Knowledge, Associated Factors, and Adverse Outcomes of Polypharmacy Among Elderly Patients

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Abstract

Background: Polypharmacy, particularly in the elderly, is a formidable global public health problem that increases hospitalization, lowers quality of life, and represents an economic burden. **Aim of the study:** Assess knowledge, associated factors, and adverse outcomes of polypharmacy among elderly patients. **Subjects and Methods; Design:** A descriptive design was utilized. **Setting:** The study was carried out at Zagazig University Hospitals' outpatient clinics. **Subjects:** Purposive sample composed of 200 elderly patients. **Tools of data collection: Tool I:** A structured interview questionnaire. **Tool II**: Elderly's knowledge of polypharmacy interview questionnaire. **Tool III:** Associated factors of polypharmacy interview questionnaire. **Tool IV:** Polypharmacy Adverse outcomes interview questionnaire. **Results:** 92% of the studied elderly had poor score of knowledge regarding polypharmacy, 77.5% had high associated factors, and 63% had high adverse outcomes. **Conclusion:** A statistically significant negative correlation was found between polypharmacy knowledge and associated factors, and between knowledge and adverse outcomes. Conversely, there was a statistically significant positive correlation between polypharmacy associated factors and adverse outcomes. **Recommendation:** Designing educational programs to increase medication awareness and familiarity among older adults, to improve health outcomes with fewer prescriptions needed.

Key words: Adverse Outcomes, Associated Factors, Elderly Patients, Knowledge, Polypharmacy.

Introduction:

By 2030, one in six people will be 60 or older, increasing from 771 million in 2022 to 994 million. By 2050, this number will double to 1.6 billion [1]. According to central agency for public mobilization and statistics [CAPMAS], the elderly population in Egypt is 6.9 million, accounting for 6.7% of the total population [2].

Ageing affects body functions, including vision, hearing, swallowing, motor, and cognitive abilities, affecting drug intake and administration. In older adults, accurate dosing and medication response monitoring are critical [3]. Chronic diseases in elderly patients increase with age, leading to increased drug use due to multiple disorders and long-term use of most drugs [4].

Polypharmacy refers to a patient's concurrent usage of multiple medications. Polypharmacy can be either appropriate or inappropriate. Minimal polypharmacy is defined as using two to four medications concurrently; major polypharmacy is defined as using five or more medications; excessive polypharmacy, or hyper polypharmacy, is defined as using ten or more medications in a day [5].

Polypharmacy is widespread in older people; in the USA, it ranges from 45 to 65%, and in some

populations globally, it can reach up to 90% [6]. Numerous researches have evaluated the frequency of polypharmacy in the older population. In developed countries, the percentage varied from 39 to 45%. Egyptian study appraised it to be 56% in rural communities [7].

Many health-related conditions, including obesity, frailty, cognitive decline, chronic pain, poor physical and mental health, depression, diabetes, and coronary heart disease can influence polypharmacy. Individual behaviors that contribute to polypharmacy include physical inactivity, smoking, and alcohol consumption [8].

The senior population's death rate, frequency of hospitalizations, duration of stay, incidence of falls, risk of geriatric syndrome, and rate of readmission are all increase as a result of polypharmacy [9].

A patient's well-being may be impacted by polypharmacy. In comparison to individuals who used medications less frequently, those who used medications more frequently experienced higher levels of psychological discomfort and a worse quality of life related to their health [10].

Polypharmacy becomes a concern when patients are administered an excessive number of medications by multiple healthcare practitioners who work independently. Furthermore, it is simple to get medications from pharmacies without a prescription [11].

Gernotological nurses must be able to form opportune relationships with their patients in order to explore concerns. Gernotological nurses play a pivotal role in ensuring patients' safety and well-being. Through educational interventions, gernotological nurses can reduce the risk of adverse responses and non-compliance by educating and motivating patients to promote compliance [12].

Gerontological nurses are accountable for making sure that prescriptions are prepared and administered correctly. In addition to observing indications and medication effects for prohibiting medication related problems. They are also aware of the risks associated with polypharmacy. Gerontological nurses assist in identifying patients who may be at risk for inappropriate polypharmacy and to inform patients and families about the risk of polypharmacy [13].

Significance of the study:
Adverse drug-related side effects in the elderly are increased by polypharmacy. Firstly, increased number of medications can lead to increased risk of deleterious drug-drug interactions; Secondly, physiological changes related to aging include weight loss, reduced cardiac output, and impairment of liver and renal excretion [14]. Additionally, patients and their families are tremendously burdened with understanding the purpose of many prescriptions written by different healthcare providers, remembering to take each drug at the appropriate time of day, and being aware of potential side effects due to polypharmacy.

Aim of the study:
Assess knowledge, associated factors, and adverse outcomes of polypharmacy among elderly patients.

Research Questions:
- What is the level of knowledge of polypharmacy among elderly patients?

- What are the factors associated with polypharmacy among elderly patients?

- What are the adverse outcomes of polypharmacy among elderly patients?

Subjects and Method:

Design:
A descriptive design was used.

Study setting:

The study was conducted at the outpatient clinics at Zagazig University Hospitals (cardiac clinic, internal medicine clinic, orthopedic clinic, and chest clinic).

