ORIGINAL ARTICLE

The Knowledge and Awareness about the Effect of Polypharmacy on Renal Function among Adults in Saudi Arabia

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Abstract

Background: Polypharmacy, the concurrent use of multiple medications, is a common issue, particularly in older adults. It can lead to adverse effects like renal function decline. Research in Japan found a link between more prescribed drugs and a faster decline in kidney function. Studies in Egypt and Saudi Arabia highlighted a lack of awareness about polypharmacy among elderly populations. However, no research in Saudi Arabia has assessed people's knowledge of polypharmacy's impact on renal function. **Objectives:** The aim of this study is to assess the knowledge of adults in Saudi Arabia regarding the effect of polypharmacy on renal function. **Methodology:** This observational cross-sectional study was conducted from November 2023 to September 2025 in Saudi Arabia. Our study population consisted of Saudi men and women aged 18 years and above. Our sample size is a minimum of 384 participants. Microsoft Office Excel (2019) was used to enter, save, and code the data that was gathered through the questionnaire. The Statistical Package of Social Science Software, version 26 for Windows, was used for all statistical analyses. **Results:** Of 477 respondents, 61.4% were women; the largest age groups were 25–34 (24.7%), 35–44 (24.9%), and 45–54 (23.1%). Most resided in the Western Region (75.1%); 66.2% held a bachelor's degree. Over half (55.8%) had never heard the term "polypharmacy," and 35.0% correctly defined it as taking more than five medications. The prevalence of polypharmacy among the study participants was 4.4%. Knowledge of drug interactions was reported by 56.2%, whereas only 17.6% felt confident identifying harmful medications. Overall knowledge levels were poor in 29.6%, moderate in 61.2%, and high in 9.2%. Knowledge differed by gender ($P = 0.004$), with higher performance among women; no significant associations were observed for age, education, chronic disease status, or self-rated health. **Conclusion:** Adult knowledge about polypharmacy's renal impact was predominantly moderate, with substantial unfamiliarity with the term and low confidence in identifying harmful medications. These findings support targeted public education, pharmacist-led reviews, and clinician prompts to discuss deprescribing and kidney monitoring in patients exposed to multiple medications.

Key words: Kidney function, medication, polypharmacy, renal function

INTRODUCTION

Polypharmacy refers to the practice of taking multiple medications concurrently, typically involving the use of several prescription drugs, over-the-counter medications, or supplements.[1] Furthermore, polypharmacy can be defined as the use of five or more medications, while hyper polypharmacy, or excessive polypharmacy, refers to the use of ten or more medications.[2]

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Numerically or based on the number of medications prescribed, taking multiple medications can negatively impact treatment and medication adherence.[3] Older adults present three main problems: Adverse drug reactions (ADRs), falls, and medication non-compliance. These problems can be attributed to physiological changes that occur with age and affect the way drugs are processed in the body.

About 40% of older adults suffer from decreased renal blood flow and glomerular filtration rate (GFR), which varies from person to person. Structural changes also occur, such as a decrease in kidney mass and nephron count. Changes in kidney function can lead to difficulties in drug elimination. It is worth noting that about half of older people eventually develop chronic kidney disease (CKD).[4]

The most significant pharmacokinetic alteration that takes place in older patients is renal elimination.[5] Although it is widely recognized that kidney function declines with age, it can also be influenced by other factors, such as polypharmacy, which is one of the most prevalent.[6] Polypharmacy may cause significant kidney damage because of the kidneys' need to eliminate a variety of medicines and their metabolites.[7] In 2010, approximately 40% of individuals aged 65 and older reported taking five or more medications, compared with 20% in 1995.[8] In several research, the risk of hospitalization and mortality associated with polypharmacy in older populations has been reviewed.[9]

In a retrospective study conducted in Japan, the objective was to determine if the quantity of prescribed drugs had an impact on the deterioration of renal function. The results of the analysis indicated a significant correlation between a higher number of prescribed drugs and a more rapid decline in estimated GFR (eGFR), suggesting a potential link between polypharmacy and renal function decline.[10]

In an Egyptian cross-sectional study, researchers evaluated knowledge levels about polypharmacy among elderly patients, revealing a considerable lack of familiarity with polypharmacy's definition (41.2%), contributing factors (36.8%), and at-risk individuals (38.5%).[11]

