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Original Article

Health Literacy and Medication Adherence among Geriatric Patients

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ABSTRACT

Background: Geriatric patients with inadequate health literacy are less careful of the medication adherence impact. **Aim:** Assess health literacy and medication adherence among geriatric patients. **Method**: A descriptive research design was utilized in this study. The study was conducted at the geriatric outpatient clinic of the specialized Medical Hospital at Mansoura University and the outpatient clinic of Mansoura Specialized Hospital affiliated to Ministry of Health & Population, Dakahlia Governorate. A purposive sample of 255 geriatric patients who met the inclusion criteria were enrolled in the study. Three tools were used to collect data: Demographic, Health Related Data, and Activities of Geriatric Patients Interview Questionnaire Sheet, European Health Literacy Survey Questionnaire, and 8-items Morisky Medication Adherence Scale. **Results:** Limited health literacy (inadequate and problematic) prevailed among 67.5% of the studied geriatric patients as well as a low medication adherence level was common among 78% of the studied geriatric patients. **Conclusion:** There was a highly statistically significant positive correlation between health literacy and medication adherence among geriatric patients as sufficient health literacy is associated with higher medication adherence in geriatric patients. **Recommendation:** Adopting multidimensional approaches aimed to improve health outcomes of geriatric patients as supporting medication adherence, improving health literacy skills, and maintaining a close nurse–patient relationship with effective communication. Also, further studies and research are needed about health literacy, medication adherence and the impact of health literacy on medication adherence among larger numbers of geriatric patients in different demographic areas in Egypt.

Keywords: Geriatric Patients, Health Literacy, Medication Adherence.

Introduction

Population aging is a global issue of importance. The world is undergoing huge age shift **(Yang, Li, Mu, Ahmad, & Meng, 2022).** According to the United Nations Population profiles, over the next decades, the global numbers of geriatric populations aged 60 years or more will project to more than double, reaching over 2 billion by 2050, specifically in developing countries **(United Nations, 2022)**. Egypt, along with other developing countries, is experiencing a huge shift in proportion of geriatric population, which is expected to reach 20.8% of the total Egyptian population by 2050 **(Osman, 2023).**

The huge shift in proportions of geriatric population comes with a variety of physiological function changes which may be associated with many long-term diseases such as arthritis, cardiovascular diseases and stroke **(Chalise, Bohora, & Khanal, 2022).** As the prevalence of chronic conditions continues to increase, the need of geriatric patients to adhere to long term therapies become critical for living with these chronic conditions safely. This adherence can't be realized without novel approaches enabling the geriatric patient to effectively execute the adherence process **(Wilder et al., 2021).**

One of the most powerful approaches is building up competence, skills and abilities of obtaining, interpreting, understanding recommendations of health care providers on when and how to take medications. This approach also refers to health literacy **(World Health Organization, 2022; van der Gaag, Heijmans, Spoiala, & Rademakers, 2022).** Health literacy can empower geriatric patients to make informed health decisions not just for staying healthy but also when being ill or being at risk **(Schillinger, 2020).**

Despite the variety of health literacy significance in different domains of health, the level of health literacy is so limited among geriatric patients. **(Amer, Abd Allah, & Abdel-Aziz, 2022)**. Limited levels of health literacy may be associated with difficulties in comprehension of health information, recommendations regarding medication use, which in turn causes erroneous intake of prescribed medications or even leads to non-adherence to medication **(Fabbri et al., 2020; Ribaut et al., 2020; Zeitouny et al, 2023).**

Medication non-adherence can cause poor health outcomes including treatment failure, significant worsening of disease, increased hospitalizations and increased health care costs **(Mirahmadizadeh, Khorshidsavar, Seif, & Sharifi, 2020; Amarch, 2022).** Therefore, it is very important that the gerontological nurse sheds light on the starting point of adherence behavior that is mainly focused on routinely assessing the health literacy level of each geriatric patient at each clinic visit. Otherwise, assessing adherence level of geriatric patients for designing improvement plans for both health literacy and medication adherence among geriatric patients, and identifying barriers that hinder geriatric patients from being a health literate person or adhering to the prescribed medication regimen.

Significance of the study

One of the major challenges to health and wellbeing among the geriatric population is chronic diseases. As it forces geriatric patients to adhere to complex therapeutic regimens for living safely with these health problems. Nowadays, Medication adherence is much more complex than just the description of medications. A key enabler for accelerating progress towards medication adherence and achieving desirable health outcomes is health literacy. As health literacy supports the ability to find, understand, evaluate, communicate, and act on information relating to medication and other health information (**Hyvert et al., 2023; Meherali, Punjani, & Mevawala, 2020).**

In a recent Egyptian study, there had unfortunately resulted that more than two thirds (68.6%) of patients over the age of 60 years had limited health literacy level **(Amer, Abd Allah & Abdel-Aziz, 2022).** On the other wise, the study of **Ahmed, Abdel-Aziz, & Ahmed, (2023)** revealed that medication adherence became a huge challenge among Egyptian geriatric patients, as it was discovered that the majority (84.8%) of geriatric patients were non-adherent to their medications.

These combined results highlight the significant burden of limited health literacy and lower medication adherence among Egyptian geriatric patients. As well as stress on how urgently nursing interventions included accurate assessment of health literacy and medication adherence levels are needed to lessen these problems. Subsequently, the present study was suggested to assess health literacy and medication adherence among geriatric patients.

2.1 Aim of the study

The aim of the study was to:

Assess health literacy and medication adherence among geriatric patients. This aim was achieved through: -

1. Assess the level of health literacy among geriatric patients.
2. Assess the level of medication adherence among geriatric patients.
3. Determine the relationship between health literacy and medication adherence among geriatric patients.

2.2 Research Questions

Q1. What is the level of health literacy among geriatric patients?

