

# Lack of perceived social support contributes to depression and anxiety in patients with glaucoma

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## Abstract

*Purpose:* To determine the prevalence and associated factors for depression and anxiety among glaucoma patients in a tertiary referral centre. Their relationship with perceived social support is also explored.

*Study design:* Cross-sectional study involving 176 glaucoma patients.

*Methods:* Patients with known psychiatric illness, physical limitations, and other visually debilitating ocular conditions were excluded. Measurement tools included the Hospital Anxiety and Depression Scale (HADS) and Multidimensional Scale of Perceived Social Support (MSPSS). Ocular examination parameters such as LogMAR visual acuity, mean deviation (MD) on standard automated perimetry, and intraocular pressure (IOP) were recorded along with sociodemographic and clinical history. Multivariate linear regression analysis was carried out to identify predictive factors for depression and anxiety.

*Results:* The prevalence of depression and anxiety among glaucoma patients was 6.8% and 9.1% respectively. MSPSS scores were significantly lower in patients with depression ( $p = 0.019$ ) and anxiety ( $p = 0.016$ ). Patients with depression and anxiety had significantly worse visual acuity and MD values. After adjustment with multiple regression analysis, depression or anxiety were still significantly associated with MD values (depression  $b = -0.13$ ,  $p < 0.001$ , whereas anxiety  $b = -0.10$ ,  $p = 0.001$ ) and MSPSS scores ( $b = -0.08$ ,  $p < 0.001$ ). IOP of the worse eye

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was associated with anxiety ( $b = 0.2$ ,  $P = 0.002$ ), whereas widowed status was associated with depression ( $p < 0.005$ ).

*Conclusions:* Analysed HADS scores in this study show depression and anxiety rates among glaucoma patients in this population are relatively low. Severe glaucoma and lack of perceived social support are significant predictive factors. The findings underline the importance of screening for depression and anxiety in glaucoma patients to provide psychosocial intervention where needed.

*Keywords:* anxiety, depression, glaucoma, perceived social support, prevalence

## **Kekurangan Persepsi Sokongan Sosial Menyumbang Kepada Kemurungan Dan Keresahan Pesakit Glaukoma**

### **Abstrak**

*Tujuan:* Untuk menentukan kadar kelaziman dan faktor-faktor yang menyumbang kepada kemurungan dan keresahan di kalangan pesakit glaukoma yang dirawat di hospital tertuari. Hubungkait dengan persepsi sokongan sosial yang diterima pesakit juga dikaji.

*Jenis kajian:* “Cross-sectional study” melibatkan 176 pesakit glaukoma.

*Kaedah:* Pesakit yang menghidap masalah psikiatrik, kekurangan upaya fizikal dan mempunyai masalah mata jenis bukan glaukoma tidak dijemput untuk menyertai kajian. Soal selidik yang digunakan termasuklah Skala Gejala Kemurungan Dan Keresahan di Hospital (HADS) dan Skala Multidimensi Persepsi Sokongan Sosial (MSPSS). Pemeriksaan mata yang diuji termasuklah tahap penglihatan, markah purata pesongan (Mean Deviation) di mesin yang mengukur medan penglihatan dan tekanan bola mata. Rekod kesihatan dan demografik pesakit juga dicatat. Analisa ‘Multivariate linear regression’ telah dijalankan untuk mengenalpasti penyumbang utama kemurungan dan keresahan pesakit.

*Keputusan:* Kadar kelaziman kemurungan dan keresahan adalah masing-masing 6.8% dan 9.1% di kalangan pesakit glaukoma. Markah MSPSS ketara lebih rendah di kalangan pesakit yang murung ( $p = 0.019$ ) dan pesakit yang resah ( $p = 0.016$ ). Pesakit yang murung dan resah mempunyai tahap penglihatan yang lebih teruk dan medan penglihatan yang lebih tertutup (nilai MD rendah). Setelah analisa “multiple regression” diselaraskan, pesakit yang murung dan resah masih lagi menunjukkan keputusan yang ketara untuk dikaitkan dengan nilai MD (kemurungan  $b = -0.13$ ,  $p < 0.001$ , manakala keresahan  $b = -0.10$ ,  $p = 0.001$ ) dan markah MSPSS ( $b = -0.08$ ,  $p < 0.001$ ). Tekanan bola mata pula turut dikaitkan

dengan perasaan resah ( $b = 0.2$ ,  $P = 0.002$ ), manakala status janda atau duda dikaitkan dengan perasaan kemurungan ( $p < 0.005$ ).