Study subjects:

A purposive sample of 200 elderly patients from the aforementioned setting who met the following criteria: age: 60 years and older, capable of communicating, willing to engage in the study, and elderly patients receiving ≥2 medications.

Sampling Technique:

A Purposive Sampling Technique was used in the recruitment of this study subjects from the above mentioned setting and who fulfilled the study inclusion criteria.

Sample size calculation:

The software epi-info package was used to calculate the sample size, presuming that 71.0% of elderly patients have polypharmacy [15], from 690 elderly patients come to outpatient clinics through 6 months, 95% confidence level, 5% error margin, and 80% test power. The sample size calculated was 200 elderly patients.

Tools for data collection:

The study data were collected using three tools:

Tool 1: A structured interview questionnaire which consisted of four parts:
- **Part (1):** Demographic characteristics of the studied elderly patients and includes: (Age, sex, level of education, marital status, residence … etc.).

- **Part (2):** Medical history of the studied elderly. It included questions regarding having chronic diseases and types of chronic diseases. In addition to smoking habit and measuring of weight and height.

- **Part (3):** Medication history of the studied elderly. It involved questions about: Number of medications taken on a regular basis, number of medications taken on irregular basis, most common types of medications taken, and do you take all medications prescribed.

- **Part (4):** Elderly's knowledge of polypharmacy interview questionnaire: It developed by the researcher and guided by **Shawkey et al.** [16] and **Aboudonya et al.** [14]. It was used to assess elderly patient's knowledge regarding polypharmacy. It consisted of questions related to definition of polypharmacy, medications that fall under polypharmacy, people more susceptible to polypharmacy, purpose, age-related changes in pharmacokinetics and pharmacodynamics, strategies to reduce polypharmacy …. etc.

Scoring system:

The total number of questions was 14, and each question had numerous correct responses ranging from one to five. Each correct answer was assigned one grade, with a total grade for all questions ranging from one to five and zero for incorrect answers or doesn't know. The knowledge score is calculated based on the number of grades achieved by participants for all questions. Out of a possible score of 34, the knowledge was categorized as good if the percent score was 75% or more (≥26), average if the percent score from 50% to less than 75% (17-25), and poor if the percent score less than 50%(<17).

Tool II: Associated factors of polypharmacy interview questionnaire:

This questionnaire was developed by the researcher and guided by **Valenza et al.** [17]. It was used to assess associated factors of polypharmacy among elderly patients. It consisted of three domains which

include, elderly patient related factors (eight items), physicians related factors (seven items), and system level related factors (three items).

Scoring system:

Items were scored as two for yes, one for no, and zero for not sure. There are three domains in this questionnaire. For each domain, the item scores were added together and the total divided by the number of items, yielding the domain's mean score. These scores were then converted to percentages. The total grade was (36) grades and the elderly patients were considered to have high level of associated factors of polypharmacy if the percent score was 60% or more (≥22 point) and low if less than 60% (<22 point).

Tool III: Polypharmacy Adverse outcomes interview questionnaire:

This questionnaire was developed by the researcher and guided by **Mpharm et al.** [18], **Eltaher and Araby** [7], and **Rickert et al.** [19]. It was used to evaluate adverse outcomes of polypharmacy among elderly patients. It included seven sections such as digestive system (seven items), cardiovascular system (five items), nervous system (five items), kidney and urinary system (four items), respiratory system (two items), cognitive impairment (three items), and other adverse effects (six items).

Scoring system:

Items were assessed on a three-point Likert scale, with scores of "2" often, "1" sometimes, and "0" never. This questionnaire is divided into seven domains. A domain's mean score was obtained by adding up all of the item scores for each domain and dividing the result by the total number of items. The percentage scores for these scores were computed. The total grade was (64) grades and the elderly patients were considered to have high level of adverse outcomes of polypharmacy if the percent score was 60% or more (≥38 point) and low if less than 60% (<38 point).

Content validity and reliability:

Three experts in the field of (community health nursing, Faculty of Nursing, Ain shams University, community health nursing, Faculty of Nursing, Zagazig University, and endemic diseases, Faculty of Medicine, Zagazig University) revised the tools. The panel evaluated the tools' content for clarity, relevance, understandability, and comprehensiveness. All suggested adjustments were made.

Cronbach's alpha test was utilized to evaluate the items of the tools for reliability, its results was 0.743 for elderly knowledge regarding polypharmacy, 0.763 for associated factors, and 0.841 for adverse outcomes which indicate an accepted reliability of the tool.

Field work:

The researcher began to arrange a schedule for gathering the data, once the permission was permitted to progress in the study. To be familiar with time of work, work process, and note elderly visiting the study settings to establish a schedule for data collection, the researcher visited study setting. The researcher used to visit the study area to interview the elderly who met the requirements and present herself to the patients. The study's goal was conveyed to each elderly person individually before they were asked to participate. Each patient answered the research tool questions individually. Answering the interview questionnaire took between 20 and 30 minutes. Six months were allotted for the fieldwork, which started at the beginning of May 2023 up to the end of October 2023); two days per week (Saturday and Thursday) from 9.00 am to 12.00 pm.

Pilot study:

A pilot study was carried out on a sample of 20 elderly patients (10% of the computed sample). They were randomly chosen from outpatient clinics at Zagazig University Hospitals (cardiac clinic, internal medicine clinic, orthopedic clinic, and chest clinic).