Q2. What is the level of medication adherence among geriatric patients?

Q3. What is the relationship between health literacy and medication adherence among geriatric patients?

3. Method

3.1 Study Design

A descriptive research design was utilized to carry out this study.

3.2 Study Setting

This study was carried out at the geriatric outpatient clinic of the specialized Medical Hospital, which is affiliated to Mansoura University, and the geriatric outpatient clinic of Mansoura Specialized Hospital, which is affiliated to the Ministry of Health & Population, Dakahlia Governorate. The geriatric outpatient clinics of the specialized Medical Hospital are located on the ground floor of the old hospital building, work two days per week (Saturday and Wednesday) and receive approximately (8 to 10) geriatric patients every working day.

Whereas the geriatric outpatient clinics of Mansoura Specialized Hospital are located on the ground floor of the new hospital building, work on (Tuesday and Thursday, and receive approximately 10 to 15 geriatric patients every working day. Both

clinics start working from 9 A.M to 2 P.M. and offer many services to geriatric patients, such as diagnosis and treatment for chronic diseases, such as diabetes and heart disease, and a medical checkup. In addition, it provides health education and monthly treatment at state expense for these patients.

3.3 Study Subjects

A purposive sample of **(255)** geriatric patients attending the previously mentioned setting, and were selected according to the following criteria:

Inclusion criteria

1. Aged 60 years or more of both sexes.
2. Able to communicate.
3. Willing to participate in the study.
4. Available at the time of data collection.
5. Taking at least one medication by doctor prescription for chronic diseases.

Sample size calculation

The sample size was estimated based on data from the literature of **Mayo-Gamble and Mouton (2018)**, it was calculated with precision/absolute error of 5% and type 1 error of 5%, the sample size was calculated according to the following formula:

$$n= [(Z1-\alpha/2)2^* P (1-P)]/d2$$

(Z1-α/2): is the standard normal variant, at 5% type 1 error ($p<0.05$) is 1.96.

P: is the expected proportion in the population, based on previous studies.

d: is the absolute error or precision.

Therefore, sample size = [(1.96)2 X (0.608). (1-0.608)] /(0.06)2 =254.3.

Based on this formula, the total sample size required for this study was **(255)** geriatric patients.

3.4 Tool of data collection

Three tools were used to collect the necessary data:

Tool I. Demographic, Health Related Data and Activities of geriatric patients Interview Questionnaire Sheet

This tool was developed by the researcher after a review of relevant literatures **(Lee, Yu, You, & Son, 2017; Mayo-Gamble & Mouton, 2018; Lohrasbi, Ilali, Nasab & Yaghoubi, 2021; Goli Roshan, Hosseinkhani, & Norouzadeh, 2021)** and consisted of three parts:

Part I. It involves demographic data of geriatric patients such as age, sex, marital status, educational level, occupation before retirement, current work, monthly income, source of income, place of residence, living arrangements and health insurance.

Part II. It involves health related data of geriatric patients such as medical history of chronic diseases, number and type of medications taken daily, dependency on caregiver in taking/ buying medication, perceived importance of medication, perceived health status.

Part III. It involves questions regarding the activities participation of geriatric patients such as taking care of children and grandchildren, using the internet, participation in sports or other physical exercise, listening to TV, radio, reading newspapers regarding geriatric health and social connection.

Tool II. The European Health Literacy Survey Questionnaire (HLS-EU-Q16)

This tool was developed by **(Sørensen et al., 2013).** It was used to measure the level of health literacy of the geriatric patient. It was translated into the Arabic language and was validated and tested for its reliability by the researcher. This tool consists of 16 items measuring health literacy level within the three domains of health: health care (seven items), disease prevention (five items) and health promotion (four items). The items on the scale are rated on a four-point Likert scale with response categories “very difficult”, “fairly difficult”, “fairly easy” and “very easy”. The total score was categorized into three levels based on cut of points as: inadequate (0 to 8), problematic (9 to 12) and sufficient health literacy (13 to 16).

Tool III. The 8-item Morisky Medication Adherence Scale (MMAS-8)

This tool was developed by **(Morisky et al., 2010).** It was used to measure the level of medication adherence of the geriatric patient. It is composed of 8 items; 7 items answered with a yes or no and 1 item with a 5-point Likert scale ranging from (0 to 4). The total score was classified into three levels based on cut-off points as: low

adherence (scores <6), medium adherence (scores of 6 or 7) and high adherence (score of 8).

3.5 Data Collection Process

The process of data collection went through two phases:

Phase I: Preparatory phase

It included the following steps:

1. **Administrative step** in which an official letter was obtained from the Vice Dean of the College of Nursing for Postgraduate Studies and Research, Mansoura University, and was directed to the Vice Dean of the College of Medicine for Postgraduate Studies and Research, Mansoura University. Then the letter was directed to the manager of each hospital of Specialized Medical Hospital and Mansoura Specialized Hospital to obtain their approval for carrying out the study.

After administrative permission was granted by the manager of each hospital, the researcher met the head of nursing staff of each geriatric outpatient's clinic, introduced herself, provided them a copy of approval and informed them about the purpose of the study and the schedule of data collection.