*Kesimpulan:* Markah HADS yang telah dianalisa dalam kajian ini menunjukkan kadar kemurungan dan keresahan di kalangan pesakit glaukoma rendah berbanding dengan negara lain. Glaukoma yang diperingkat akhir dan kekurangan persepsi sokongan sosial yang diterima adalah antara faktor penentu. Kajian ini telah mencerminkan kepentingan membuat saringan kemurungan dan keresahan di kalangan pesakit glaukoma supaya intervensi awal dapat dilakukan.

*Kata kunci:* glaukoma, kadar kelaziman, kemurungan, keresahan, persepsi sokongan sosial

## Introduction

Glaucoma is a chronic eye condition and the second leading cause of blindness worldwide.<sup>1</sup> The number of individuals estimated to be blind from glaucoma is 4.5 million, accounting for more than 12% of all global blindness.<sup>2</sup> In Malaysia, the 2014 National Eye Survey II showed an estimated prevalence of blindness in those aged 50 and above was at 1.2%, of which 6.6% was caused by glaucoma.<sup>3</sup>

The latest report released by Malaysia's National Health Morbidity Survey in 2015 revealed that the prevalence of mental health problems among adults aged 16 years and above shows an increasing trend, escalating from 10.7% in 1996 to 29.2% in 2015.<sup>4</sup> These increasing trends are similarly found in other Asian nations such as Singapore and India.<sup>5,6</sup> At the same time, a meta-analysis conducted by Yajing *et al.* of 28 pooled selected studies reported the prevalence of depression or depressive symptoms with any ocular disease was 25% (1,502/6,589 individuals, 95% CI, 0.20–0.30), with values ranging from 5.4% to 57.0%.<sup>7</sup> The highest prevalence was among patients with dry eye disease (29%), followed by glaucoma (25%), age-related macular degeneration (24%), and cataracts (23%).<sup>7</sup>

Psychiatric problems such as depression and anxiety are often present in glaucoma patients receiving treatment.<sup>7-12</sup> Previous studies also reported that patients with glaucoma often have coexisting anxiety disorder, with the prevalence between 13.0% and 33.0%.<sup>7-10,13,14</sup> For depressive disorders, the reported prevalence is between 10% and 57%.<sup>8-10,12,16-18</sup> These conditions often lead to unreliable Humphrey Visual Field tests and reduce quality of life for the patient.<sup>8,9,19,20</sup> Depression and anxiety may arise in glaucoma patients due to the fear of potential blindness, heavy economic burden caused by multiple medications and surgeries, and impaired ability to perform daily activities such as driving and reading.<sup>8,21,22</sup> The majority of the studies have concluded that the severity of visual field defects has a direct association with depression and anxiety among glaucoma patients.<sup>8,12,17,23,24</sup>

Perceived social support refers to the perceived availability and adequacy of social connections.<sup>25</sup> Previous studies have shown the importance of social support and how it contributes to good mental health and improved quality of life among different medical conditions.<sup>26-29</sup> The aim of this study was to determine the prevalence and associated factors for depression and anxiety among glaucoma patients in a tertiary referral centre. Their relationship with perceived social support was also explored. To our knowledge, this is the first study linking depression and anxiety with perceived social support among glaucoma patients in Malaysia.

## Methods

This was a cross-sectional, observational study undertaken in the Ophthalmology Clinic in a tertiary referral hospital in Malaysia. The study was conducted from August 2018 to August 2019. It was approved by the institution's Medical Research Ethics Committee (MREC 201873-6439). All participants signed an informed consent form before starting the interview session. The study adhered to the tenets of the declaration of Helsinki.