The pilot study was designed to examine the study tool's feasibility, clarity, and applicability, as well as to determine the time required to complete the questionnaire sheet. All participants were clearly informed about the study's goal. Because the data gathering tools changed after the pilot study, the pilot elderly patients were excluded later from the main study population.

Administrative and Ethical considerations:

The administrative design was implemented by submitting a formal letter from the post-graduate department at Faculty of Nursing, Zagazig University to the director of Zagazig University Hospitals outlining the purpose of the study to request permission and collaboration to perform the study.

Firstly, the research ethics committee (Rec) of the Faculty of Nursing at Zagazig University authorized the study proposal. The older patients were then given a verbal description of the study's objectives, in addition to the ability to withdraw from the study at any time without justification. In addition, after a thorough explanation of the study's purpose, each elderly patient verbally gave their informed consent to participate. The older patients were informed that participation in this study was entirely voluntary. They were also told that any information obtained from them would be kept confidential and applied exclusively for research.

Statistical analysis:

All data were gathered, tabulated, and analyzed statistically with SPSS 20.0 for Windows (SPSS Inc., Chicago, IL, USA 2011). The quantitative results were reported as the mean ± SD. Qualitative data were reported as absolute frequencies (numbers) and relative frequencies (percentages). When applicable, the percentage of categorical variables was compared using the Chi-square test or Fisher's exact test. The Spearman correlation coefficient was used to analyze the relationship between research variables; sign (+) indicates direct correlation and sign (-) indicates negative correlation. Predictors of total scores of knowledge, associated factors, and adverse outcomes were assessed by best fitting multiple linear regression. The Cronbach alpha coefficient was calculated to evaluate the scales' reliability based on their internal consistency. P-value < 0.05 was regarded statistically significant, p-value < 0.001 was considered highly statistically significant, and p-value ≥ 0.05 was considered statistically non-significant.

Results:

Table (1): Represents demographic characteristics of the elderly patients. It was revealed that the studied elderly patients age ranged between 60 and 75 years, with mean 66.29 ±3.904 and 85% of them were aged between 60 and 69 years, with more males (60.5%). In addition, 59% of the studied elderly patients were married, rural residents (86%), and live with their families (91.5%). In addition, 32.5 % of studied elderly don't read or write. All of them are not working. Concerning income, their income was sufficient (78%). Pension was the current source of income in 89% of them.

Table (2): Displays that 48.5% and 40.5% of the studied elderly take four and three medications on a regular basis respectively. While, 55.5% and 33% of them take two and one medications on irregular basis respectively. The table also reveals that, the most commonly medications used were blood pressure lowering medications (97.5%) followed by blood sugar lowering medications (67.5%) and cholesterol and triglyceride lowering medications (66.5%). As well, 59 % of the studied elderly take all medications prescribed, compared to 41% take medications without a prescription from them, 51.2% and 48.8% take one and two medications without a prescription respectively.

Figure (1): Represents that 92% of the studied elderly patients had poor scores of knowledge regarding polypharmacy compared to 5.5% and 2.5% had average and good scores respectively with mean 11.34± 4.18.

Figure (2): Illustrates that 77.5% of the studied elderly patients had high of polypharmacy associated factors scores compared to 22.5% had low scores.

Figure (3): Shows that 63% of the studied elderly patients had high scores of polypharmacy adverse outcomes compared to 37% had low scores.

Table (3): Indicates a statistically significant negative correlation between polypharmacy knowledge and associated factors, and between knowledge and adverse outcomes (p<0.001). Whereas a statistically significant positive correlation was found between polypharmacy adverse outcomes and associated factors.

Table (4): Indicates that that advanced age, being married, and high educational level had statistically positive correlation with elderly's score of knowledge. While, score of associated factors was significantly negatively correlated with rural residence and positively with living with family. Furthermore, score of adverse outcomes was significantly positively correlated with advanced age.

Discussion:

Globally, polypharmacy is becoming a serious and expanding concern to public health. Increasing multi-morbidity in the aging population world widely contributes to the high rate of polypharmacy [20].

Polypharmacy is linked to a wide range of adverse health outcomes, resulting in large expenses for both the patient and the healthcare system, with the risk and harm severity growing with the number of medications. Nonetheless, polypharmacy may be unavoidable in most chronic illness patients. In this regard, various factors have been discovered to influence polypharmacy. [21].

The present study showed that most of the studied elderly patients aged from 60 to 75 years old with mean age 66.29 ±3.904 and three fifths of them were male. This might be related to this age group was the targeted population for this study and might reflect a demographic trend or an increasing population within this age range. This result was supported by **Mugada et al.** [22] who conducted a study in India and reported that the mean age of elderly patients was 65.90±5.48 years and more than half of them were males. In addition, the current study revealed that more than half of the studied elderly were married and most of them were rural residents. This result is in a harmony with a study carried out by **Priya et al.** [23] in India and reported that the 64% of the studied elderly were rural residents.

Moreover, the present study demonstrated that, less than half of the studied elderly had low level of education and most of them lived with their families. This could be owing to their advanced ages; in the past, most individuals did not worry about their children's educational levels, particularly in agricultural environments such as study sittings. Moreover, population's social dynamics and support systems may also be connected to the fact that the majority of older people live with their relatives.