2. **Literature review step** in which the researcher reviewed national and international literature on the various aspects of health literacy and medication adherence among geriatric patients, proposed from scientific published articles, internet searches, and textbooks. This review was a guide for developing the study tools.
3. **Developing the study tools step for data collection:**
   - **Tool I** (Demographic, Health related Data and Activities Structured Interview Schedule); was developed by the researcher after a thorough review of related literature and divided into 3 parts: **part 1;** Demographic data of geriatric patients, **part 2;** Health related data of geriatric patients and **part 3**; Activities that geriatric patients participated in.
   - **Tool II** (The European Health Literacy Survey Questionnaire) was translated into the Arabic language by the researcher. An expert in the English language from the English Department, Faculty of Education, and Mansoura University employed back translation to confirm the accuracy of the tool translation.
   - The Arabic version of the study **tool III** (The 8- items Morisky Medication Adherence Scale) was utilized by the researcher in this study.
   - **Content validity of the study tools:** the study tools were revised for its content validity by a panel of five experts in the study's field of Gerontological Nursing. According to their opinions, the necessary modifications were applied. The modifications were related to adding some questions regarding activities that studied geriatric patients participated in. Then, the final form was used for data collection.
   - **Face validity of the study tools;** the study tools were tested for its face validity by conducting a pilot study prior to data collection on (26) geriatric patients that represent (10%) from the total study sample (255). It was conducted testing the clarity, feasibility, and applicability of the study questions, identifying any comments, obstacles, and problems that may be encountered during data collection as well as determining the time needed to fill in study questions. Then any geriatric patient who participated in the pilot study was excluded from the total study sample, and there were no necessary modifications done on the study tools after conducting the pilot study.
   - **Reliability of the study tools**: The study tool II (The European Health Literacy Survey Questionnaire) was tested for its reliability or internal consistency by using Cronbach's Alpha test. The ***r*** coefficient was (0.814) which assured reliability and strong consistency of this tool.

Phase II: Operational phase

The actual work of data collection took four months for completion. Its implementation began at the beginning of June 2023 and was completed by the end of September 2023 with these subsequent steps:

- The researcher started data collection after obtaining the necessary approval from the managers of specialized medical hospital and Mansoura Specialized Hospital. According to the schedule of each geriatric outpatient clinic in both hospitals, the researcher visited each clinic from 9 A.M. to 1 P.M. At Specialized Medical Hospital, the working days of the clinic were Saturday and Wednesday. While the days of working at Mansoura Specialized Hospital were Tuesday and Thursday.
- The researcher met the geriatric patients in the waiting area of each geriatric outpatient clinic and started data collection by introducing herself to the geriatric patients and their family caregivers. Study subjects whose matched sample criteria and accepts to participate in the study were provided with enough necessary explanations about study's purpose and reassured about the confidentiality of the data collected.
- The researcher interviewed each geriatric patient individually in order to collect necessary data about: **(i)** Demographic, Health-related data, and Activities of geriatric patients by using tool I (Demographic, Health-related Data and Activities Structured Interview Schedule). **(ii)** Level of health literacy of geriatric patients by using tool II (The European Health Literacy Survey Questionnaire). As well as **(iii)** Level of medication adherence of geriatric patient by using tool III (The 8-item Morisky Medication Adherence Scale).
- The researcher could interview 4 to 5 geriatric patients on each day of the data collection schedule and took about 30-45 minutes with each geriatric patient to read each questionnaire item, record geriatric patient, responses and to ascertain all questions were answered. The time varied according to geriatric patient, level of understanding and his cooperation with the researcher.
- The researcher was able to collect data from the previous mentioned settings as the following: (195) geriatric patients from geriatric outpatient clinic of Specialized Medical Hospital and (60) geriatric patients from geriatric outpatient clinic of Mansoura Specialized Hospital, as nursing staff at geriatric outpatient clinic of Specialized Medical Hospital were more cooperative with researcher during sorting participants which facilitated data collection.

3.6 Ethical Considerations of the Study

An ethical approval was obtained from the Research Ethics Committee of the Faculty of Nursing – Mansoura University with reference number ***(Ref. No. 322).*** Informed consent was obtained from each geriatric patient who attended the outpatient clinics, matched the sampling criteria, and after explanation of the study's purpose. The researcher highlighted that the confidentiality of the collected data was maintained and used only for the study purpose. Each geriatric patient was assured that his participation was voluntary, and they have the right to withdraw from the study at any stage without any consequences or penalty.

VII. Statistical Analysis

The data obtained were analyzed using SPSS software (Statistical Package for Social Science) version 22. Descriptive statistics were displayed as frequencies and percentages for categorical variables, whereas Continuous variables were represented as mean & standard deviation. For inferential statistics, three tests were used namely as; **(i) Chi-square test ($\chi 2$)** was used to test the association between two categorical variables and to test the analysis of variance. **(ii) Pearson correlation coefficient test (*r*)** was conducted to test the association between two continuous variables. **(iii) Multivariate linear regression** was performed to explore the most affecting factors for health literacy and medication adherence. For data visualization, Microsoft Excel was used to create graphs. At $p < 0.05$, the difference was deemed significant.

Results

Table 1 shows distribution of the studied geriatric patients according to their demographic data. According to this table, the age of the studied geriatric patients ranged between 60 to 88 years, with a mean age of 68.25±6.85 years. Males were more prevalent in the study; they constituted 52.2% of the studied geriatric patients. Regarding other

demographic data, 58.4% were married, 26.7% of them were secondary educated. Approximately two thirds (65.5%) of them were employed before retirement while after retirement; low proportion (21.6%) of them were continued work.

In relation to monthly income, 56.5% of the geriatric patients studied reported that their income was not enough, and the main source of income was a pension, which was reported by 60.4% of them. 62.4% of the studied geriatric patients resided in urban areas and 50.6% of them were living with their families. Finally, the table shows that, 56.1% of the geriatric patients studied were health insured.

Table 2 indicates distribution of the geriatric patients studied according to their health-related data. According to this table, diabetes mellitus was the most prevalent disease among the studied geriatric patients as reported by 88.2% of them. 57.2% of the studied geriatric patients studied suffered from chronic diseases for 5 to 10 years. As the majority of geriatric patients studied had diabetes mellitus, hypoglycemic drug was the most common medication used by 88.2% of them.