Patients with glaucoma were diagnosed based on European Glaucoma Society criteria, *i.e.*, patients who showed signs of progressive optic neuropathy characterised by morphological changes of the optic nerve head and retinal nerve fibre layer with corresponding visual field defect.<sup>15</sup> We included all patients diagnosed with any type of glaucoma, primary or secondary. Other inclusion criteria were participants aged 18 years old and above, diagnosed to have glaucoma at least 1 month before the interview, able to consent for the interview, and able to communicate in Bahasa Malaysia or English. We excluded patients diagnosed with any psychiatric disorders or physical disabilities other than visual disability, such as being mute, deaf, amputees, and those with total life dependency under treatment with systemic beta-blockers for hypertension or any other conditions deemed likely to contribute to mental health problems. To ensure that the visual impairments were only attributable to glaucoma, we also excluded patients with other causes of blindness including severe macular disease, dense cataract, any retinal disorders, and amblyopia.

## Questionnaire

The interview session was carried out in a private quiet room in the eye clinic by a trained interviewer (MFH). The measurement tool used is the Hospital Anxiety and Depression Scale (HADS).<sup>9,12,31</sup> This scale was developed by Zigmond and Snaith to identify and quantify the two most common forms of psychological disturbances, namely depression and anxiety, in physically ill patients in a non-psychiatric setting.<sup>31</sup> The original HADS was translated into Bahasa Malaysia and

validated.<sup>32</sup> The scale consists of seven items for depression and seven items for anxiety, which are scored using the Likert scale from 0 to 3. The calculation is by summation of the scores for all items. The cut-off scores used in the current study is ten, by which 0–10 indicates lack of depression/anxiety and 11–21 indicates that depression/anxiety are present.

Another measurement tool used in the study is the Multidimensional Scale of Perceived Social Support (MSPSS). This scale includes a scoring system for social support that patients receive from family, friends, and significant others.<sup>33</sup> The mean value of 12 components was used to categorize the subjects into low, moderate, and high perceived social support. Scores of 1.0–2.9 indicate low support, 3.0–5.0 indicate moderate support, and 5.1–7.0 indicate high social support.<sup>33</sup>

### **Statistical analysis**

Using a sample size calculator to estimate a single proportion with a level of confidence of 0.95 and based on a prevalence of 10–57% for depression and 13–33% for anxiety, 13% was taken as a factor of interest.<sup>8,9,12,16-18</sup> By assuming 13% of the subjects in the population have the factor of interest, the study required a sample size of 174 patients for estimating the expected proportion with 5% absolute precision and 95% confidence. Data were collected and analysed using SPSS software version 25 (SPSS, Inc., Chicago, IL, USA). Numerical variables were presented using mean, standard deviation, median, interquartile range, and range. Categorical variables were presented as frequency and percentage. The median score of each numerical variable between normal patients and depression/anxiety patients was compared using the Mann-Whitney test. The association of categorical variables and severity of disease was determined using Pearson's chi-squared test with exact *p*-value or Fisher's exact test if the previous test did not hold its statistical assumption. For models with a continuous outcome, we used a linear rather than a logistic regression model to determine the influence of risk factors on depression and anxiety. Factors that were of statistical significance in the univariate analysis were included for multivariable linear regression analysis. The distribution of residuals in these models are less likely to diverge from normality. Additionally, linear models provide a robust estimate of the difference even when the data are not normally distributed.<sup>34</sup> Statistical significance was defined by a *p*-value of less than 0.05.

## **Results**

A total of 190 eligible patients were approached but only 176 patients consented to participate in the study (93% response rate). The sociodemographic characteristics of the patients are presented in Table 1. The majority of patients were

male (56.8%), married (68.8%), and had completed at least secondary education (81.8%). Two-thirds were retired (66.5%) and had perceived high social support with MSPSS median score of 5.58. For clinical characteristics, most participants

Table 1. Sociodemographic characteristics of the study population ( $N = 176$ )

Variable	Mean (SD)
Age, years (SD)	67.5 (13.3)
<b>Gender, <math>n</math> (%)</b>	
Male	100 (56.8)
Female	76 (43.2)
<b>Ethnicity, <math>n</math> (%)</b>	
Malay	57 (32.4)
Chinese	77 (43.8)
Indian	37 (21.0)
Other	5 (2.8)
<b>Marital status, <math>n</math> (%)</b>	
Single	22 (12.5)
Married	121 (68.8)
Divorced/widowed	33 (18.8)
<b>Education, <math>n</math> (%)</b>	
No formal education	3 (1.7)
Primary education	29 (16.5)
Secondary education	74 (42.0)
Tertiary education	70 (39.8)
<b>Occupation, <math>n</math> (%)</b>	
Unemployed	29 (16.5)
Working full time	23 (13.1)
Working part time	7 (4.0)
Retired	117 (66.5)
<b>MSPSS mean score</b>	
Mean (SD)	5.53 (1.12)
Median (IQR)	5.58 (1.57)
Range	1.58–7.00