In the same line, **Aljawadi et al.** [24] who conducted a study in Saudi Arabia reported that the 42.6% of the studied older adults were illiterate and 85.2% of them live with their family. These findings were partially congruent with **Eltaher and Araby** [7] in Egypt whose study stated that 79.8% of the studied elderly live with their family.

Related to medication history of the elderly, the present study declared that slightly more than two fifths of them took three medications on a regular basis and nearly half of them took four medications on a regular basis. This may be related to the higher incidence of chronic health conditions among elderly. This finding was matched with **Sheikh-Taha and Asmar** [25] who conducted a study in Lebanon and found that 43% of the studied elderly took four medications per day.

Moreover, the current study displayed that about one third of the studied elderly took one medication on irregular basis and more than half of them took two medications on irregular basis. This could be attributed to that medication may be recommended not just for therapeutic objectives but also to enhance quality of life and control aging-related symptoms. This can involve taking vitamins, painkillers, or sleep aids. In the same concern, this result is consistent with a study carried out by **Assefa et al.** [26] in Ethiopia, found that 52.6% of the studied elderly used 2 medications irregularly.

Additionally, the present study reflected that the majority of medications that used by the studied elderly were blood pressure lowering medications followed by blood sugar lowering medications, then cholesterol and triglyceride lowering medications. This might be related to the study result that showed that most chronic diseases in the studied elderly were hypertension, diabetes, and heart diseases. This result is compatible with **Mugada et al.** [22] in India whose study mentioned that the most frequently prescribed drugs were blood pressure and blood sugar drugs 67.8%. In the same respect, a study conducted in Iraq by **Abdulkader et al.** [27] stated that hypertension and hyperlipidemia drugs were the two most common drugs (82.6%) that used by elderly.

As well, the present study revealed that more than half of the studied elderly took all medications prescribed, compared to slightly more than two fifths of them took medications without a prescription. This might be due to numerous factors affecting patterns of medication adherence among the studied elderly. The belief that taking prescribed drugs is essential to controlling one's health conditions is a reasonable explanation. Besides, supervision and guidance of the health care providers. In agreement with this study result, a study performed by **Gupta et al.** [28] in India stated that 60.3% of the studied elderly used the prescribed medications. Also, a study carried out by **Priya et al.** [23] in India reported that 54.6% of the studied elderly used their drugs as prescribed by the physician.

Concerning elderly's knowledge of polypharmacy among the studied elderly, the current study represented that most of the studied elderly had poor score of knowledge compared to minority of them had average and good scores respectively with mean 11.34±4.18. This might be related to the low educational level of the majority of the studied elderly as well as their cognitive abilities, which may be influenced by aging and having difficulties with reading, remembering, and comprehending instructions, beside poor understanding of the information given by health care professionals. In addition to limited medical services in rural areas.

This result was congruent with a study carried out by **Didone et al.** [29] in Brazil, who stated that 58% of the studied participants had inadequate knowledge regarding polypharmacy. Also, a study carried out by **Ali et al.** [30] in Ireland found that 61.7% of the studied elderly patients had poor knowledge about polypharmacy.

Pertaining associated factors of polypharmacy, the current study revealed that more than three quarters of the studied elderly had high score of associated factors compared to less than one quarter of them had low score. This could be because people

commonly develop several chronic diseases as they get older, which necessitates continuous care and the prescription of numerous medications. In order to treat the symptoms or side effects of existing diseases, health care providers may also recommend additional medications. Moreover, poor coordination and communication between health care providers.

This result agreed with a study conducted by **Ishizaki et al.** [31] in Tokyo reported that 58.7% of the studied elderly had high level of polypharmacy associated factors. Likewise, **Delara et al.** [32] in Canada affirmed that 52% of the studied participants had high risk related factors of polypharmacy.

Pertaining polypharmacy adverse outcomes, the current study clarified that more than three fifths of the studied elderly had high score of polypharmacy adverse outcomes compared to more than one third of them had low score. This might be due to the variety and complexity of medications that are prescribed to the elderly. Negative consequences are more likely when there are more prescriptions used, particularly when there are interactions between the treatments or when their side effects worsen one another.

Similarly, this result agreed with a study performed by **Toh et al.** [33] in Singapore, stated that 54.2% of older adults with polypharmacy had increased risks of mortality, were more probably to have adverse consequences, and necessitated further assistance in contrast to individuals without polypharmacy. Also, a study carried out by **Davies et al.** [34] in United Kingdom, reported that the 48.5% of the studied older adults had high level of subsequent adverse health outcomes related to polypharmacy.

Pertaining to correlation between total scores of knowledge, associated factors, and adverse outcomes, the current study highlighted that there was a statistically significant negative correlation between polypharmacy knowledge and associated factors, and between knowledge and adverse outcomes. This could be interpreted as the lower knowledge, the higher associated factors, the higher adverse outcomes. Whereas a statistically significant positive correlation was found between associated factors and adverse outcomes. This could be interpreted as the higher associated factors score the higher adverse outcomes score.