The table also reveals that 51% of geriatric patients studied were taking less than five types of medication daily and 71% of them depend on care giver in taking or buying their medications as well as, 58.4% of them were perceiving the importance of medication. Moreover, 75.7% of them were using eyeglasses as an assistive device in medication administration.

Table 3 shows the distribution of the studied geriatric patients according to their activities' participation. According to this table, taking care of children and grandchildren was the most common activity practiced by 60% of the studied geriatric patients. As for other activities, 41.2% of them were using the internet, 37.6% participated in sports or other physical exercise, and 58.4% of them listened to television or radio or read newspapers regarding geriatric health. Also, 53.9% of them are in daily contact with others.

Figure 1 displays distribution of the studied geriatric patients according to their level of health literacy. According to this figure, 49.5% of the geriatric patients studied had inadequate health literacy, while 32.5% of them had sufficient health literacy level, and only 18% of them had problematic health literacy level.

Figure 2 shows distribution of the studied geriatric patients according to their levels of medication adherence. According to this figure, 78% of the studied geriatric patients had low level of medication adherence, 20.40% had medium adherence, while only 1.60 % of them had a high adherence level with a mean ± SD 3.95± 2.35.

Figure 3 demonstrated the correlation between health literacy and medication adherence of the studied geriatric patients. According to this figure, there was a highly statistically significant positive correlation between health literacy and medication adherence of the studied geriatric patients (r =0.657& P value< 0.001) which indicates that studied geriatric patients who had a sufficient level of health literacy were highly adherent to their medications and vice versa.

Table 4 shows the multivariate linear regression analysis model for health literacy among geriatric patients. It was noted from this table that, educational level of the geriatric patient as well his current work, monthly income, number of chronic diseases and medication adherence, were the most influential factors on the level of health literacy among the studied geriatric patients (**β**= 0.507, -0.120-, 0.097, -0.105-& 0.349, respectively), **P** values<0.001**, and responsible for 70 % of health literacy (**R2** =0.700).

Table 5 showed the multivariate linear regression analysis model for medication adherence among geriatric patients. It was noted from table that, monthly income of the geriatric patient as well health literacy status, were the most influential factors on the level of medication adherence among the studied geriatric patients where medication adherence level was significantly higher among those who had sufficient monthly income and higher health literacy level (**β**= 0.204, & 0.602, respectively), **P** values<0.001**, and responsible for 47% of medication adherence (**R2** =0.476).

Table 1. Distribution of the Studied Geriatric Patients According to Their Demographic Data.

Demographic data	n= 225	100%
Age (years)		
▪ 60 < 65	195	76.5
▪ 65 < 70	55	21.5
▪ ≥ 70	5	2.0
Mean ± SD (Min – Max)	**68.25±6.85 (60-88yrs)**	
Sex		
▪ Male	133	52.2
▪ Female	122	47.8
Marital status		
▪ Single	6	2.4
▪ Married	149	58.4
▪ Divorced	29	11.4
▪ Widow	71	27.8
Educational level		
▪ Illiterate	56	22.0
▪ Read and write	43	16.9
▪ Elementary education	29	11.4
▪ Preparatory education	38	14.9
▪ Secondary education	68	26.7
▪ Higher education	21	8.1
Occupation before retirement		
▪ Employed	167	65.5
▪ Not employed	88	34.5
Current work		
▪ Yes	55	21.6
▪ No	200	78.4
Monthly income		
▪ Not enough	144	56.5
▪ Enough	104	40.8
▪ Enough and save	7	2.7
Source of current income		
▪ Pension	154	60.4
▪ Social affairs	60	23.5
▪ Relative	23	9.0
▪ Legacy	18	7.1
Place of residence		
▪ Urban	159	62.4
▪ Rural	96	37.6
Living arrangements		
▪ With the family (husband/ wife)	129	50.6
▪ With son	100	39.2
▪ Alone	26	10.2
Health insurance		
▪ Yes	143	56.1
▪ No	112	43.9

Table 2. Distribution of the Studied Geriatric Patients According to their Health-Related Data.

Health related data:	n (255)	100%
Types of chronic diseases[#]		
▪ Diabetes mellitus	225	88.2
▪ Hypertension	200	78.4
▪ Urological disease	77	30.2
▪ Cardiovascular diseases	43	16.9
▪ Musculoskeletal diseases	43	16.9
▪ Gastrointestinal diseases	35	13.7
▪ Respiratory diseases	25	9.8
▪ Thyroid disease	22	8.6
▪ Neurological diseases	7	2.7
Duration of chronic disease		
▪ < 5 years	80	31.4
▪ 5-10 years	146	57.2
▪ > 10 years	29	11.4
Type of medication[#]		
▪ Hypoglycemic agents	225	88.2
▪ Hypertensive drugs	200	78.4
▪ Analgesic	30	42.8
▪ Vitamins and minerals	105	41.2
▪ Renal drugs	77	30.2
▪ Cardiovascular drugs	43	16.9
▪ Thyroid drugs	22	8.6
Number of medications taken daily		
▪ Less than 5 medications	130	51.0
▪ More than 5 medications	125	49.0
Dependency on care giver in taking/ buying medication		
▪ Yes	181	71.0
▪ No	74	29.0
Perceived importance of medication		
▪ Yes	149	58.4
▪ No	106	41.6
Use of assistive devices[#]		
▪ Eyeglasses	193	75.7
▪ Reminder devices	99	38.8
▪ Hearing aid ▪ id	33	12.9

([#]) More than one answer was given

Table 3. Distribution of the Studied Geriatric Patients According to their Activities' Participation.

