

Original Article

Relationship between Glaucoma Severity, Vision-related Quality of Life and Perceived Wellbeing among Older Adults.

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Abstract:

Background: Glaucoma is a major public health issue that worsens normal vision and is the second leading cause of permanent blindness in the world. It has become imperative to improve the vision related quality of life and wellbeing of older adults with glaucoma because of its greater prevalence and disastrous effects. **Study aim:** investigate the relationship between glaucoma severity, vision-related quality of life and perceived wellbeing among older adults. **Research Design:** a descriptive correlational design was adopted. **Setting:** five ophthalmic outpatient clinics of the Damanhour Eye Hospital at Damanhour City, EL-Beheira Governorate, Egypt were chosen for conducting the study. **Subjects:** a convenient sample consisting of 150 older adults with glaucoma were recruited for this study. **Tools:** comprises three tools; General participant's socio-demographic and clinical characteristics structured interview, Glaucoma Quality of Life-15 (GQoL-15) Questionnaire, and the Well-being of Older People Scale (WOOPS). **Results:** The severity of glaucoma was found to be highly statistically significant in relation to the older adult's glaucoma quality of life ($P < 0.001^*$) and perceived wellbeing ($P < 0.001^*$). **Conclusion:** there are significant negative association between the older adult's glaucoma severity and their glaucoma quality of life as well as their perceived wellbeing. **Recommendations:** Periodic screening of the glaucoma severity and visual function of older adults with glaucoma should be adopted as an integral part of the gerontological nurses' regular assessment, and it should be incorporated into the routine care of those patients.

Keywords: Glaucoma, Glaucoma severity, Vision quality of life, Wellbeing of older adults.

Introduction:

All over the world, glaucoma is considered the second dangerous vision disorder that cause permanent blindness without early warning manifestations among older adults. ⁽¹⁾ It is a chronic progressive degenerative optic neuropathy which is associated with gradual visual field loss. ⁽²⁾ Glaucoma is a condition characterized

by high Intraocular Pressure (IOP). The IOP is increased when normal fluid within the eyes cannot properly drain out of them causing damage to the optic nerve.⁽³⁾

Older people are considered the most vulnerable age group who are frequently suffering from glaucoma.⁽⁴⁾ Worldwide in 2020, it is estimated that 76 million older adults suffered from glaucoma, and they are increased to 79.6 million in 2022.⁽⁵⁾ This number has been expected to reach 95.4 million by 2030 and 111.8 million by 2040.⁽⁶⁾ Recently in 2024, an epidemiological study found that two thirds of all glaucoma patients are above 70 years of age and it expects greater increase in glaucoma prevalence among older adults by 2060 due to the aging of the population.⁽⁷⁾ In Egypt, prevalence of glaucoma varies in several regions; In Aswan (2021)⁽⁸⁾, it has been found that 18.3% of geriatric patients suffer from glaucoma. A study conducted at the Nile Delta region (2021)⁽⁹⁾, revealed that 20.8% had glaucoma. Also, the prevalence of glaucoma among geriatric patients attending the ophthalmic outpatient clinics at Damanhour Eye hospital in 2022 is about 20.4%.⁽¹⁰⁾ Furthermore, there are more than 2.2 million people with visual impairment in Egypt and 900,000 of them are totally blind due to glaucoma.⁽¹¹⁾

It is not surprisingly that older people are the most vulnerable group to have glaucoma; as the aging process can induce several changes that increase glaucoma risk such as weakness of the drainage channels, gradual vulnerability of the optic nerve, and a decrease in the number of optic nerve axons. There are also relevant alterations in cornea structure with age such as thickening of both epithelial and endothelial layers in addition to corneal thickness that can cause progression of ocular hypertension.^(12, 13) Age could also influence the balance of neuroinflammation and the retinal environment.⁽¹⁴⁾

Vision Related Quality of Life (VRQoL) is defined as how well the eyes and basic visual system can detect a target stimulus and how well the person performs vision related activities. Glaucoma has a great impact on the VRQoL especially when its severity is advanced or when both eyes are affected.⁽¹⁵⁾ It has deleterious impact on older adults' central and peripheral vision. Glaucoma also deteriorates the image quality, reduces contrast sensitivity or color discrimination, affects the patients' ability to adapt with glare and dark making them complaining of difficulty in seeing at night, adjusting to bright or dim light, and going from light to dark room.⁽¹⁶⁾ As a result, low VRQoL contributes to difficulty of engaging in daily activities. This can expose the older adults' independence and safety to greater risk.^(17, 18)