MSPSS: Multidimensional Scale of Perceived Social Support; SD: standard deviation; IQR: interquartile range

had a severe level of glaucoma in the worse eye (mean MD -13.93 dB), more than half had been diagnosed for more than 3 years (51%), and most had bilateral disease (89.2%). The study patients had an average HADS-D score of 4.41 and HADS-A score of 4.43 (Table 2).

There was no statistical difference in demographic factors between patients with and without depression or those with and without anxiety. Participants with depression or anxiety had significantly lower MSPSS scores (Table 3). For ocular factors, patients with anxiety had significantly worse LogMAR visual acuity in the worse eye, while both arms of patients had lower MD values on standard automated perimetry (Table 4).

Table 2. Clinical characteristics of study population ( $N = 176$ )

Variable	Mean (SD)
LogMAR VA worse eye	0.59 (0.62)
MD in worse eye, dB	-13.93 (9.95)
IOP worse eye, mmHg	16.49 (6.11)
<b>Type of glaucoma, <math>n</math> (%)</b>	
Primary	140 (79.5)
Secondary	36 (20.5)
<b>Duration, <math>n</math> (%)</b>	
< 12 Months	19 (10.7)
12–60 Months	65 (36.5)
> 60 Months	92 (51.7)
<b>Laterality, <math>n</math> (%)</b>	
Unilateral	19 (10.8)
Bilateral	157 (89.2)
<b>Number of glaucoma surgeries, <math>n</math> (%)</b>	
Nil	114 (64.0)
1	42 (23.6)
> 1	20 (11.2)
<b>Type of glaucoma surgery, <math>n</math> (%)</b>	
Nil	112 (62.9)
Laser	20 (11.2)
Surgery	40 (22.5)
Surgery + laser	4 (2.2)

Variable	Mean (SD)
<b>Number of glaucoma eyedrops, n (%)</b>	
0	9 (5.1)
1	66 (37.5)
2	27 (15.3)
3	36 (20.5)
4	38 (21.6)
Use of topical beta-blockers	102(60%)
Mean HADS-D score	4.41 (3.57)
Frequency of depression, n (%)	12 (6.8)
Mean HADS-A score	4.43 (3.93)
Frequency of anxiety, n (%)	16 (9.1)

VA: visual acuity; MD: mean deviation on Humphrey Visual Field test; IOP: intraocular pressure; HADS-D: Hospital Anxiety and Depression Scale for Depression; HADS-A: Hospital Anxiety and Depression Scale for Anxiety

Table 3. Comparison of demographic factors associated with depression and anxiety among patients with glaucoma ( $N = 176$ )

Variable	Without depression $N = 164$	Depression $N = 12$	$p$ -value	Without anxiety $N = 160$	Anxiety $N = 16$	$p$ -value
<b>Gender, n (%)</b>						
Male	92 (56.1)	8 (66.7)	0.557*	90 (56.3)	10 (62.5)	0.793*
Female	72 (43.9)	4 (33.3)		70 (43.8)	6 (37.5)	
<b>Age mean (SD)</b>	68(13)	63(17)	0.774*	68(11)	68(14)	0.663*
<b>Ethnicity, n (%)</b>						
Malay	54 (32.9)	3 (25.0)	0.743**	52 (32.5)	5 (31.3)	0.747**
Chinese	72 (43.9)	5 (41.7)		71 (44.4)	6 (37.5)	
Indian	33 (20.1)	4 (33.3)		32 (20.0)	5 (31.3)	
Other	5 (3.0)	0 (0.0)		5 (3.1)	0 (0.0)	