Activities	n= 225	100%
Taking care of children and grand children		
▪ Yes	153	60
▪ No	102	40
Using internet		
▪ Yes	105	41.2
▪ No	150	58.8
Participation in sports or physical exercise		
▪ Yes	96	37.6
▪ No	159	62.4
Listening TV, radio, reading newspaper regarding geriatric health		
▪ Yes	149	58.4
▪ No	106	41.6
Social connection		
▪ Daily	153	53.9
▪ Weekly	85	39.4
▪ Monthly	17	6.7

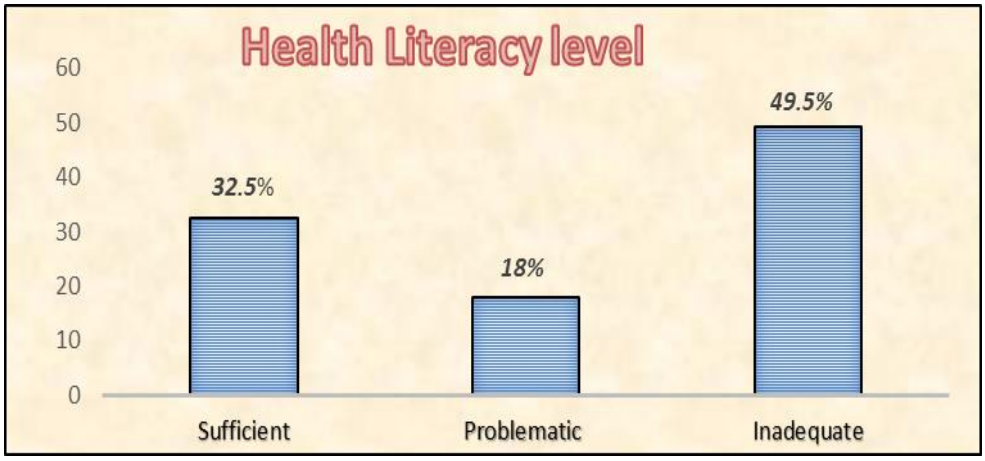

Figure 1. Distribution of the Studied Geriatric Patients According to their Level Of Health Literacy (n= 255).

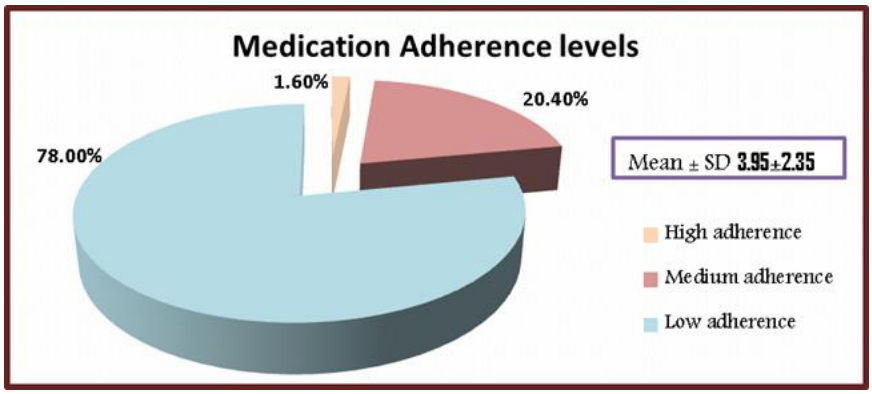

Figure 2. Distribution of the Studied Geriatric Patients According to their Levels Of Medication Adherence (n= 255).

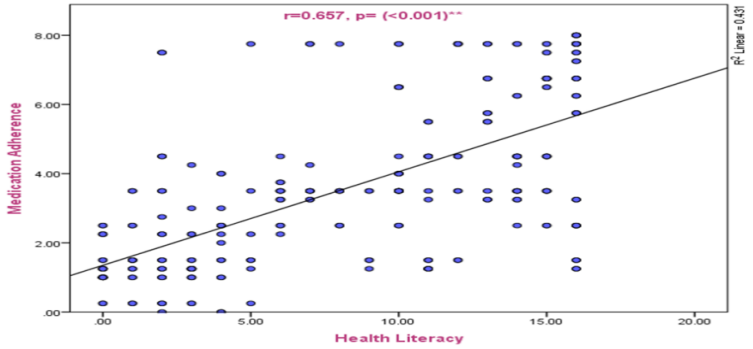

Figure 3. Correlation Between Health Literacy and Medication Adherence of the Studied Geriatric Patients (n=255).

Table 4. Multivariate Linear Regression Analysis Model for Health Literacy Among Geriatric Patients.

Predictors	Health literacy				
	Unstandardized Coefficients		Standardized Coefficients	t	P
	B	Std. Error	Beta		
(Constant)	3.145	1.354		2.323	0.021
Age	-.735-	.456	-.062-	-1.610-	0.109
Educational level	**1.700**	**.148**	**.507**	**11.517**	**<0.001****
Job Before Retirement	.596	.534	.043	1.117	0.265
Current work	**-1.445-**	**.476**	**-.120-**	**-3.034-**	**0.003****
Monthly Income	**1.007**	**.416**	**.097**	**2.421**	**0.016***
No. comorbidities	**-.839-**	**.338**	**-.105-**	**-2.481-**	**0.014***
Number of medications	-.792-	.476	-.069-	-1.664-	0.097
Duration of disease	.145	.335	.016	.432	0.666
using internet	.398	.498	.034	.799	0.425
Doing sports or physical exercise	.142	.509	.012	.280	0.780
Total MMAS	**.847**	**.106**	**.349**	**7.966**	**<0.001****
R^2=0.700, F= 51.517, P=<0.001**					

R2, coefficient of determination; **B,** Unstandardized Coefficients; **Beta**: Standardized Coefficients.
CI, confidence interval , **F, p: f, and p** values for the model, **t:** t-test of significance.
***:** Statistically significant at p ≤ 0.05. Note: **Bold** for those variables with statistically significant.

