaredP-value
	Total (N = 2946)		No (n = 1,812)		Yes (n = 1,134)		
	Frequency	Percentage (Col)	Frequency	Percentage (Row)	Frequency	Percentage (Row)	
From 18.5 to 25	872	(28.6)	578	(65.6)	294	(34.4)	
From 25 to 30	1132	(37.5)	702	(62.1)	430	(37.9)	
>30	892	(32.1)	498	(55.6)	394	(44.4)	

BMI: Body mass index; SAR: Saudi Riyal; WHO: World Health Organization.*Based on Geriatric Depression Scale (GDS)**Based on Short Portable Mental Status Questionnaire (SPMSQ)

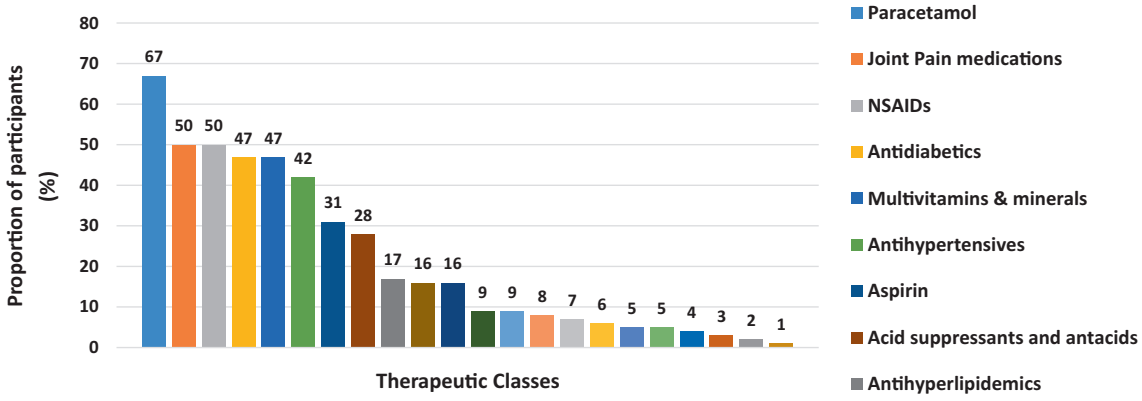

Fig. 1. Prevalence of Medication Utilization According to Therapeutic Classes among SOA in 2006–2007 (N = 2,946). Source: Khoja et al, 2018(Khoja et al., 2018). Used with permission from the authors.

patients over 12 years of age and was conducted in the outpatient department of a tertiary care teaching hospital (Salih et al., 2013), and the study by Balkhi et al. (2018) included the non-Saudi population as well (Balkhi et al., 2018).

In this study, southern and northern geographical regions and rural residential areas were significantly associated with a lower risk of PP (Yang et al., 2015). This could be due to lower access to medicines in participants from this region as these areas are relatively remote than other geographical regions; difficult geographical terrain leading to difficulty in movement and also due to different belief systems such as reluctant to use medications and preference for Complementary Alternative medicine (CAM) (Alrowais and Alyousefi, 2017; Khalil and Elzubier, 1997; Mansour, 2016). The risk of PP was significantly higher in those with income between SAR 5,000 and <10,000 compared to those with SAR were significantly associated with SAR < 2,500. This finding can be explained by higher access to medications (Al-Doghaither et al., 2003; Al-Ghanim, 2004). Certain clinical conditions such as diabetes, hypertension, pain, urinary incontinence during day and night, and suggestive depression were also significantly associated with a higher risk of PP. Some of these are the common chronic conditions in the older population and require multiple medications for the long term to achieve therapeutic goals (Al-Hashar et al., 2016; Junius-Walker et al., 2006; Salih et al., 2013). These findings underscore the importance of intervention by pharmacists as they frequently interact with this population in the community settings (Al-Ghanim, 2010; Ibrahim et al., 2005). The effect of pharmacists' intervention in reducing the use of potentially inappropriate medications and falls has been established in the geriatric population in Europe and Japan. Therefore, a service such as medication therapy management can be very useful in preventing inappropriate use of medications among older adults. Therefore, the partnership between the ministry of health and community pharmacies in Saudi Arabia that created the national e-prescribing program "WASFATY" can be an important enabler for providing medication therapy management to older adults visiting community pharmacies across the nation (Minstry of Health, 2021).