Glaucoma is a predictive of poor perceived wellbeing with affection of all wellbeing dimensions either physically, mentally, psychosocially, or financially.⁽¹⁹⁾ Vision impairment brought on by glaucoma is linked to a decline in physical health as it affects an older adults' physical functioning at wide range as they become unable to move around, maintain their capacity to perform self-care related tasks, promote balance control, ensure personal safety during daily activities, and pursue hobbies. This displays greater limitation on older adult's independent living and can result in maximum dependence and disability because of fear of falling.^(16, 20) A study in 2021, found that 72% of geriatric patients reported that glaucoma negatively impacts their daily lives.⁽²¹⁾ Another Egyptian study (2022)⁽¹⁶⁾ found that glaucoma is associated with greater functional disabilities. Furthermore, due to the asymptomatic, lifelong, and chronic nature of glaucoma as well as its potential outcome of blindness, it can often impose a psychological burden causing anxiety and depression. Also, glaucoma interferes with older adults' ability to participate in society and carry out social activities which affects their relationships and social wellbeing.⁽²²⁾

Glaucoma also places a financial strain on geriatric patients, their families, and healthcare systems due to the costs needed for medical treatment, rehabilitation programs, and sometimes need for nursing home care. Specifically, patients with severe glaucoma have increased dependency on others and need more specialized

care, which drives up the overall costs for managing such advanced disease. ⁽²³⁾ In general, glaucoma in older adults is a significant predictor of lower self-rated health, falls, dependence, isolation, depression, poor physical and psychological health as well as higher morbidity and mortality. ⁽²⁴⁾ Therefore, the gerontological ophthalmic nurses have greater responsibility toward those individuals. They should perform complete assessment of the visual function and glaucoma severity for implementing interventions that prevent glaucoma related consequences and promote proper vision and wellbeing. ⁽²⁵⁾ In this respect, identifying the relationship between glaucoma severity, vision-related quality of life and perceived wellbeing among older adults is of great significance.

Significance of the study:

Glaucoma can be controlled through early diagnosis and accurate treatment to avoid progression to an advanced stage that could precipitate serious damage to the patient's vision. ⁽¹¹⁾ Early detection of glaucoma and controlling its severity help to get better disease management and patient's outcomes. ⁽²⁶⁾ Furthermore, preserving VRQoL at a sustainable cost has become increasingly recognized as an important priority in glaucoma management. ^(27, 28) Investigation of the relationship between glaucoma severity, VRQoL and perceived wellbeing could provide a basis for effective interventions to control glaucoma progression and limit its severity. This could enrich the gerontological nursing practice and present beneficial guidance for appropriate care of older adults with glaucoma. This aligns with the 2030 Sustainable Development Goals (SDGs) and Egypt's Vision 2030 Sustainable Development Strategy, which prioritize promoting wellbeing and ensuring healthy lives for all people at all ages. ^(29, 30)

Aim of the study

This study aims to investigate the relationship between glaucoma severity, vision-related quality of life, and perceived wellbeing among older adults.

Research question

What is the relationship between glaucoma severity, vision-related quality of life and perceived wellbeing among older adults?

Materials and Method:

Research design: This study utilized a descriptive correlational research design.

Setting:

Five outpatient ophthalmic clinics namely; glaucoma clinic, reception clinic, and three ophthalmic follow-up clinics at the Damanhour Eye Hospital in the EL-Beheira Governorate of Egypt served as the study setting.

Subjects:

One hundred and fifty (150) older adults who met the following selection criteria made up the sample of the study; they had to be at least 60 years old, diagnosed with glaucoma within the last three months, be able to communicate clearly, and free from any other vision disorders. To guarantee a 95% confidence level, expected frequency 50%, and a 5% margin of error, 120 respondents was the minimum number of respondents that was estimated for this study using the Epi info 7.0 program. However, this study was conducted on a sample size of 150 older adults to improve the validity of its findings. They were recruited using convenient sampling technique.

Study Tools:

Three tools were employed to carry out this study

Tool (I): General participant's socio-demographic and clinical characteristics structured interview.

To get the necessary data from the study subjects, the researchers developed this tool based on a review of pertinent literature. It was split into two sections:

Section 1: Glaucomatous older adults' sociodemographic data, including age, sex, income, cohabitation, education level, and occupation prior to their retirement.