Table 5. Multivariate Linear Regression Analysis Model for Medication Adherence Among Geriatric Patients.

Predictors	Medication adherence				
	Unstandardized Coefficients		Standardized Coefficients	t	P
	B	Std. Error	Beta		
(Constant)	1.445	.674		2.142	0.033
Age	.003	.017	.009	.178	0.859
Educational level	.016	.100	.012	.164	0.870
Job Before Retirement	.149	.257	.030	.581	0.562
Current Job	.160	.285	.028	.562	0.575
Monthly Income	**.871**	**.216**	**.204**	**4.033**	**<0.001****
No. Comorbidities	-.157-	.175	-.048-	-.896-	0.371
Number of medications	-.321-	.248	-.068-	-1.296-	0.196
Perceived health status	-.321-	.208	-.086-	-1.546-	0.124
Self-dependent for medication administration	.420	.266	.081	1.579	0.116
Total HL	**.248**	**.030**	**.602**	**8.235**	**<0.001****
R^2=0.476, **F**= 27.920, **P**=<0.001**					

R2, coefficient of determination; **B,** Unstandardized Coefficients; **Beta**: Standardized Coefficients.

CI, confidence interval, **F, p: f, and p** values for the model, **t:** t-test of significance.

***:** Statistically significant at $p \leq 0.05$. Note: **Bold** for those variables with statistically significant.

Discussion

Rapid expansion in the geriatric population around the world place those groups in the focus of health care research **(Zhao & Xie, 2023).** Since aging is usually accompanied by many chronic diseases that require the inevitable and necessary adhere to a larger number of medications daily **(Carvalho & Almeida, 2022).** Proper adherence to these medications is in question because many geriatric patients leave health care clinics without adequate understanding of the instructions around medication use. Understanding information related to medication or other health information requires sufficient health literacy. As health literacy helps individuals in obtaining, understanding, using and applying the necessary health information in ways that promote and maintain health **(Unni & Bae, 2022).**

Optimizing assessment of health literacy level of the geriatric patients along with regular assessing their medication adherence level are considered two of nurse's main duties. Recently, researchers have become interested in health literacy to manage adherence problems. **Mohsen, Abd El-Aal, Hassan,** and **El-Abbassy (2021)** supported health literacy as a viable mechanism for improving medication adherence. The current study demonstrated that there was a highly statistically significant positive correlation between health literacy and medication adherence of the geriatric patients, which indicates that geriatric patients who had a sufficient level of health literacy were highly adherent to their medications and vice versa.

The current study was conducted on two hundred and fifty-five geriatric patients, the majority of them were young old. Males were more prevalent than females, most of them were married. More than half of the geriatric patients studied had secondary education; about two thirds were employed before retirement, while after retirement, a low proportion of them continued work. Moreover, more than half conveyed that their monthly income was not enough and about two thirds of them depend on a pension as a source of income. About two thirds were residing in urban areas and more than half of them were living with their families. Finally, more than half were health insured.

These results may be explained as, nowadays, the young old age group is more cooperative than previous, males are more prone to risky behaviors that exacerbated hospital admission and needed follow up, and the Egyptian culture supports males to marry and remarried. The majority of studied geriatric patients were secondary educated and employed, explaining that, most of them were males and from urban areas where different educational resources were widely

available and in the past, there was no limit for continuation of education for males, and secondary educated males were employed in governmental sectors.

Elderly beliefs about old age as time of rest and worship may make majority of them discontinued work after retirement that may be a good reason for insufficient income. Middle-Eastern cultures like Egypt possessed more collective values where care and support encouraged geriatric patient to life with their families. Finally, the majority of study participants were employees and in Egypt, the majority of employees are health insured.

These results are consistent with studies. conducted in Egypt by **Mohamed, Mohamed, Abozied** and **Mohamed (2024),** reported that the majority of the participants were in the age group of 60 to less than 65 years; with a mean age of 67.6± 6.3 years, in Japan by **Kita, Machida, Shibagaki,** and **Sakurada (2021),** found that the majority of studied participants were males, in Saudi Arabia by **Almutairi, et al ., (2022),** found that the majority of study participants were married, in United State (Us) by **Zheng, et al., (2021),** found that the majority of study participants were secondary educated and in Egypt by **Aldosokey, Elshafeai, Mahmoud** and **Abdelatey Hassan (2021)** which found that approximately three quarters of study participants were employed in governmental sectors.

The same findings were also informed by studies done in Asia by **Henning, Roncarati,** and **Steinmayer (2024),** which revealed that the majority of the study participants had governmental support but not enough. Study of **Fowler et al., (2023)** in England, stated that the majority of the studied participants were residing in urban areas. Also, studies done in Egypt by **Fahmy, Hassan,** and **El-sherbieny (2023)** and by **Mohamed, Sharkawy, El-Aziz,** and **Mahmoud (2020),** revealed that the majority of the study participants were living with their families. Study conducted by **Liu et al. (2023)** in China, reported that the majority of the studied geriatric patients were health insured.

With regards to **health-related data** of the studied geriatric patients, **according to Table 2,** diabetes was the most prevalent disease among the studied geriatric patients. This may be attributed to the aging process of the human body which predisposes several alterations in energy homeostasis and carbohydrate metabolism that eventually results in deficiency of insulin secretion and growing insulin resistance. As a result of this finding, hypoglycemic drugs were the most commonly used medications among the majority of the studied geriatric patients. The same finding was informed by a study done in England by **Cartwright** and **Smith (2024)** and a study done in India by **Hannan, Sinha, Ganiyani,** and **Pustake (2021),** which found the similar finding that the majority of study participants were diabetic and were taking hypoglycemic drugs for controlling their chronic condition.