The strength of this study includes the use of a nationwide, representative, population-based survey to describe the medication utilization, prevalence of PP, and factors associated with PP. Hence, the results provided by this study can be considered as baseline information on PP on which future studies can be conducted. However, there are certain limitations of this study that should be acknowledged. Since it was a survey based on self-reported information, it is prone to recall and information bias, especially since the population included SOA. The definition of PP was based on a cutoff of medications from $\geq$ 5 therapeutic classes; however, participants might have been taking > 1 drug in a therapeutic class. Hence, the prevalence of PP estimated in our study could be an underestimation, and the actual burden of PP in the SOA could be much higher. Finally, this study was conducted in non-institutionalized SOA. Thus, the findings might only be generalizable to community-dwelling SOA and not those living in nursing homes or younger populations.

Table 2
Multivariable modified poisson regression of factors associated with PP among SOA in 2006–2007 (N = 2946).

Characteristics	RR	95% CI
Age (Ref: 60–65)	1	[1,1]
66–70	0.972	[0.868,1.090]
71–75	1.026	[0.909,1.158]
76–80	1.11	[0.966,1.275]
81–85	1.037	[0.866,1.241]
86–90	1.01	[0.789,1.295]
>90	0.912	[0.590,1.408]
Gender (Ref: Female)		
Male	0.908	[0.812,1.016]
Geographical regions (Ref: Central)	1	[1,1]
Western	0.906	[0.813,1.008]
Eastern	1.055	[0.924,1.204]
Southern	0.741***	[0.652,0.843]
Northern	0.736**	[0.596,0.908]
Level of education (Ref: Illiterate)	1	[1,1]
<6 years	0.961	[0.863,1.070]
Intermediate to High school	0.772*	[0.627,0.951]
University or higher	0.725	[0.475,1.106]
Income (SAR) (Ref: < 2,500)	1	[1,1]
>10000	0.953	[0.750,1.211]
7,500–9,999	1.238*	[1.015,1.511]
5,000–7,499	1.230**	[1.072,1.412]
2,500–4,999	1.082	[0.978,1.198]
Marital Status (Ref: Monogamy)	1	[1,1]
Polygamy	0.992	[0.869,1.133]
Widowed	0.964	[0.855,1.088]
Single	0.916	[0.742,1.130]
Separated	0.936	[0.726,1.208]
Residence (Ref: Urban)		
Rural	1.175**	[1.052,1.312]
Diabetes mellitus (yes vs. no)	1.863***	[1.686,2.059]
Hypertension (yes vs. no)	1.829***	[1.624,2.060]
Musculoskeletal pain (yes vs. no)	2.282***	[1.918,2.713]
Urine incontinence (yes vs. no)	1.389***	[1.238,1.560]
Cancer (yes vs. no)	1.193	[0.911,1.563]
Visual impairment (yes vs. no)	1.031	[0.958,1.108]
Hearing Impairment (yes vs. no)	0.978	[0.889,1.077]
Depression§ (Ref: Normal < 5)	1	[1,1]
Suggestive (5–10)	1.379***	[1.259,1.512]
Depression (>10)	1.253	[0.964,1.629]
Cognitive Impairment¥ (Ref: Normal)	1	[1,1]
Mild	0.909	[0.780,1.059]
Moderate	0.885	[0.708,1.106]
Severe	0.708*	[0.501,1.000]
BMI WHO categories (Ref:18.5 to 25)	1	[1,1]
< 18.5	1.007	[0.688,1.475]
From 25 to 30	0.994	[0.892,1.108]
>30	0.984	[0.879,1.101]
Observations:	2946	

RR: Relative Risk; 95 %CI: 95% Confidence Interval; BMI: Body mass index; SAR: Saudi Riyal; WHO: World Health Organization.
§on Geriatric Depression Scale (GDS)
¥Based on Short Portable Mental Status Questionnaire (SPMSQ)
* p < 0.05, ** p < 0.01, *** p < 0.001

5. Conclusion

The prevalence of PP among SOA was very high, 51.5%. It was associated with region, income, diabetes, hypertension, urinary incontinence, and depression. Polypharmacy leads to many negative implications such as drug interactions and combined side effects, hospitalization, and death. Therefore, raising the knowledge of health care providers on consequences of PP, linking the medical number to the national identity number to know the patient's medical history, and providing patient education, medication chart review, and medication therapy management services may help in decreasing the negative consequences of PP and improving therapy outcomes.

Declaration of Competing Interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

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