In a parallel cross-sectional study in Saudi Arabia, the goal was to establish polypharmacy prevalence among older adults, which affected 51.5% of the population. These findings underscore the urgency of assessing adults' awareness and knowledge of polypharmacy in Saudi Arabia.[12]

Understanding the general population's knowledge and awareness of this illness in Saudi Arabia would help medical professionals in both treating patients and preventing the progression of malignant disorders. Despite the importance of this subject, no research has been done in Saudi Arabia to determine how much people are aware of and knowledgeable about the impact of polypharmacy on renal function. The aim of this study is to assess the knowledge about the effect of polypharmacy on renal function among adults in Saudi Arabia.

Objectives

The main objective of this study is to assess the knowledge about the effect of polypharmacy on renal function among adults in Saudi Arabia.

MATERIALS AND METHODS

Study design

This was an observational cross-sectional study conducted from November 2023 to September 2025 in Saudi Arabia. The demographic of interest for the study was Saudi individuals aged 18 years and above. Participants were selected from among those who received the questionnaire. Media applications were used to disseminate the survey, and participants were recruited through these platforms.

Inclusion and exclusion criteria

The inclusion criteria for this study consisted of all Saudi men and women aged 18 years and above who were able to provide informed consent and agreed to participate.

Sample size

The sample size was determined using the Qualtrics calculator with a 95% confidence level; therefore, the minimum required sample size was 384 participants.

Method for data collection and instrument

Data were collected using an online questionnaire designed for the study. The questionnaire consisted of 16 questions divided into three sections. The first section included questions about sociodemographic characteristics. The second section included general information about medications and dosages. The third section contained questions about the side effects of medications and the participants' sources of information. The survey data were collected from medical students through the online questionnaire.

Scoring system

Part I: Knowledge level regarding the effect of polypharmacy on the kidney

Participants were assessed on their level of knowledge concerning the impact of polypharmacy on kidney function through six items in two separate questions from the second and third sections. Each correct answer was given a score

of 1, whereas each incorrect answer received a score of 0. Participants were classified according to their total scores into three categories: those with a low level of knowledge (scores ≤2), a moderate level of knowledge (scores of 3–4), and a high level of knowledge (scores ≥5).

Analysis and data entry method

Data collected through the questionnaire were entered, stored, and coded using Microsoft Office Excel (2019). Statistical analyses were performed using the Statistical Package for the Social Sciences software, version 26 for Windows. Qualitative variables were described using frequencies and percentages through descriptive statistics. The association between categorical variables was tested using Pearson's Chi-square test. $P = 0.05$ or less was considered statistically significant for all analyses.

RESULTS

This study included 477 participants with varied demographic profiles. Women comprised 61.4% of the sample, whereas men made up 38.6%. The age distribution was fairly balanced across middle-aged groups: 25–34 years (24.7%), 35–44 years (24.9%), and 45–54 years (23.1%). Younger adults aged 18–24 represented 18.9%, whereas only 8.4% were 55 years or older. Most participants were married (69%), followed by single individuals (25.8%), with divorced and widowed participants representing 2.7% and 2.5%, respectively. Two-thirds held bachelor's degrees (66.2%), 21.6% had high school education, 5.5% held postgraduate qualifications, and 6.7% fell into other categories. Geographic distribution was uneven, with 75.1% from the western region, 14% from the southern region, and the remaining regions representing <7% combined. Urban dwellers slightly outnumbered rural residents (61.2% vs. 38.8%). Health perceptions were generally positive, with 46.8% rating their health as good and 41.7% as excellent, whereas only 10.9% rated it fair and 0.6% poor. Employment status was balanced (55.3% working, 44.7% not working). Most participants (76.9%) reported no chronic conditions, whereas 23.1% had at least one chronic disease. Most importantly, 4.4% of participants reported using more than five medications in the past 2 weeks, highlighting a notable prevalence of high-intensity polypharmacy. This subgroup may face elevated risks for adverse renal outcomes and underscores the urgent need for targeted medication review and deprescribing strategies in clinical practice [Table 1].