Variable	Without depression N = 164	Depression N = 12	p-value	Without anxiety N = 160	Anxiety N = 16	p-value
<b>Marital status, n (%)</b>						
Single	19 (11.6)	3 (25.0)	0.303**	21 (13.1)	1 (6.3)	0.691**
Married	115 (70.1)	6 (50.0)		110 (68.8)	11 (68.8)	
Divorced/ Widowed	4 (2.4)	0 (0.0)		4 (2.5)	0 (0.0)	
Widow	26 (15.9)	3 (25.0)		25 (15.6)	4 (25.0)	
<b>Education, n (%)</b>						
No formal education	3 (1.8)	0 (0.0)	0.278**	3 (1.9)	0 (0.0)	0.334**
Primary education	27 (16.5)	2 (16.7)		24 (15.0)	5 (31.3)	
Secondary education	66 (40.2)	8 (66.7)		67 (41.9)	7 (43.8)	
Tertiary education	68 (41.5)	2 (16.7)		66 (41.3)	4 (25.0)	
<b>Occupation, n (%)</b>						
Unemployed	27 (16.5)	2 (16.7)	0.939**	25 (15.6)	4 (25.0)	0.249**
Working full time	21 (12.8)	2 (16.7)		23 (14.4)	0 (0.0)	
Working part time	7 (4.3)	0 (0.0)		6 (3.8)	1 (6.3)	
Retired	109 (66.5)	8 (66.7)		106 (66.3)	11 (68.8)	
<b>Income, n (%)</b>						
< 1000	25 (15.2)	3 (25.0)	0.628**	25 (15.6)	3 (18.8)	0.607**
1001–3000	49 (29.9)	3 (25.0)		47 (29.4)	5 (31.3)	
3001–5000	43 (26.2)	4 (33.3)		42 (26.3)	5 (31.3)	
5001–7000	25 (15.2)	2 (16.7)		24 (15.0)	3 (18.8)	
> 7000	22 (13.4)	0 (0.0)		22 (13.8)	0 (0.0)	
<b>Household, n (%)</b>						
1–2	61 (37.2)	3 (25.0)	0.559**	60 (37.5)	4 (25.0)	0.467*
3–5	78 (47.6)	6 (50.0)		74 (46.3)	10 (62.5)	
> 5	25 (15.2)	3 (25.0)		26 (16.3)	2 (12.5)	

Variable	Without depression N = 164	Depression N = 12	p-value	Without anxiety N = 160	Anxiety N = 16	p-value
<b>MSPSS score</b>						
Mean (SD)	5.60 (1.05)	4.52 (1.57)	<b>0.019***</b>	5.60 (1.10)	4.87 (1.18)	<b>0.016***</b>
Range	2.00–7.00	1.58–6.75		1.58–7.00	2.41–6.41	

VA: visual acuity; IQR: interquartile range; SD: standard deviation

\*Pearson's Chi-Squared test with exact p-value

\*\*Fisher's exact test

\*\*\*Mann-Whitney test

Table 4. Comparison of clinical factors associated with depression and anxiety among patients with glaucoma (n = 176)

Variable	Without depression (N = 164)	Depression (N = 12)	p-value	Without anxiety (N = 160)	Anxiety (N = 16)	p-value
<b>LogMAR VA in worse eye</b>						
Median (IQR)	0.30 (0.60)	0.70 (1.30)	<b>0.082*</b>	0.30 (0.60)	1.00 (1.20)	<b>0.001*</b>
<b>Mean deviation in worse eye (dB)</b>						
Median (IQR)	-11.22 (16.23)	-28.46 (13.68)	<b>0.004*</b>	-10.65 (16.63)	-17.45 (15.19)	<b>0.001*</b>
<b>IOP in worse eye (mmHg)</b>						
Median (IQR)	15.00 (5.00)	16.00 (6.00)	0.883*	15.00 (5.00)	16.0 (7.00)	0.126*
<b>Type of glaucoma, n (%)</b>						
Primary	130 (79.3)	10 (83.3)	0.957***	126 (78.8)	14 (87.5)	0.531***
Secondary	34 (20.7)	2 (16.7)		34 (21.3)	2 (12.5)	
<b>Duration of glaucoma</b>						
< 12 Months	18 (11.0)	1 (8.3)	0.910***	17 (10.6)	2 (12.5)	0.934**
12–60 Months	60 (36.6)	5 (41.7)		60 (37.5)	5 (31.3)	
> 60 Months	86 (52.4)	6 (50.0)		83 (51.9)	9 (56.3)	