Toward medication used daily, caregiver support in managing pharmaceutical concerns and perception about medication importance, the current study illustrated that more than half of the studied geriatric patients were using fewer than five types of medications daily, about three quarters of them were dependent on the care giver in taking/ buying their medications and more than half were perceiving the importance of medication.

This result was consistent with the study of **Liu et al. (2023)** in China, the study of **Algabbani** and **Algabbani (2020)** in Saudi Arabia, which stated that the majority of study participants reported taking less than five medications a day. Also, this finding was supported by **Widyakusuma, Suryawati, Wiedyaningsih,** and **Probosuseno (2023)** in Indonesia, which revealed that more than two thirds of the study participants were assisted for medication refill. Studies of **Cartwright** and **Smith (2024)** done in England and of **Reach et al. (2023)** in France also supported this finding and revealed that two-thirds of the studied participants perceived medication importance.

Assistive devices have a helpful role in completing activities of daily living **(Park & Kim, 2024)**. According to the current study results, eyeglasses are the most commonly used assistive device among the majority of studied geriatric patients. This may be justified as eyeglasses play a significant role in enhancing visual wellbeing and in addressing age-related vision changes, which weaken geriatric patients' capacity to accomplish many daily activities as taking medication. This result is supported by the study done in India by **Thakur, Kalia, Kaur,** and **Sharma (2018),** which found that the most frequently used assistive devices were eyeglasses.

Regarding **the activities' participation** of the studied geriatric patients, **according to table 3,** the present study revealed that taking care of children and grandchildren was the most common activity among about two thirds of the studied geriatric patients. This result may be related to traditional

Egyptian cultures that strongly support geriatrics nurturing to their grandchild and relate this activity with life satisfaction. Supporting that, a study done in the South-East Asia Region (SEAR) by **Yadav (2021),** study of **Yang & Yin (2022)** in China and the Egyptian study of **Ibrahim Fahim, Gaber Sos, Adel Hakim,** and **Ahmed Hamza (2020),** revealed the same finding.

As for other activities, more than half of the geriatric patients studied don't use the internet, about two thirds of them don't participate in any sports or physical exercises, and more than half are still preferring the use of traditional media such as watching TV, listening radio or reading the newspaper regarding geriatric health. For social connection, more than half of the geriatric patients studied were daily contacted with others. This result may be considered the fact that many geriatric patients were less familiar of new technologies and some of them have chronic illnesses (such as severe arthritis or advanced cardiovascular disease) that may limit their choice of physical activities. While social connection is strongly related to Egyptian culture, which values friendship, seeing neighbors, attending meetings, and helping others.

The results are consistent with studies performed in China by **Lyu** and **Sun (2021)** and by **Yang et al. (2021)** revealed that the majority of study participants had never accessed the internet. While study of **He, Cao, Liu, Wu,** and **Zhang (2022)** done in United States (US) disagreed with this study result as found that about two thirds of the studied participants were using the internet. Study of **Davison** and **Cowan (2023),** which was done in Scotland, noticed a clear decline in the sports participation rate among the studied participants. While a study done in England by **Brinkley, Sandercock, Lowry,** and **Freeman (2024),** disagreed with this current study result as reported that sports participation rate among study participants was moderate.

Traditional media such as watching TV and reading the newspaper is commonly used among more than half of studied geriatric patients. This finding was supported by a previous study done in India by **Khan, Dahiya,** and **Khan (2023)** that indicated that most participants were less media use and more tended to use traditional media. While the study done in Taiwan by **Wang, Fu, Hsieh, Lin,** and **Yang (2021)** disagreed with this finding and revealed that internet usage is largely gaining popularity among geriatric patients compared to traditional media. Regarding social connection, the study done in Egypt by **Abd Elaziz,** and **Shawky (2024)** revealed the same study finding. But this result is in disagreement with a study done in Europe by **Morgan et al., (2021)** who revealed that social relations as well as family relations were just driven by individuals' resources and needs.

Health literacy is characterized as an individual's ability to access, understand, interpret, and apply health information **(Meherali, Punjani, & Mevawala, 2020).** According to the current study result, more than two thirds (67.5%) of the studied geriatric patients had limited level of health literacy (HL), that is inadequate and problematic HL, according **to Figure 1.** This result may be attributed to the mean age of the studied geriatric patients was 68.25±6.85 years **Table1** where health literacy decline as the age increase due to the age related changes, general loss of cognitive, hearing, vision ability, which affect the elderly ability to comprehend, reason, compare, read, hear, access, understand and apply health information or may be explaining as, most health information are technology based, widely spread on internet and has been in written formats which require a high reading, calculating, and decision-making skills. These skills require higher education with familiarity to deal with it. While in the current study, low proportion of the studied geriatric patients were highly educated **(Table 1).**

This finding was like those found in previously published Egyptian study of **Aldosokey, Elshafeai, Mahmoud & Abdelatey Hassan, (2021)** that showed the majority of study participants had a limited level of health literacy. Also, the studies done in Italy by **Schiavone& Attena, (2020),** in china by **Shi, Ma, Zhang & Chen, (2023)**, in Portugal by **de Almeida, & Veiga, (2020)** and in Taiwan by **Chiu, et al., (2020)**, supported current study result and reported the same finding. In contrast with study result, the studies done in Malaysia by **Abd-Rahim, Mohamed-Yassin, Abdul-Razak, Isa,** and **Baharudin (2021)** and in Vietnam by **Do et al. (2020),** which stated that the health literacy level among studied participants was sufficient.