In the same respect, these findings were in harmony with a study carried out by **Ali et al.** [30] in Ireland indicated that there was a significant negative correlation between elderly patient's knowledge of their regular medications and its adverse outcomes and associated factors and they clarified that with higher levels of knowledge are less likely to experience associated factors and adverse effects. Consistently, this result in agreement with **Davies et al.** [34] in United Kingdom who carried out a study mentioned that, as older adults' understanding of polypharmacy increases, the probability of experiencing adverse outcomes tends to decrease. Also, this result was supported by **Delara et al.** [32] in Canada whose study declared that presence of higher factors associated with polypharmacy contributed to a higher likelihood of experiencing adverse outcomes.

Pertaining correlation between elderly polypharmacy knowledge, associated factors, and adverse outcomes and their characteristics, the current study revealed that age and educational level had statistically positive correlation with elderly's score of knowledge. While, score of associated factors was significantly negatively correlated with residence. Furthermore, score of adverse outcomes was significantly positively correlated with age.

This result is in accordance with a study carried out by **Shawkey et al.** [16]

in Egypt stated that knowledge about Polypharmacy was positively significantly correlated with age and educational level. This result is in a harmony with a study carried out by **Priya et al.** [23] in India reported that residence was significantly negatively correlated with polypharmacy associated factors. In the same line, a study performed by **Mohamed et al.** [35] in United States declared that there was significant positive correlation between adverse outcomes of polypharmacy and the elderly age.

Conclusion:

The current study findings indicated generally poor knowledge regarding polypharmacy, with high scores of polypharmacy associated factors, and high scores adverse outcomes among the studied elderly. There was a statistically significant negative correlation between polypharmacy knowledge and associated factors, and between knowledge and adverse outcomes. Conversely, there was a statistically significant positive correlation between polypharmacy associated factors and adverse outcomes.

Recommendations:

- Designing educational programs to increase medication awareness and familiarity among older adults, to improve health outcomes with fewer prescriptions needed.

- To have a more comprehensive understanding of polypharmacy among the elderly, future studies on larger samples from various geographical regions are recommended.

Table (1): Demographic characteristics of the elderly patients (n=200)

Demographic characteristics	No.	%
Age		
60- 69	170	85.0
70- 75	30	15.0
Mean ± SD	66.29 ±3.904	
Range	(60-75)	
Gender		
Male	121	60.5
Female	79	39.5
Marital status		
Married	118	59.0
Widower	82	41.0
Educational levels		
Not read or write	65	32.5
Read and write	31	15.5
Basic education	45	22.5
Secondary education	54	27.0
University education	5	2.5
Current occupation		
Not work	200	100.0
Residence		
Rural	172	86.0
Urban	28	14.0
Living with whom		
Family	183	91.5
Alone	17	8.5
The monthly income of the elderly		
Insufficient	31	15.5
Sufficient	156	78.0
Sufficient and saving	13	6.5
Current source of income		
Pension	178	89.0
Children help	17	8.5
Ministry of Solidarity and Social Justice	5	2.5

Table (2): Medication history of the elderly (n=200)

Items	No.	%
Number of medications taken on a regular basis		
Two	7	3.5
Three	81	40.5
Four	97	48.5
Five or more	15	7.5
Number of medications taken on irregular basis		
One	66	33.0
Two	111	55.5
Three	23	11.5
The most common types of medications taken[@]		
Blood pressure lowering medications	195	97.5
Blood sugar lowering medications	135	67.5
Cholesterol and triglyceride lowering medications	133	66.5
Chest allergy medications	34	17.0
Acidity medications	124	62.0
Painkillers	106	53.0
Anti-inflammatory	70	35.0
Vitamins and nutritional supplement	70	35.0