Section 2: Clinical characteristics of the glaucomatous older adults which captured three parts

- a) Medical history such as co-morbid diseases and medications taken.
- b) Factors associated with glaucoma such as previous history and family history of glaucoma, and lifestyle factors such as having periodic general and visual follow up, daily vegetables and fruits intake, practice of regular exercises, daily caffeine consumption, and smoking. Also, the daily fluids intake and exposure to environmental pollutants at home or previous work was included.
- c) Glaucoma characteristics which was collected from the patient's medical file. These include:
 - Glaucoma severity (mild, moderate, or severe) that was determined by the ophthalmologist at these selected clinics during the patient's visual examination using diagnostic tests such as IOP measurements, visual field measurements, and Optical Coherence Tom ography (OCT).
 - The type and site of glaucoma as well as its potential causes and associated signs and symptoms if present.

Tool (II): Glaucoma Quality of Life-15(GQoL-15) Questionnaire.

The Glaucoma Quality of Life-15 (GQoL-15) Questionnaire was developed by Nelson et al. (2003) ⁽³¹⁾ to assess VRQoL in patients with glaucoma. It is a validated scale that explores the degree of difficulty with various visual tasks. It is composed of 15 items and each item's response is rated on a five-point Likert scale from 1 to 5 where 1 indicates no difficulty and 5 indicates severe difficulty, with higher scores indicating worse functioning and poorer VRQoL. The GQL-15 questionnaire was approved to be valid, easy-to-use instrument and reliable measure with a cronbach's alpha of 0.90 in an Egyptian study. ⁽¹⁶⁾ Total score of the GQoL-15 questionnaire is 75 that was classified into good VRQoL (15-35), fair VRQoL (36-55), and poor VRQoL (56-75).

Tool (III): The Well-being of Older People Scale (WOOPS).

It was developed by Hackert et al. (2020) ⁽³²⁾ to assess a comprehensive set of well-being domains in older adults. Each domain was assigned a score between 1 to 5; where 1 denotes the lowest level of wellbeing

and 5 denotes the highest level of wellbeing. Higher scores correspond to higher levels of perceived wellbeing. In a previous study, it has been found that WOOPS achieved satisfactory reliability and content validity in assessing wellbeing in older adults with adequate internal consistency (cronbach's alpha of 0.89).⁽³³⁾ Total score is 45 and classified as follows: a score of 9-20 reflects poor perceived wellbeing, while a score of 21-32 reflects fair perceived wellbeing, and a score of 33-45 indicates good perceived wellbeing

Methods:

i. Administrative process:

The research ethics committee of Damanhour University's Faculty of Nursing granted approval to conduct the study. After that, a formal letter explaining the study processes and requesting approval to carry out the research was sent to the director of the Damanhour Eye Hospital.

ii. Study tools preparation:

After developing Tool I by the researchers based on reviewing related literature, Tools II and Tool III were translated into Arabic language and reviewed by a panel of five experts for their content validity. The modifications needed were done according to the panel's input. These tools were also evaluated for reliability by using Cronbach's alpha; tool II ($r=0.982$), and tool III ($r=.833$).

iii. Pilot study

It was performed on 10% of total sample size ($n=15$ older adults), who were not part of the study sample; this was done to make sure that the tools were feasible and clear, as well as to check for any potential roadblocks or issues that could arise during data collection. No amendments were made considering the pilot study's results.

iv. Data collection

Individual interviews were conducted with each older adult who met the inclusion criteria in order to gather the data required for the study in the waiting areas of the selected outpatient clinics. The interview lasted from 15 to 20 minutes based on each subject's comprehension and cooperation level. The researchers used to visit the setting five days a week, from 8.30 a.m. to 12 MD. A period of six months was dedicated to the collection of data; from the start of October 2023 to the end of March 2024.

v. Statistical analysis

To make the data suitable for computer feeding, it was coded and put in a unique format. Checking and verification procedures were followed during data entry to make sure there were no errors. Version 26 of the statistical package for social science (SPSS) was utilized to analyze data. The subsequent statistical analysis metrics were employed:

- Descriptive statistics that constituted frequencies, percentages, mean, and Standard Deviation (SD).
- Analytic statistics involved Chi square (X^2), Monte Carlo correction, Pearson coefficient, and

Regression analysis. A statistically significant P value was defined as 0.05 or less.

vi. Ethical considerations

The study protocol was given an ethical approval by the nursing faculty's ethics committee of the Damanhour University, with reference number [71-d]. After being informed of the study's purpose and being given the assurance that the data collected would only be used for that purpose, each study subject gave a written informed consent. Throughout the study, participants' privacy and freedom to leave at any time were guaranteed. Additionally, the data confidentiality was preserved throughout the research process.