Variable	Without depression (N = 164)	Depression (N = 12)	p-value	Without anxiety (N = 160)	Anxiety (N = 16)	p-value
<b>Laterality, n (%)</b>						
Unilateral	18 (11.0)	1 (8.3)	0.982***	18 (11.3)	1 (6.3)	> 0.999**
Bilateral	146 (89.0)	11 (91.7)		142 (88.8)	15 (93.8)	
<b>Number of glaucoma surgeries, n (%)</b>						
Nil	106 (64.6)	8 (66.7)	0.535***	106 (66.3)	8 (50.0)	0.349***
1	38 (23.2)	4 (33.3)		36 (22.5)	6 (37.5)	
> 1	20 (12.2)	0 (0.0)		18 (11.3)	2 (12.5)	
Type of glaucoma surgery, n (%)						
Nil	104 (63.4)	8 (66.7)	0.857***	105 (65.6)	7 (43.8)	0.167***
Laser	18 (11.0)	2 (16.7)		16 (10.0)	4 (25.0)	
Surgery	38 (23.2)	2 (16.7)		35 (21.9)	5 (31.3)	
Surgery and laser	4 (2.4)	0 (0.0)		4 (2.5)	0 (0.0)	
<b>Number of glaucoma eyedrops, n (%)</b>						
0	9 (5.5)	0 (0.0)	0.939***	9 (5.6)	0 (0.0)	0.182***
1	60 (36.6)	6 (50.0)		63 (39.4)	3 (18.8)	
2	26 (15.9)	1 (8.3)		25 (15.6)	2 (12.5)	
3	34 (20.7)	2 (16.7)		32 (20.0)	4 (25.0)	
4	35 (21.3)	3 (25.0)		31 (19.4)	7 (43.8)	

VA: visual acuity; IQR: interquartile range

\*Mann-Whitney test

\*\*Pearson's chi-squared test with exact p-value

\*\*\*Fischer's exact test

Univariate regression analysis showed that divorced status, lower MSPSS scores, visual acuity, and MD values were significantly associated with depression (Table 5). Whereas for anxiety, it was associated with lower income, lower MSPSS score, visual acuity, MD values, recent diagnosis, and a higher number of glaucoma surgeries. From the multivariable analysis, factors that remained associated with depression were MD values, MSPSS scores, and widowed status (Table 6). When MSPSS and marital status were controlled for, an increase in MD value by 1 unit resulted in a decrease of HADS-D score by 0.13 points on average ( $b = -0.13, P < 0.001$ ). When the MSPSS score increased by 1 point, the HADS-D score was reduced by 0.08 points ( $b = -0.08, P < 0.001$ ). Widowed status was a significant factor for depression.

For anxiety, the multivariable analysis showed significant factors included MD values, MSPSS scores, and intraocular pressure (IOP) in the worse eye. With every increase in MD by 1 unit, the anxiety score decreased by 0.10 points on average ( $b = -0.10, P = 0.001$ ) with the adjustment of MSPSS and marital status. When the MSPSS score increased by 1 point, the HADS-A score was reduced by 0.08 points ( $b = -0.08, P < 0.001$ ) when other factors were adjusted. With every unit increment in IOP, the patient had 0.20 units higher in HADS-A score on average, with adjustment of MD and MSPSS ( $b = 0.20, P = 0.002$ ).

Table 5. Association factor of HADS-D AND HADS-A scores using univariate linear regression analysis ( $N = 176$ )

Variable	Depression (HADS-D)			Anxiety (HADS-A)		
	b (se)	95% CI	p-value	b (se)	95% CI	p-value
<b>Gender</b>						
Male	-0.10 (0.55)	-1.18, 0.97	0.849	-0.59 (0.60)	-1.78, 0.59	0.323
Female	Ref			Ref		
Age	-0.02 (0.02)	-0.06, 0.03	0.469	-0.02 (0.02)	-0.06, 0.03	0.394
<b>Ethnicity</b>						
Other	0.74 (1.68)	-2.58, 4.05	0.661	-2.07 (1.84)	-5.69, 1.56	0.262
Chinese	0.30 (0.63)	-0.95, 1.54	0.639	-0.58 (0.69)	-1.93, 0.78	0.404
Indian	0.01 (0.76)	-1.49, 1.51	0.993	0.33 (0.83)	-1.31, 1.97	0.689
Malay	Ref			Ref		