When participants assessed their own health, the responses were generally positive – 46.8% rated their health as good and 41.7% said it was excellent. Only 10.9% described their health as fair, and just 0.6% considered it poor [Figure 1].

Participants showed varied familiarity with polypharmacy concepts. Over half (55.8%) had never heard the term before,

Table 1: Sociodemographic characteristics and polypharmacy among participants (*n*=477)

Parameter	No.	Percent
Gender		
Female	293	61.4
Male	184	38.6
Age Group (years)		
18–24	90	18.9
25–34	118	24.7
35–44	119	24.9
45–54	110	23.1
55+	40	8.4
Social Status		
Married	329	69
Single	123	25.8
Divorced	13	2.7
Widowed	12	2.5
Education Level		
Bachelor's Degree	316	66.2
High School	103	21.6
postgraduate	26	5.5
Others	32	6.7
Place of Residence		
Western Region	358	75.1
Southern Region	67	14
Central Region	33	6.9
Eastern Region	15	3.1
Northern Region	4	0.8
Residence Type		
City	292	61.2
Village	185	38.8
Self-rated health condition		
Good	223	46.8
Excellent	199	41.7
Fair	52	10.9
Poor	3	0.6
Work Status		
Working	264	55.3
Not working	213	44.7
You get your medication from		
More than one place	317	66.5
One place	160	33.5
Place of Prescription		
Governmental	252	52.8
Private	133	27.9
Both governmental and private	92	19.3

(Contd..)

Table 1: *(Continued)*

Parameter	No.	Percent
Number of total medications used in the last 2 weeks		
I didn't use any medications	249	52.2
1–2	153	32.1
3–4	54	11.3
More than 5	21	4.4
Suffering from a chronic disease		
No	367	76.9
Yes	110	23.1

whereas 44.2% acknowledged previous awareness. When defining polypharmacy, 35% correctly identified it as taking more than five different medications simultaneously, though 26.4% admitted they did not know. Other interpretations included taking medications separately (16.1%), taking more than two medications together (15.9%), and taking medication more than 5 times daily (6.5%). Confidence in identifying harmful medications varied considerably – 34.4% were uncertain, 27% felt they probably could, and only 17.6% expressed confidence. Meanwhile, 13% were not confident, and 8% described themselves as less confident. Most participants (72.7%) had not witnessed kidney problems from polypharmacy, though 27.3% reported observing such effects. A slight majority (56.2%) claimed knowledge about drug interactions, whereas 43.8% did not. Personal experiences with side effects from multiple medications were uncommon, with 73.4% reporting none and 26.6% having experienced adverse effects [Table 2].

Participants identified various polypharmacy-related side effects. Gastrointestinal disturbances ranked highest, with diarrhea and constipation recognized by 46.1%, followed by dizziness (45.1%). Other commonly identified effects included vomiting (40%), headache (38.6%), and depression and anxiety (21.2%). Less frequently mentioned were weakness (15.5%), falls (13%), eczema (11.9%), coughing (10.9%), and stroke (6.5%). Regarding information sources, websites were most prevalent (55.1%), closely followed by doctors (53.7%). Social media served 28.9% of participants, whereas friends and family were consulted by 25.8%. Scholarly journals represented the least common source at just 4% [Table 3].

Overall knowledge assessment revealed that 61.2% demonstrated moderate knowledge, 29.6% showed poor knowledge, and only 9.2% achieved high knowledge scores [Table 4].

Table 5 shows that gender showed a statistically significant association with knowledge levels (P = 0.004). Female participants performed notably better, with 11.9% achieving high knowledge versus 4.9% of males. Moderate knowledge included 62.8% of women compared to 58.7% of men,

Table 2: Parameters related polypharmacy knowledge (n=477)

Parameter	No.	Percent
Have you heard of polypharmacy before?		
No	266	55.8
Yes	211	44.2
How would you define polypharmacy?		
Taking >5 different medications	167	35
I don't know	126	26.4
Taking medications separately	77	16.1
Taking >2 medications together	76	15.9
Taking medication >5 times/day	31	6.5
Confidence in identifying harmful medications		
Not sure	164	34.4
Probably	129	27
Confident	84	17.6
I am not confident	62	13
Less confident	38	8
Seen negative kidney effects from polypharmacy		
No	347	72.7
Yes	130	27.3
Knowledgeable about drug interactions		
Yes	268	56.2
No	209	43.8
Experienced side effects from multiple medications		
No	350	73.4
Yes	127	26.6