Results:

Table 1 shows the socio-demographic characteristics of the study subjects. Their age ranged from 60 up to 85 years with a mean of 64.37±4.06. More than one half (55.3%) of the elders were females and 60% were married followed by 30% were widow. Illiteracy prevailed among 51.3% of the study subjects. Concerning occupation before retirement, it was found that 45.3% were employees, 39.3% were housewives, and small percentages were either workers or had free business (8%, 7.4%) respectively. As for income, about two thirds (66%) of the study subjects reported their monthly income was inadequate.

Table (1): Distribution of the study subjects according to their socio-demographic characteristics (n=150)

Socio-demographic characteristics		No	%
Sex	Female	83	55.3
	Male	67	44.7
Age	60 <75	91	60.7
	75 < 85	40	26.7
	≥85	19	12.6
	Mean± SD	64.37±4.06	
Marital status	Married	90	60.0
	Widowed	45	30.0
	Divorced	15	10.0
Level of education	Illiterate	77	51.3
	Read & write	30	20.0
	primary education	22	14.7

	Secondary & university education	21	14.0
Occupation before retirement	Employee	68	45.3
	Housewife	59	39.3
	Worker	12	8.0
	Free business	11	7.4
Income	Not enough	99	66.0
	Enough	51	34.0

Table 2 reveals the distribution of the study subjects according to their general health history. Diabetes Mellitus (DM) was the most prevalent (60%) chronic disorder among the study subjects followed by Hypertension (HTN) (40%), cataract (6.7%), and anemic (5.3%). A few percent suffered from gastrointestinal disorders (4.7%) and renal diseases (4.7%). It can be noted that greater proportion (70%) of the study subjects consumed eye drops, followed by hypoglycemic agents (60%), antihypertensive drugs (40%), as well as vitamins and minerals (5.3%). Similar percent (4%) of them consumed gastrointestinal and renal drugs.

Table (2): Distribution of the study subjects according to general health history (n=150)

Health history #	No.	%
Diabetes Mellitus	90	60.0
Hypertension	60	40.0
Cataract	10	6.7
Anemia	8	5.3
Gastrointestinal diseases	7	4.7
Renal diseases	7	4.7
Medications consumed #		
Eye drops	105	70.0
Hypoglycemic agents	90	60.0
Antihypertensive drugs	60	40.0
Vitamins & minerals	8	5.3
Gastrointestinal drugs	6	4.0
Renal drugs	6	4.0

Multiple responses were given

Table 3 reflects the glaucoma related characteristics among the study subjects. The severity of glaucoma fluctuated between severe in 40% of the study subjects to moderate in 34.7%, and mild in 25.3%. More than three

quarters (76%) of the older adults had an open glaucoma, about one fifth (19.3%) had closed glaucoma, and only (4.7%) suffered from mixed glaucoma. 42.7% were suffering from glaucoma in the right eye, 38.7% were suffering from glaucoma in the left eye, and only 18.6% had glaucoma in both eyes. Moreover, 79.3% of the study subjects had previous history of glaucoma and 64.7% had positive family history of glaucoma. Duration of being diagnosed with glaucoma differed among the study subjects as; 44.7% reported being diagnosed for less than one year, 41.3% being diagnosed for one to less than three years. Diabetic retinopathy was the most common reported cause of glaucoma (39.3%), followed by hypertensive retinopathy (22.7%), cataract (18.6%), and eye inflammation (10.7%).

Table (3): The glaucoma related characteristics among the study subjects (n=150)

Glaucoma characteristics		No	%
Severity of glaucoma	Mild	38	25.3
	Moderate	52	34.7
	Severe	60	40.0
Type of glaucoma	Open glaucoma	114	76.0
	Closed glaucoma	29	19.3
	Mixed glaucoma	7	4.7
Site of glaucoma	Left eye	58	38.7
	Right eye	64	42.7
	Both eyes	28	18.6
Previous history of glaucoma	Yes	119	79.3
	No	31	20.7
Family history of glaucoma	Positive	97	64.7
	negative	53	35.3
Duration of glaucoma diagnosis	Less than 1 year	67	44.7
	From 1 to less than 3 years	62	41.3
	From 3 to less than 6 years	21	14.0
Causes of glaucoma	Diabetic retinopathy	59	39.3
	Hypertensive retinopathy	34	22.7
	Cataract	28	18.6
	Eye inflammation	16	10.7

	Unknown	13	8.7
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Table 4 indicates the glaucoma quality of life among the study subjects. It was observed that more than two fifth (42.7%) of the study subjects had fair vision related quality of life, more than one third (36.7%) had good vision related quality of life, and about one fifth (20.7%) had poor vision related quality of life.