Variable	Depression (HADS-D)			Anxiety (HADS-A)		
	b (se)	95% CI	p-value	b (se)	95% CI	p-value
<b>Marital status</b>						
Single	-1.15 (1.00)	-3.14, 0.83	0.252	-0.84 (1.11)	-3.04, 1.35	0.45
Married	-1.27 (0.73)	-2.72, 0.18	0.086	-0.88 (0.81)	-2.48, 0.73	0.283
Divorced	-3.77 (1.89)	-7.51, -0.03	<b>0.048</b>	-3.21 (2.10)	-7.35, 0.94	0.128
Widow	Ref			Ref		
<b>Education level</b>						
No formal Education	0.07 (2.17)	-4.21, 4.35	0.975	-3.37 (2.39)	-8.08, 1.35	0.16
Secondary education	-0.22 (0.78)	-1.76, 1.33	0.784	-0.48 (0.86)	-2.18, 1.22	0.578
Tertiary education	-1.02 (0.79)	-2.58, 0.54	0.200	-0.93 (0.87)	-2.65, 0.79	0.286
Postgraduate	-4.93 (3.63)	-12.10, 2.24	0.177	2.97 (4.01)	-4.94, 10.87	0.46
Primary education	Ref			Ref		
<b>Occupation</b>						
Unemployed	0.50 (0.75)	-0.97, 1.97	0.501	0.60 (0.82)	-1.02, 2.22	0.468
Working full time	-0.07 (0.82)	-1.69, 1.54	0.929	0.42 (0.90)	-1.36, 2.20	0.641
Working part time	1.28 (1.40)	-1.48, 4.04	0.361	1.06 (1.54)	-1.98, 4.09	0.494
Retired	Ref			Ref		
<b>Household income</b>						
< 1000	1.87 (1.02)	-0.14, 3.88	0.068	2.35 (1.11)	0.15, 4.55	0.036
1001–3000	1.15 (0.91)	-0.64, 2.94	0.207	1.21 (1.00)	-0.75, 3.18	0.224
3001–5000	0.90 (0.92)	-0.92, 2.72	0.332	2.03 (1.01)	0.04, 4.03	<b>0.046</b>
5001–7000	1.73 (1.03)	-0.30, 3.75	0.094	1.88 (1.12)	-0.34, 4.10	0.097

Variable	Depression (HADS-D)			Anxiety (HADS-A)		
	b (se)	95% CI	p-value	b (se)	95% CI	p-value
>7000	Ref			Ref		
MSPSS score	-1.11 (0.23)	-1.55, -0.66	<b>&lt; 0.001</b>	-0.80 (0.26)	-1.31, -0.29	<b>0.002</b>
LogMAR VA in worse eye	1.65 (0.42)	0.82, 2.49	<b>&lt; 0.001</b>	1.28 (0.48)	0.35, 2.22	0.008
MD in worse eye	-0.13 (0.03)	-0.18, -0.08	<b>&lt; 0.001</b>	-0.09 (0.03)	-0.15, -0.03	<b>0.004</b>
IOP in worse eye	0.04 (0.04)	-0.05, 0.13	0.386	0.09 (0.05)	-0.01, 0.19	0.062
<b>Type of glaucoma</b>						
Primary	-0.11 (0.67)	-1.43, 1.22	0.873	-0.83 (0.73)	-2.28, 0.62	0.262
Secondary	Ref			Ref		
Duration (months)	-0.06 (0.05)	-0.17, 0.04	0.234	-0.14 (0.06)	-0.25, -0.02	<b>0.019</b>
<b>Laterality</b>						
Unilateral	-0.35 (0.87)	-2.06, 1.37	0.691	0.11 (0.96)	-1.78, 2.00	0.907
Bilateral	Ref			Ref		
Number of glaucoma surgeries	0.65 (0.35)	-0.03, 1.33	0.059	0.76 (0.38)	0.01, 1.51	<b>0.047</b>
Number of eye drops	0.31 (0.21)	-0.10, 0.73	0.139	0.43 (0.23)	-0.03, 0.89	0.064
Use of topical beta-blockers	0.13 (0.54)	-1.2, 0.95	0.809	0.6 (0.601)	-0.59, 1.78	0.323