@ Responses are not mutually exclusive

Total score of elderly's knowledge of polypharmacy

2.50% 5.50%

92%

- Good
- Moderate
- Poor

Mean±SD=
11.34± 4.18

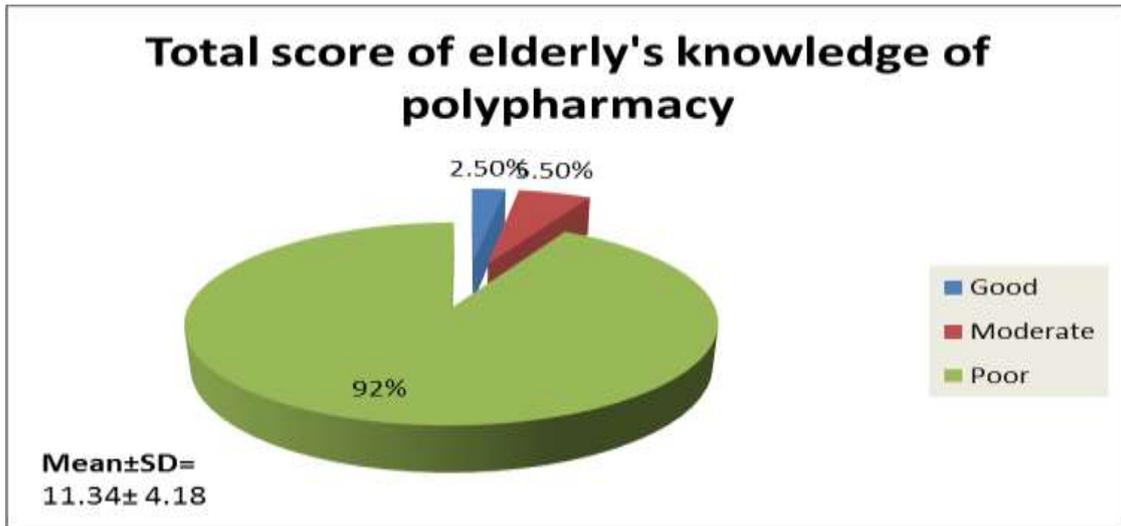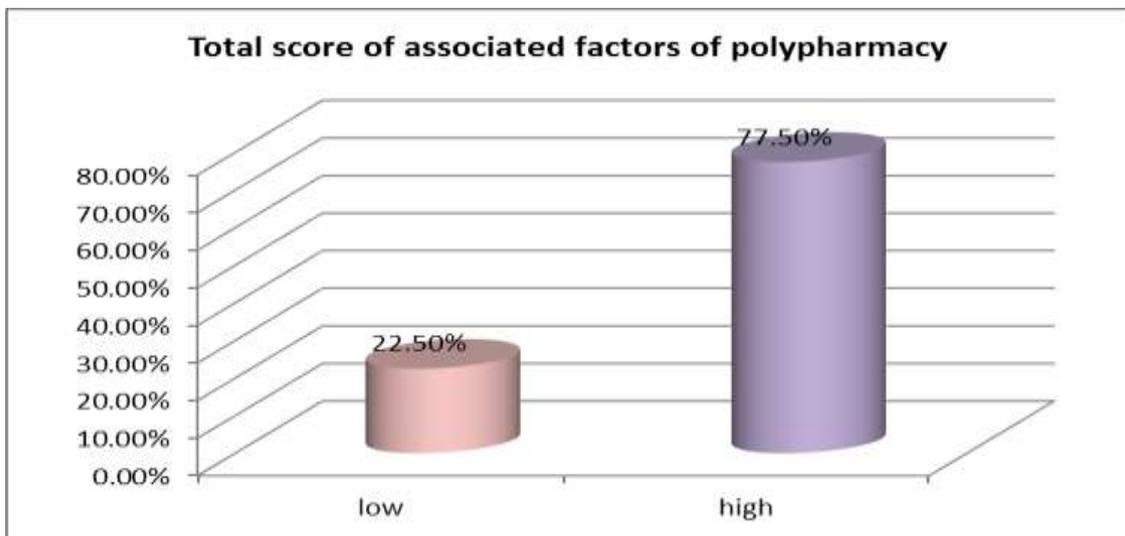**Figure (1): Total score of elderly's knowledge of polypharmacy (n=200)**

Total score of associated factors of polypharmacy

77.50%

22.50%

low   high

Figure (2): Total score of associated factors of polypharmacy (n=200)

Total score of Polypharmacy Adverse outcomes
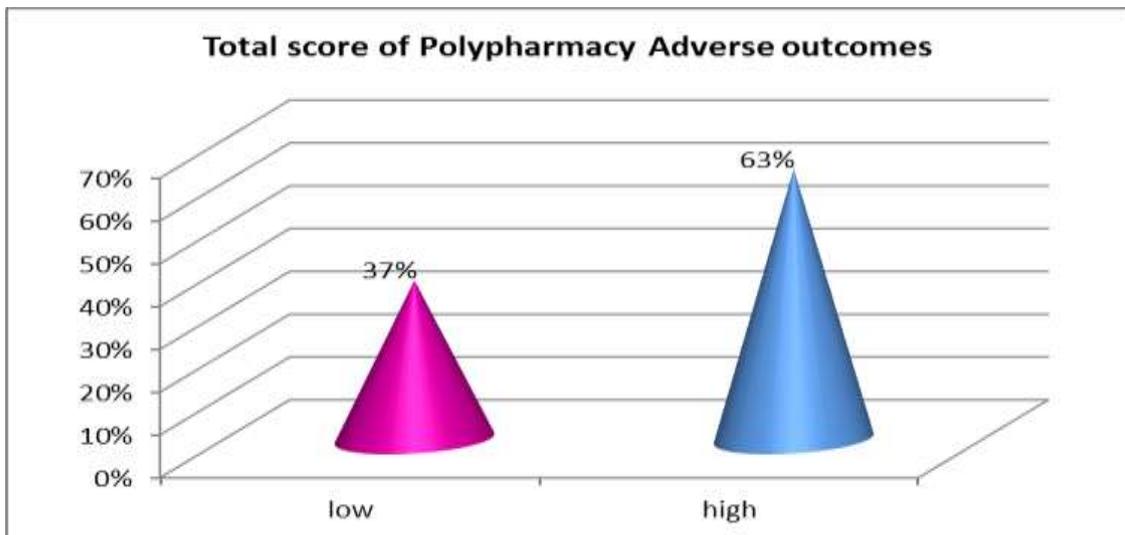
63%

37%

low   high

Figure (3): Total score of polypharmacy adverse outcomes (n=200)

Table (3): Correlation between total scores of knowledge, associated factors, and adverse outcomes

Items	Knowledge		Associated factors	
	r	P	r	P
Knowledge				
Associated factors	-0.149	0 .035*		
Adverse outcomes	-0.212	0 .003**	0 .331	0.001**

*: significant (p<0.05), **: statistically highly significant (p<0.001), r: correlation coefficient

Table (4): Correlation between elderly's polypharmacy knowledge, associated factors, and adverse outcomes and their characteristics