Medication adherence is a key for achieving therapeutic goals and improving patient outcomes **(Bartlett Ellis, Haase, & Ruppar, 2023).** The current study revealed that more than three quarters of the geriatric patients studied had low adherence levels to their prescribed medication, according to **Figure 2.** This result may be related to aging progress, which causes alterations in drug pharmacokinetics and pharmacodynamics that

result in delaying beneficial effects of drugs and make the patient more neglectful of treatment. Also, the high cost of medication along with insufficient income can be a tangible barrier to adherence, particularly for geriatric patients on limited incomes.

This finding was in the same line with several previous studies done in America by **Fhon et al . (2024),** in Germany by **Luegering et al . (2023),** in Brazil by **Linkievicz, Sgnaolin, Engroff, Behr Gomes Jardim,** and **Cataldo (2022)**, in Iraq by **Salih,** and **Ismail (2022)** and in Egypt by **Hussein, Awad,** and **Mahmoud (2020),** which stated that adherence level among the majority of studied geriatric patients was significantly low. While European studies of **Irshaidat, Gustafsson,** and **Norberg (2023)** and **Burnier, Polychronopoulou,** and **Wuerzner (2020)** disagreed with this finding and showed that most studied geriatric patients rated themselves as adherent to their prescribed medication. This difference in findings may be related to differences in the type of questionnaire or measurement methods used or may also be related to differences in sample characteristics.

Around the relation between health literacy and medication adherence among geriatric patients, the result of the present study confirmed that there was a highly statistically significant positive correlation between health literacy and medication adherence of the geriatric patients studied, **according to figure (3).** From this significant result, the geriatric patient who had sufficient health literacy level was more likely to be medication adherent and vice versa. This may be because health literate patients were able to fully comprehend the benefits and risks of medications and properly judge how far medication adherence is important and affects health outcomes.

This result agrees with many previously published studies done in England by **Hyvert et al. (2023),** in German by **Schönfeld, Pfisterer-Heise** and **Bergelt (2021),** in Pakistan by **Suhail, et al. (2021),** in Europe by **Kvarnström, Westerholm, Airaksinen,** and **Liira (2021)** and in India by **Gautam et al . (2021)** which asserted that the both constructs were positively associated. While Turkish study of **Ocakoglu, Demirci,** and **Guclu (2020)** doesn't support this result and asserted that medication adherence in elderly patients was not associated with their health literacy.

Among geriatric patients, health literacy as well as medication adherence, can be affected by several factors likely act as a barriers to achieve optimal level **(Tao et al., 2024; Maffoni et al., 2020)**. In the current study, the regression analysis for health literacy, according to **Table 4,** reported that educational level of the geriatric patient as well his current work, monthly income, number of chronic diseases and medication adherence, were the most influential factors on the level of health literacy among the studied geriatric patients where sufficient health literacy was significantly observed among those who had higher education, current work, enough income, fewer number of chronic diseases and who were highly adherent to their prescribed medication. Similarity, the study done in China by **Tao et al. (2024)** who concluded that geriatric patients' education, occupation, and income as the major predictors of health literacy level. This result was also matched with the study of **Wieczorek et al. (2023)** in Europe, who investigated the relation between a number of chronic conditions and health literacy levels among European geriatric patients and showed the same findings.

While for medication adherence, the multivariate linear regression analysis, according to **Table 5,** confirmed that monthly income of the geriatric patient as well as his health literacy status, were the most influential factors on the level of medication adherence among the studied geriatric patients where higher level of medication adherence was significantly noted among those who had sufficient monthly income and higher health literacy level. Similarity, the study of **Fenta et al. (2024)** in Ethiopia and Egyptian study of **Ahmed, Abdel-Aziz,** and **Ahmed (2023)** which mentioned that sufficient income was one of the significant predictors for medication adherence among geriatric patients. Besides, studies of **Wiedyaningsih (2024)** in Indonesia and of **Huang, Pecanac,** and **Shiyanbola (2020)** in America revealed the same finding and demonstrated health literacy as the strongest predictor of medication adherence among geriatric patients.

Finally, from our point of view, the present study concluded that the health literacy level of geriatric patients was significantly correlated with their medication adherence level. This is good evidence that having sufficient health literacy can empower geriatric patients to actively adhere to prescribed medications. From this supportive evidence, health literacy can be viewed as a preventive and curative tool against incorrect use of medication, medication errors, medication nonadherence, adverse reactions, recurrent hospital

visits, emergency room readmission, higher healthcare expenditures and mortality.

Conclusion

In the light of the study findings, it can be concluded that, health literacy as well as medication adherence remain a challenge among Egyptian geriatric patients. Since the health literacy level of geriatric patients in the present study was significantly limited. As well as it was found that the majority of them had a low level of adherence to their medications. A positive, highly statistically significant relationship was found between health literacy and adherence to medication among geriatric patients. That is strong evidence that the higher health literacy level, the greater adherence to prescribed medications, and vice versa.

Recommendations

- Systematic and periodic assessment of health literacy levels of geriatric patients as a part of patient care and also evaluate the extent of their adherence to their prescribed medications to identify patients who are at higher risk and design appropriate improvement plans that could improve the level of health literacy and support medication adherence.
- Direct special attention to geriatric patients with a limited level of health literacy and medication adherence, addressing all factors that directly or indirectly influence these levels and use these factors as opportunities in designing an improvement plan.
- Conduct long-term corresponding health educational programs for geriatric patients. Adopting multidimensional approaches aimed at improving access, understanding, and using health-related information. Methods such as the teach-back method and focusing on key points could facilitate geriatric patients' understanding of the relevant health information as well as their remembering of information
- Dissemination of health-related information in an easily comprehensible way using various approaches in health lectures, as broadcasting of videos or distribution of brochures, included positive outlook on health literacy, medication adherence and their effect on health outcomes.
- Further studies and research about health literacy, medication adherence, and the impact of health literacy on medication adherence among a larger number of geriatric patients in different demographic areas in Egypt.

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