Table (4): Glaucoma quality of life among the study subjects (n= 150)

Glaucoma Quality of life	No.	%
Good vision related quality of life	55	36.7
Fair vision related quality of life	64	42.7
Poor vision related quality of life	31	20.7
Score of peripheral vision subscale	16.29±5.76	
Score of dark adaptation and glare subscale	16.15±6.38	
Score of central vision subscale	6.97±2.23	
Score outdoor mobility subscale	2.61±1.09	
Total score of vision related quality of life questionnaire	1.84±0.74	

Table 5 portrays the perceived wellbeing among the study subjects. It was noticed that about two thirds (65.3%) of the study subjects had poor perceived wellbeing, one third (30.7%) had fair perceived wellbeing and only 4 % had good perceived wellbeing.

Table (5): The perceived wellbeing among the study subjects (n= 150)

Perceived wellbeing scale	No.	%
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Good perceived wellbeing	6	4.0
Fair perceived wellbeing	46	30.7
Poor perceived wellbeing	98	65.3
Total score of perceived wellbeing scale	19.19±6.22	

Table 6 illustrates the relationship between the severity of glaucoma and the VRQoL among the study subjects. It shows that when severity of glaucoma decreases, the VRQoL increases. For those who had mild glaucoma, more than three quarters (76.3%) of them had good VRQoL. Older adults with moderate glaucoma, more than one half (51.9%) of them experienced fair VRQoL. For those who had severe glaucoma, one half (50.0%) had poor VRQoL. The relationship between the severity of glaucoma and the glaucoma quality of life is a highly statistically significant ($P < 0.001^*$).

Table (6): Relationship between glaucoma severity and glaucoma quality of life among the study subjects (n= 150)

Severity of Glaucoma	Vision related quality of life					
	Good		Fair		Poor	
	No.	%	No.	%	No.	%
Mild (n= 38)	29	76.3%	7	18.4%	2	5.3%
Moderate(n=52)	17	32.7%	27	51.9%	8	15.4%
Severe(n=60)	9	15.0%	21	35.0%	30	50.0%
Test of significance $\chi^2(MCp)$	42.263 (<0.001*)					

χ^2 : Chi square test
 *: Statistically significant at $p \leq 0.05$

Table 7 reveals the relationship between the severity of glaucoma and the perceived wellbeing among the study subjects. It was noticed that the lower severity of glaucoma was correlated with greater perceived wellbeing. For more clarification, more than three quarters (78.8%) of the study subjects who had moderate glaucoma had fair perceived wellbeing. About three quarters (73.7%) of those who had mild glaucoma had

good perceived wellbeing. For those who suffered from severe glaucoma, about two thirds (63.3%) of them had poor perceived wellbeing, with a highly statistically significant association between the severity of glaucoma and the perceived wellbeing ($P < 0.001^*$).

Table (7): Relationship between glaucoma severity and perceived wellbeing among the study subjects (n= 150)

Severity of Glaucoma	Perceived wellbeing					
	Good		Fair		poor	
	No.	%	No.	%	No.	%
Mild (n= 38)	28	73.7%	10	26.3%	0	0.0%
Moderate(n=52)	1	1.9%	41	78.8%	10	19.2%
Severe(n=60)	5	8.3%	17	28.3%	38	63.3%
Test of significance χ^2 (^{MC} p)	52.659 (<0.001*)					

χ^2 : Chi square test MC: Monte Carlo
 *: Statistically significant at $p \leq 0.05$

Table 8 shows univariate logistic regression analysis of the factors associated with higher glaucoma severity among the study subjects. As for sociodemographic characteristics, a statistically significant correlation was found between severity of glaucoma and age ≥ 75 years ($p=0.025$), female gender ($p=0.027$), illiterate educational level ($p=0.001$), and inadequate income ($p=0.014$). As for health history, a statistically significant correlation was found between the glaucoma severity and DM ($p=0.025$), HTN ($p=0.008$), and anemia ($p=0.025$). As regards glaucoma related characteristics, a statistically significant association was detected between the glaucoma severity and open glaucoma (glaucoma type) ($p= 0.014$), previous glaucoma history ($p=0.001$), positive family history ($p=0.045$), and long duration of glaucoma diagnosis from 3 to less than 6 years ($p=0.001$). Additionally, a statistically significant correlation was found between the severity of glaucoma and certain unhealthy lifestyle factors such as inadequate periodic visual follow up ($p=0.001$), smoking ($p=0.005$), daily consumption of caffeinated beverages ($p=0.004$), and lack of regular exercise($p=0.004$).