Items	Knowledge		Associated factors		Adverse outcomes	
	r	P	r	P	R	P
Age	0.176	0.013*	-.111	0.117	0.215	0.001**
Gender	0.089	0.211	0.043	0.541	-0.037	0.598
Marital status (married)	0.231	0.001**	0.011	0.878	-0.098	0.167
Educational levels (high)	0.430	0.001**	0.049	0.490	0.083	0.242
Residence (rural)	0.112	0.115	-0.542	0.001**	-.019	0.788
Living with whom (Family)	0.084	0.235	0.164	0.020*	0.085	0.231
Monthly income	0.137	0.054	0.079	0.264	0.127	0.073
Current source of income	0.091	0.198	-0.027	0.703	0.127	0.074

*: significant (p<0.05), **: statistically highly significant (p<0.001), r: correlation coefficient

References

1. United Nations [UN]: On the occasion of the International Day of older persons 6.6% percentage of elderly person of total population. [Online]. 2022 [Cited 2023 September 28]; Retrieved from https://www.capmas.gov.eg/Admin/News/PressRelease/2022929134228_333.pdf.

2. Central Agency for Public Mobilization and Statistics [CAPMAS]: Total population of Egypt as of 2022, by age group. [Online]. 2022 [Cited 2023 October 12]; Retrieved from https://knoema.com/atlas/Egypt/Population-aged-65-years-and-above.

3. Hailu, B.Y., Berhe, D.F., Gudina, E.K., Gidey, K., and Getachew, M. Drug related problems in admitted geriatric patients: the impact of clinical pharmacist interventions. *BMC Geriatrics Journal*. 2020; 13(20): 1-8.

4. Adan, M., Gillies, C., Tyrer, F., and Khunti, K. The multimorbidity epidemic: challenges for real-world research. *Primary health care research & development Journal*. 2020; 21(6):1-12.

5. Hughes, C. Appropriate and inappropriate Polypharmacy-Choosing the right strategy. *British journal of clinical pharmacology*. 2021; 87(1): 84-86.

6. Nguyen, K., Subramanya, V., and Kulshreshtha, A. Risk Factors Associated with Polypharmacy and Potentially Inappropriate Medication Use in Ambulatory Care Among the Elderly in the United States: A Cross-Sectional Study. *Drugs-Real World Outcomes Journal*. 2023; 10(4): 357-362.

7. Eltaher, S.M., and Araby, E.M. Prevalence and Factors Associated with Polypharmacy among Elderly Persons. *The Egyptian Journal of Community Medicine*. 2019; 37(3): 55-61.

8. Castilho, E.C.D., Reis, A.M.M., Borges, T.L., Siqueira, L.D.C., and Miasso, A.I. Potential drug-drug interactions and polypharmacy in institutionalized elderly patients in a public hospital in Brazil. *Journal of Psychiatric and Mental Health Nursing*. 2018; 25(1): 3-13.

9. Park, H.Y., Park, J.W., Song, H.J., Sohn, H.S., and Kwon, J.W. The Association between Polypharmacy and Dementia: A Nested Case-Control Study Based on a 12-Year Longitudinal Cohort Database in South Korea. *Journal of international oral health.* 2017; 12(1): 223-240.

10. Schenker, Y., Park, S.Y., Jeong, K., Pruskowski, J., Kavalieratos, D., Resick, J. et al. Associations Between Polypharmacy, Symptom Burden, and Quality of Life in Patients with Advanced, Life-Limiting Illness. *Journal of general internal medicine*. 2019; 34(4): 559-566.

11. Dahal, R., and Bista, S. Strategies to Reduce Polypharmacy in the Elderly. PubMed Central Journal; (2023). 19(1):131-137.

12. Walker, P. Bedside Nurses' Perception of Their Role Managing Elderly Patient's Polypharmacy. Published PHD thesis, Walden University, Minnesota. 2020. P.20.

13. Kim, J., and Parish, A. Polypharmacy and medication management in older adults. *Nursing Clinics of North America Journal*. 2021; 52(11): 457-468.

14. Aboudonya, M.E., Badr Elden, S.A., Hassan, H.E., and Hafez, S. Knowledge and Practices Used by Old Age Patients to Control Polypharmacy. *NILES Journal for Geriatric and Gerontology*. 2022; 5(1): 80-91.

15. Sidamo, T., Deboch, A., Abdi, M., Debebe, F., Dayib, K., and Balcha Balla, T. Assessment of Polypharmacy, Drug Use Patterns, and Associated Factors at the Edna Adan University Hospital, Hargeisa, Somaliland. *Journal of tropical medicine.* 2022; 2858987. https://doi.org/10.1155/2022/2858987

16. Shawkey, H.A., Ali, S.M., and Abd Elhameed, S.H. Assessment of Older Adults' Knowledge and Attitudes towards Polypharmacy. *Mansoura Nursing Journal*. 2022; 9(2): 37-51.

17. Valenza, P.L., McGinley, T.C., Feldman, J., Patel, P., Cornejo, K., and Liang, N. Dangers of Polypharmacy. *Journal of the American Geriatrics Society*. 2017; 63(2):397-399.

18. MPharm, L.E.D., Spiers, G., Kingston, A., Todd, A., Adamson, J., and Hanratty, B. Adverse Outcomes of Polypharmacy in Older People: Systematic Review. *Journal of evaluation in clinical practice*. 2020; 21(11): 181-187.