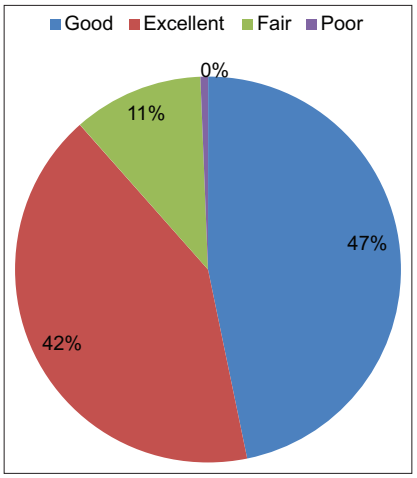

Figure 1: Self-rated health condition among participants

whereas poor knowledge was more prevalent among males (36.4%) than females (25.3%). However, no significant associations emerged between knowledge levels and age

Table 3: Multiple-choice questions regarding side effects and source of information about polypharmacy (*n*=477)

Parameter	No.	Cumulative percentage
Common side effects of polypharmacy		
Diarrhea and Constipation	220	46.1
Dizziness	215	45.1
Vomiting	191	40
Headache	184	38.6
Depression and Anxiety	101	21.2
Weakness	74	15.5
Falls	62	13
Eczema	57	11.9
Coughing	52	10.9
Stroke	31	6.5
Information sources about polypharmacy effects		
Web sites	263	55.1
By your doctor	256	53.7
Social media	138	28.9
Friends and family	123	25.8
Journals	19	4

Table 4: Knowledge score results among the participants.

Group	Frequency	Percent
Poor knowledge	141	29.6
Moderate knowledge	292	61.2
High knowledge	44	9.2
Total	477	100.0

($P = 0.347$), education ($P = 0.271$), chronic disease presence ($P = 0.911$), or self-rated health ($P = 0.323$), suggesting gender was the primary demographic factor influencing polypharmacy knowledge.

DISCUSSION

The present discussion interprets findings on adults' knowledge and awareness about the effect of polypharmacy on renal function in Saudi Arabia and situates them within contemporary evidence, followed by brief limitations of this cross-sectional study. The study's aim was to assess knowledge about the effect of polypharmacy on renal function among adults in Saudi Arabia, addressing a gap given the high national polypharmacy prevalence and renal risk concerns in aging populations.

In this sample of 477 participants, most respondents demonstrated moderate knowledge (61.2%), with only 9.2% achieving high knowledge and 29.6% showing poor knowledge, whereas 55.8% had not previously heard the term "polypharmacy," underscoring substantial conceptual gaps despite frequent medication exposure in the community. This knowledge pattern is concerning in light of national data from the Saudi National Survey for Elderly Health showing that polypharmacy affects approximately 51.5% of older adults and is linked to multimorbidity contexts wherein renal vulnerability is common, reinforcing the relevance of targeted public education on medication burden and kidney risk.[12] The relatively low proportion of high knowledge also contrasts with the proportion who felt knowledgeable about drug–drug interactions (56.2%), suggesting a narrower familiarity with specific risks (e.g., interactions) compared with the broader construct of polypharmacy and its renal implications. Given robust evidence that higher medication counts are associated with accelerated decline in eGFR and greater odds of kidney dysfunction, limited conceptual knowledge is likely to impede timely preventive behaviors such as deprescribing discussions and medication reviews.[7,10]

Several result details align with pathophysiological and pharmacoepidemiologic literature linking multi-drug exposure to kidney injury through cumulative nephrotoxin load, interaction-mediated toxicity, and reduced renal reserve with age and comorbidity.[7,13] The current finding that only 27.3% reported witnessing negative kidney effects from polypharmacy may reflect the often subclinical, progressive nature of renal decline, which is not readily visible to patients absent laboratory testing, despite consistent associations between increasing medication count and eGFR deterioration in outpatient cohorts. In cardiovascular outpatients, the number of prescribed drugs was the only independent factor associated with accelerated renal function deterioration, strengthening the plausibility that cumulative drug exposure contributes meaningfully to CKD progression beyond measured comorbidities.[10] Complementarily, a large nested case–control study in older adults showed that both polypharmacy (5–10 ingredients) and excessive polypharmacy (≥10 ingredients) increased the risk of kidney dysfunction, with adjusted odds ratios indicating a graded relationship between medication count and renal outcomes.[7]