Table (8): Univariate Logistic regression analysis of the factors associated with higher glaucoma severity among the study subjects

Predicting factors of the glaucoma severity	p- value	OR	95% CI	
			LL	UL
Socio-demographic characteristics				

1- Age ≥ 75 years	0.025*	1.903	1.082	3.345
2- Female gender	0.027*	3.685	1.163	11.679
3-Marital status	0.122	0.934	0.858	1.018
4-Illiterate educational level	0.001*	6.916	2.188	21.864
5-Living arrangement	0.183	2.097	0.706	6.228
6- Not enough income	0.014*	0.431	0.220	0.845
7-Occupation before retirement	0.115	1.303	0.938	1.810
Health history				
1-Diabetes Mellitus	0.025*	18.439	1.436	236.756
2-Hypertension	0.008*	43.504	2.660	711.55
3-Anemia	0.025*	29.120	1.523	556.768
4- Cataract	0.124	10.801	0.130	9.780
5-GIT diseases	0.532	1.706	0.320	9.093
6-Renal diseases	0.105	0.250	0.047	1.333
Glaucoma characteristics				
1-Type of glaucoma (Open glaucoma)	0.014*	0.231	0.120	0.865
2- Site of glaucoma	0.060	3.308	0.949	11.529
3--Previous history of glaucoma	0.001*	15.812	4.528	55.222
4-Positive family history of glaucoma	0.045*	2.014	1.017	3.987
5-Long duration of glaucoma diagnosis	0.001*	3.134	1.878	5.230
Lifestyle factors				
1- Inadequate periodic follow up for chronic diseases	0.574	1.078	0.829	1.404
2-Inadequat periodic visual follow up	0.001*	9.895	3.006	32.573
3-Smoking	0.005*	7.016	1.775	27.728
4- Daily consumption of caffeinated beverages	0.004*	6.096	1.786	20.810
5-Lack of regular exercises	0.004*	8.101	1.937	33.870
6-Lack of vegetables and fruits consumption	0.202	1.592	0.779	3.255
7-Lack of Fluid intake (less than 1.5 l/day)	0.889	0.968	0.613	1.529
8-Exposure to environmental pollutants at home	0.285	1.500	0.714	3.153
9-Exposure to environmental pollutants at previous work	0.497	1.262	0.645	2.470

CI: Confidence interval

LL: Lower limit

UL: Upper Limit

*:Statistically significant at $p \leq 0.05$.

Discussion

In recent years, the VRQoL has had an integral role in the treatment of glaucoma. The European Glaucoma Society (EGS) emphasizes the importance of promoting good visual function and adequate wellbeing as part of glaucoma treatment guidelines. ⁽³⁴⁾ Despite having higher prevalence and catastrophic impact on the patients' VRQoL and perceived wellbeing, the association between glaucoma severity, VRQoL and perceived wellbeing among older adults has not been completely addressed in the literature. ⁽³⁵⁾ Hence, the current study focuses on clarifying such association.

According to our knowledge, this is the first study that correlates glaucoma severity with VRQoL and wellbeing among Egyptian older adults. The findings of the present study revealed that the majority of the study subjects suffered from higher severity of glaucoma which ranged between severe (40%) to moderate (34.7%). This could be attributed to various sociodemographic characteristics, health related factors, and other unhealthy lifestyle factors of the study subjects (table 8) as will be discussed thereafter. This result is

in accordance with recent studies conducted by Huh et al. in Korea (2024) ⁽³⁶⁾, and Bhorade et al. in USA (2020) ⁽³⁷⁾ in which more than one half of the study sample had moderate to advanced glaucoma. Conversely, Heijl et al. (2013) reported that prevalence of undetected glaucoma increased with age, while disease severity did not increase in subjects older than 60 years. ⁽³⁸⁾