19. Rickert, A., Trampisch, U.S., Mielke, K.R., Drewelow, E., and Makinen, J. Polypharmacy in older adult patients with chronic diseases. *International journal of clinical pharmacy*. 2018; 19(113): 2-9.

20. Okpechi, I.G., Tinwala, M.M., Muneer, S., Zaidi, D., Ye, F., Hamonic, L.N., and Bello, A.K. Prevalence of polypharmacy and associated adverse health outcomes in adult patients with chronic kidney disease: protocol for a systematic review and meta-analysis. *Systematic reviews*. 2021; 10(1): 1-7.

21. Khezrian, M., McNeil, C.J., Murray, A.D., and Myint, P.K. An overview of prevalence, determinants and health outcomes of polypharmacy. *Therapeutic advances in drug safety*. 2020; 11(1):109-117.

22. Mugada, V., Bhagavathi, K.C., Sagina, P., Karnataka, K., Ravada, S., and Kancharapu, R.M. Potentially inappropriate medications, drug-drug interactions, and prescribing practices in elderly patients: a cross-sectional study. *Revista da*

Associacao Medica Brasileira (1992). 2021; 67(6): 800-805. https://doi.org/10.1590/1806-9282.20200912

23. Priya, S., Gupta, N.L., and Chauhan, H.S. Polypharmacy-Prevalence and risk factors among elderly patients in government medical college, Tanda, Distt Kangra (HP). 2019; 43-52. Retrieved from: https://www.researchgate.net/publication/359496413_POLYPHARMACY_-PREVALENCE_AND_RISK_FACTORS_AMONG_ELDERLY_PATIENTS_IN_GOVERNMENT_MEDICAL_COLLEGE_TANDA_DISTT_KANGRA_HP

24. Aljawadi, M.H., Khoja, A.T., Alaboud, N.M., AlEnazi, M.E., Al-Shammari, S.A., Khoja, T.A. et al. Prevalence of Polypharmacy and Factors Associated with it Among Saudi Older Adults–Results from the Saudi National Survey for Elderly Health (SNSEH). *Saudi Pharmaceutical Journal*. 2022; 30(3): 230-236.

25. Sheikh-Taha, M., and Asmar, M. Polypharmacy and severe potential drug-drug interactions among older adults with cardiovascular disease in the United States. *BMC geriatrics Journal*. 2021; 21(4): 1-6.

26. Assefa, Y.A., Kedir, A., and Kahaliw, W. Survey on polypharmacy and drug-drug interactions among elderly people with cardiovascular diseases at Yekatit 12 Hospital, Addis Ababa, Ethiopia. Integrated Pharmacy *Research and Practice Journal*. 2020; 9(3): 1-9.

27. Abdulkader, M.A., Ali, A.N., Yousif, S.A., Hussein, S.M., and Salih, F.L. Prevalence and risk factors of polypharmacy among elderly patients. *Research Journal of Pharmacy and Technology*. 2023; 16(6): 2627-2630.

28. Gupta, R., Malhotra, A., and Malhotra, P. A study on polypharmacy among elderly medicine in-patients of a tertiary care teaching hospital of North India. *National Journal of Physiology, Pharmacy and Pharmacology*. 2018; 8(9): 1297-1301.

29. Didone, T.V.N., Melo, D.O.D., Lopes, L.D.C., and Ribeiro, E. Inadequate knowledge of prescription drugs and their predictors in very old patients and their caregivers. *Revista Brasileira de Geriatria e Gerontologia*. 2021; 23(2): 77-82.

30. Ali, O., Mati, A., O'Reilly, A., Killeen, E., Stenson, C., Smith, W. et al. Patient knowledge about prescribed medication in older adults. *Irish Medical Journal*. 2023; 116(8):831-836.

31. Ishizaki, T., Mitsutake, S., Hamada, S., Teramoto, C., Shimizu, S., Akishita, M., and Ito, H. Drug prescription patterns and factors associated with polypharmacy in> 1 million older adults in Tokyo. *Geriatrics & Gerontology International Journal*. 2020; 20(4): 304-311.

32. Delara, M., Murray, L., Jafari, B., Bahji, A., Goodarzi, Z., Kirkham, J. et al. Prevalence and factors associated with polypharmacy: a systematic review and meta-analysis. *BMC geriatrics Journal*. 2022; 22(1): 601.

33. Toh, J.J.Y., Zhang, H., Soh, Y.Y., Zhang, Z., and Wu, X.V. Prevalence and health outcomes of polypharmacy and hyper polypharmacy in older adults with frailty: A systematic review and meta-analysis. *Ageing Research Reviews Journal*. 2023; 83(9): 12-26.

34. Davies, L. E., Spiers, G., Kingston, A., Todd, A., Adamson, J., and Hanratty, B. Adverse outcomes of polypharmacy in older people: systematic review of reviews. *Journal of the American Medical Directors Association*. 2020; 21(2): 181-187.

35. Mohamed, M.R., Mohile, S.G., Juba, K.M., Awad, H., Wells, M., Loh, K.P. et al. Association of polypharmacy and potential drug- drug interactions with adverse treatment outcomes in older adults with advanced cancer. *American Cancer Society Journal*. 2023; 129(7): 1096-1104.