The side effects most commonly recognized by participants, gastrointestinal disturbances (46.1%), dizziness (45.1%), vomiting (40.0%), and headache (38.6%), map closely to adverse drug event profiles repeatedly documented in older populations exposed to multiple medications, where dizziness and falls are canonical polypharmacy sequelae. This concordance suggests that while the umbrella concept of polypharmacy may be unfamiliar to many, lived experiences or observations of symptomatic adverse effects are more readily identifiable, potentially providing a practical entry point for educational messaging that links recognizable

Table 5: Relation between polypharmacy knowledge level and sociodemographic characteristics

Parameters	Polypharmacy knowledge level			Total (*n*=477)	*P* value
	High	Moderate	Low		
Gender					
Female	35	184	74	293	0.004
	11.90%	62.80%	25.30%	61.40%	
Male	9	108	67	184	
	4.90%	58.70%	36.40%	38.60%	
Age group					
18–24	9	54	27	90	0.347
	10.00%	60.00%	30.00%	18.90%	
25–34	8	73	37	118	
	6.80%	61.90%	31.40%	24.70%	
35–44	9	80	30	119	
	7.60%	67.20%	25.20%	24.90%	
45–54	16	58	36	110	
	14.50%	52.70%	32.70%	23.10%	
55+	2	27	11	40	
	5.00%	67.50%	27.50%	8.40%	
Education level					
Primary School	1	9	2	12	0.271
	8.30%	75.00%	16.70%	2.50%	
High School	12	52	39	103	
	11.70%	50.50%	37.90%	21.60%	
Bachelor's Degree	29	195	92	316	
	9.20%	61.70%	29.10%	66.20%	
postgraduate	1	20	5	26	
	3.80%	76.90%	19.20%	5.50%	
Primary school or uneducated	0	6	1	7	
	0.00%	85.70%	14.30%	1.50%	
Intermediate school	1	10	2	13	
	7.70%	76.90%	15.40%	2.70%	
Chronic disease					
No	35	224	108	367	0.911
	9.50%	61.00%	29.40%	76.90%	
Yes	9	68	33	110	
	8.20%	61.80%	30.00%	23.10%	
Self-rated health					
Good	26	134	63	223	0.323
	11.70%	60.10%	28.30%	46.80%	
Poor	1	1	1	3	
	33.30%	33.30%	33.30%	0.60%	
Fair	3	36	13	52	
	5.80%	69.20%	25.00%	10.90%	
Excellent	14	121	64	199	
	7.00%	60.80%	32.20%	41.70%	

symptoms to cumulative medication burden and renal safety. Notably, falls identified by 13.0% are consistently reported in polypharmacy literature and present a clinically salient outcome that can be leveraged to motivate deprescribing conversations alongside kidney risk communication. The observed gender difference that female participants were more likely to achieve high knowledge (11.9% vs. 4.9%; $P = 0.004$) is noteworthy and may be interpreted in the context of differential exposure to medications and health service engagement seen in Saudi datasets, where polypharmacy prevalence and patterns vary by demographic strata, and where community utilization characteristics can differ by gender and region. In the SNSEH analysis, gender was associated with polypharmacy in bivariable comparisons, and multiple determinants such as region, comorbidity burden (diabetes, hypertension, and pain), and depression were independently related to higher polypharmacy risk, which could increase opportunities for medication counseling and, by extension, knowledge acquisition unevenly across groups. The present study's lack of significant associations between knowledge and age, education, or chronic disease may therefore reflect the sampling frame, channel of recruitment, and the specific knowledge instrument rather than the absence of underlying structural determinants, underscoring the need for stratified educational outreach and pharmacist-led interventions that meet groups where medication exposure and risk concentrate.[12]