Regarding VRQoL, this study indicated that more than two fifths (42.7%) of the study subjects had fair VRQL and about one fifth (20.7%) had poor VRQoL (table 4). Several aspects of VRQoL were affected among those subjects such as; peripheral vision, central vision, seeing at night, dark and glare adaptation, adapting to lightning, and recognizing people. Daily activities were also affected including reading, walking, climbing stairs, estimating distance, outdoor mobility, and crossing roads. Ultimately, their VRQoL was negatively affected. This finding is congruent with that of a study done in Colombia (2023). ⁽³⁹⁾ Additionally, a statistically significant reverse relationship was found between severity of glaucoma and VRQoL (Table 6); as VRQL decreases when severity of glaucoma increases. The possible justification of this finding is that geriatric patients with severe glaucoma had poor performance in different visual tasks and they suffered from visual impairment that altered their capacity to carry out activities that require good vision. In a harmony with this result, Dhawan et al. in India (2019) ⁽⁴⁰⁾ concluded that older patients with severe glaucoma have reduced VRQL scores. On the other hand, one contradicting study found that excessive visual acuity loss and field deficits had a minimal impact on subjective dizziness manifestations, degree of disability, and fall-related self-efficacy. ⁽⁴¹⁾

Older adults who were included in the current study had lower levels of perceived wellbeing; nearly two thirds of them had poor perceived wellbeing (table 5). They exhibited reduction in all well-being dimensions including physical health, mental health, social life, receiving support, acceptance and resilience, feeling useful, independence, financial status, and satisfaction with living situation. Furthermore, a statistically significant correlation between severity of glaucoma and perceived wellbeing was evident in this study (table 7). This could be interpreted by the fact that as glaucoma worsens, the increased vision loss can cause feelings of vulnerability, insecurity, and diminished independent living. The threat of total blindness looms large for many people, causing anxiety that can affect many aspects of their lives. Simple everyday tasks can become difficult, which can result in depression, a decrease in self-worth and confidence, a poorer quality of life, and worse physical and mental health. ⁽⁴²⁾ In this respect, a study conducted in India by Dubey et al. (2020) supports this study's finding. It discovered that patients' functional performance was affected by severe glaucoma, and their sense of social and personal wellbeing significantly declined. ⁽⁴³⁾

A noteworthy strength of this study is that it addresses the factors responsible for causing higher glaucoma severity among the study subjects. These include various sociodemographic characteristics, health related factors, and other lifestyle factors (table 8). A statistically significant correlation is evident between the glaucoma severity and sociodemographic characteristics such as advanced age, female sex, illiterate individuals, and inadequate income. Being 70 years or more is correlated with higher glaucoma severity. This could be justified by the multiple changes that affect older adults' vision with advanced aging. The same finding is supported by other studies conducted in United States by Davuluru et al. (2023) ⁽⁴⁴⁾ and Grzybowski et al. (2020) ⁽⁴⁵⁾, which indicates that prevalence of glaucoma increases with increasing age. On the contrary, a study conducted in Scotland by Wong et al. (2023) revealed that there was no significant relationship between severity of glaucoma and increasing age. ⁽⁴⁶⁾

Female sex constituted more than one half of this study's subjects (table 1) with a statistically significant correlation with the severity of glaucoma. This could appear unsurprisingly; as women not only outlive men,

but also outnumber men in glaucoma cases worldwide ⁽⁴⁷⁾. The significant estrogen reduction following menopause beside the greater longevity and disadvantages in socioeconomic and health beliefs among older women might provide clear explanation of this finding ⁽⁴⁸⁾. This result is congruent with a study conducted in Paris by Rizk et al. (2024) ⁽⁴⁹⁾ and contradicted with Ye et al. from China (2020). ⁽⁵⁰⁾ Illiterate patients usually experience severe and recurrent glaucoma because they may have no chance to adopt a healthy lifestyle. Furthermore, educated individuals have better health access opportunities, allowing them to have regular eye examination and frequent follow up visits that facilitate earlier diagnosis. ⁽⁵¹⁾ This is supported by the present study as more than one half of the study subjects were illiterate and had higher severity of glaucoma. Similarly, a study conducted in India by Gogate et al. (2011) ⁽⁵²⁾ revealed that older patients who were less educated were more likely to have severe late presentation of glaucoma.