Importantly, multiple longitudinal analyses and syntheses reinforce that polypharmacy is not merely a correlate but is associated with clinically consequential kidney outcomes and mortality, particularly in older adults with existing CKD, which heightens the importance of public knowledge on renal risk. For instance, among elderly individuals with CKD, polypharmacy has been associated with increased all-cause and cardiovascular mortality, and prior cohorts report elevated risks of kidney failure with higher medication counts, reinforcing the clinical urgency for prevention, review, and deprescribing strategies when appropriate.[14,15] Against this backdrop, the current finding that over half of respondents reported knowledge about drug interactions (56.2%) is encouraging, yet confidence remained limited, with only 17.6% feeling confident identifying potentially harmful medications, suggesting that passive familiarity may not translate into actionable self-management behaviors without structured guidance from clinicians and pharmacists. Evidence indicates that deprescribing interventions can confer modest mortality reductions in older populations, supporting the integration of medication reconciliation, patient counseling, and shared decision-making into routine care to mitigate renal and systemic risks from multi-drug regimens.[14]

The study further found that websites (55.1%) and physicians (53.7%) were the predominant information sources about polypharmacy effects, which can be operationalized in interventions by combining clinician-delivered counseling with curated, accessible online materials that explain how cumulative medication burden affects kidney function and what symptoms or lab trends should prompt review.[12] Given that SNSEH data highlight the prominence of analgesics, non-steroidal anti-inflammatory drugs (NSAIDs), and cardiometabolic drugs among older Saudi adults, agents with known nephrotoxic potential or interaction risks, public-facing resources should emphasize safe NSAID use, interaction checks, adherence to monitoring, and early engagement in deprescribing conversations when risk outweighs benefit.[12,15] The alignment between participants' recognition of common ADRs and the documented adverse-event spectrum suggests that risk communication can be symptom-anchored while still educating about subclinical renal injury that necessitates periodic kidney function testing, especially in those using five or more medicines or with multiple chronic diseases.[12]

Overall, the study's core message that adult knowledge about polypharmacy's renal impact is predominantly moderate with sizable gaps in term recognition supports targeted educational programs that explicitly connect polypharmacy to kidney outcomes and empower patients to ask for medication reviews, particularly in higher-risk groups identified by national data (e.g., those with diabetes, hypertension, pain, urinary incontinence, or depressive symptoms).[12] Embedding pharmacist-led medication therapy management in community and primary care settings, coupled with clinician prompts to review nephrotoxic combinations and cumulative pill burden, represents an evidence-aligned approach to translate knowledge gains into kidney-protective practices.[12,14] Because kidney dysfunction related to polypharmacy may progress silently, educational materials should highlight the importance of eGFR monitoring and the potential for incremental declines with each additional medication, a relationship observed across cohorts and settings that underscores the cumulative nature of risk.[7,10]

Limitations include the cross-sectional design, which precludes causal inference between knowledge and behaviors or outcomes, and the reliance on self-reported awareness and experiences, which are subject to recall and social desirability biases. The sample was recruited online with heavy representation from the western region (75.1%) and a high proportion of university-educated respondents (66.2%), which may limit generalizability and could attenuate detectable associations between knowledge and sociodemographic characteristics observed in other settings. Finally, the knowledge instrument, while comprehensive, may not capture nuanced facets of renal risk literacy (e.g., specific nephrotoxic drug classes or interaction scenarios), suggesting value in future validation studies and mixed-methods work to refine constructs and inform tailored, population-level interventions.

CONCLUSION

This cross-sectional study found that most adults demonstrated moderate knowledge regarding the effect of polypharmacy

on renal function, but over half had never heard the term, and few felt confident identifying harmful medications. Female participants exhibited higher knowledge, whereas age, education, chronic disease, and self-rated health were not associated with knowledge levels. The pattern of recognized adverse effects and reliance on physicians and web sources highlights practical channels for interventions. Targeted education, pharmacist-led medication reviews, and routine prompts for eGFR monitoring and deprescribing in multi-drug users are recommended to mitigate renal risk and improve medication safety.

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ETHICAL APPROVAL

Informed consent was obtained from each participant after explaining the study in full and clarifying that participation was voluntary. Data collected were securely saved and used for research purposes only.

Informed consent

Written informed consent was obtained from all individual participants included in the study.

Data and materials availability

All data associated with this study are presented in the paper.

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