Inadequate income and low financial status are consistently major predictors of glaucoma severity among older adults. ⁽⁴⁴⁾ Findings of the present study illustrated that the majority of the study subjects had low income (table 1). Moreover, higher severity of glaucoma was encountered among those who hadn't enough income. The reason for this finding may be that older people with inadequate income may have difficulty in accessing healthcare and follow up services. Insufficient income may also cause non-compliance with prescribed treatment and could affect the individuals' nutritional status and their overall health. The same finding is supported by study in Korea (2019). ⁽⁵¹⁾ Regarding the health-related factors associated with increased severity of glaucoma, the current study showed that DM, HTN and anemia are among the most prevalent disorders that are significantly associated with higher severity of glaucoma. This association can be explained by the effect of such diseases on blood circulation and dysregulation of the IOP. ^(53,54) Several previous studies reported a significant association between glaucoma severity and HTN or DM or both. ^(55,56)

Other certain glaucoma characteristics were linked to higher severity of glaucoma in this study including type of glaucoma, previous glaucoma history, positive family history, and long duration of glaucoma diagnosis. In the current study, open glaucoma was the most prevalent type. It often develops gradually without noticeable symptoms until advanced stages and severity occur. ⁽⁵⁷⁾ This could provide an explanation of the increased glaucoma severity among those study subjects. At the same line with these findings, a study conducted in Australia found that glaucoma occurred about three years earlier and was more severe when other members of the family had the disease. ⁽⁵⁸⁾

Concerning older adults' lifestyle, certain unhealthy lifestyle factors were associated with increased glaucoma severity in this study. Smoking is considered one of the modifiable risk factors for glaucoma and a predictor of glaucoma severity. ⁽⁵⁹⁾ This was declared in the current study and can be justified as smoking can accelerate degenerative changes and damage the trabecular meshwork that could increase severity of the condition over time ⁽⁶⁰⁾.

In contrast to a previous study which reported that caffeine consumption has no impact on glaucoma severity. ⁽⁶¹⁾, the current study showed significant association between glaucoma severity and daily caffeine consumption. This is at the same line with a study which found that consuming daily caffeine may increase glaucoma severity more than threefold. ⁽⁶²⁾ The current study also found that inadequate regular exercise and lack of visual follow up were both linked with greater severity of glaucoma. It appeared reasonable that inadequate exercise and follow up could be predictors of increased glaucoma severity as; regular exercises are important for enhancing sufficient blood supply to the eye structures. As well, periodic follow up is essential to monitor disease progression and treatment compliance. In accordance, a study conducted in San Francisco (2024) ⁽⁶³⁾ found that regular moderate physical activity decreased the average rate of visual field

loss by approximately 10 percent. In general, identifying association of glaucoma severity with these sociodemographic, lifestyle, and health related factors could provide essential basis for developing comprehensive interventions for addressing and managing glaucoma among older patients.

From the foregoing discussion in this study, severity of glaucoma acts as mediator in the relationship between VRQoL and perceived wellbeing. More specifically, higher glaucoma severity induces greater vision impairment that is associated with a reduced VRQoL and lower perceived wellbeing. This is suggesting that when glaucoma severity is controlled, as a result, the older adults' VRQoL and perceived wellbeing can be improved. This emphasizes the greater role of the ophthalmic gerontological nurses in early identification of geriatric patients with glaucoma and planning for effective interventions.

Conclusion:

According to this study's findings, it can be concluded that glaucoma severity has a statistically significant relationship with the VRQoL and perceived wellbeing among older adults. Furthermore, factors associated with higher severity of glaucoma among older adults are related to various sociodemographic characteristics, health related factors, certain glaucoma characteristics, and other unhealthy lifestyle factors.

Recommendations:

Recommendations intended for gerontological nurses and older adults:

1. Periodic screening of the glaucoma severity and visual function for older adults with glaucoma should be adopted as an integral part of the gerontological nurses' regular assessment, and it should be incorporated into the routine care of those patients.
2. Hand-out printed booklet should be done by nurses and given to each older adult with glaucoma admitted to the outpatient clinics. This booklet will illustrate the components of controlling the disease and preventing further vision loss through maintaining a healthy diet, practicing regular exercise, and adhering to recommended treatment and periodic follow up.
3. Continuous health educational programs for older adults with glaucoma and their family to improve, update, and refresh their knowledge regarding the disease and importance of maintaining healthy lifestyle for achieving control of glaucoma severity, and therefore minimizing further deterioration of their visual function and perceived wellbeing.

Recommendations intended for future research:

1. Future research should investigate the efficacy of nursing interventions program on reducing glaucoma severity and improving visual related quality of life and perceived wellbeing among older adults.

Study Limitations

Some limitations should be acknowledged in this study such as applying a convenience sample for the participants' allocation could limit generalization of the study findings due to lack of randomization. Additionally, recall bias may result from the use of some self-reported tools during data collection.

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