VA: visual acuity; MD: mean deviation on Humphrey Visual Field test; IOP: intraocular pressure; HADS-D: Hospital Anxiety and Depression Scale for Depression; HADS-A: Hospital Anxiety and Depression Scale for Anxiety; MSPSS: Multidimensional Scale of Perceived Social Support; REF: Reference

Table 6. Factors associated with depression (HADS-D) and anxiety (HADS-A) in patients with glaucoma by multivariable linear regression analysis ( $N = 151$ )

Variable	Depression			Anxiety		
	b (se)	95% CI	p-value	b (se)	95% CI	p-value
MD worse eye	-0.13 (0.03)	-0.18, -0.08	< 0.001	-0.10 (0.03)	-0.15, -0.04	0.001
MPSS score	-0.08 (0.02)	-0.12, -0.05	< 0.001	-0.08 (0.02)	-0.12, -0.04	< 0.001
IOP worse eye	-	-	-	0.20 (0.07)	0.08, 0.33	0.002
<b>Marital status</b>						
Single	-2.02 (0.94)	-3.88, -0.17	0.033	-	-	-
Married	-2.05 (0.70)	-3.44, -0.65	0.004	-	-	-
Divorcee	-3.99 (1.64)	-7.23, -0.75	0.016	-	-	-
Widow	Ref			-	-	-

MD: mean deviation on Humphrey Visual Field test; MPSS: Multidimensional Scale of Perceived Social Support; IOP: intraocular pressure; b: unstandardized regression coefficient; CI: confidence interval; se: standard error; Ref: reference. Multivariable regression analysis was applied; adj.  $R^2 = 0.278$ ; residual plot showed the residual was normally distributed and scattered around the band of 0.

## Discussion

In the current study, the prevalence of depression and anxiety among glaucoma patients was 6.9% and 9.2%, respectively. For depression, this prevalence is slightly lower than the national average in Malaysia of 8–12%.<sup>27</sup> However, the prevalence of anxiety is slightly higher than the national average, which is quoted as 0.4–5.6%.<sup>35</sup> Our prevalence values are much lower (depression 6.9% *versus* 30%, anxiety 9.2% *versus* 64%) compared to a similar study done in Singapore, where cultural and ethnic distribution are similar to Malaysia.<sup>8,36</sup> Furthermore, compared to other Asian countries, the prevalence of anxiety disorders among glaucoma patients in Malaysia was much lower than in Pakistan (33.0%), China (22.92%), Turkey (13.5%), and Japan (13.0%).<sup>9–12</sup> Similarly, the prevalence of depression in our study was lower than in Pakistan (24.0%), Australia (19.9%), China (16.4%), America (10.9%), and Turkey (57.0%).<sup>9,11,12,17,18</sup>

The differences in prevalence may be attributed to the variety of study designs employed. Many of the studies focused on different types of glaucoma, for example, among primary glaucoma only.<sup>8,10</sup> Furthermore, the differences in prevalence can also be attributed to socioeconomic differences among other countries.<sup>37,38</sup> There have been no studies to determine which scale is superior as a screening tool for depression and anxiety among glaucoma patients. Questionnaires used by other studies include the Self Rating Depression Scale (SDS), Beck Depression Index (BDI II), Patient Health Questionnaire (PHQ 9), Geriatric Depression Scale (GDS 15), Hamilton Depression Rating Scale (HRDS), and Hamilton Depression/Anxiety Rating Scale (HAM-D and HAM-A).<sup>7,8</sup> However, the common assessment tools used in Malaysia are the Beck Depression Inventory (BDI), Depression, Anxiety and Stress Scale (DASS), and Patient Health Questionnaire 9 (PHQ-9), in addition to the Hospital Anxiety and Depression Scale (HADS) used in this study.<sup>31</sup> All these questionnaires were validated in Bahasa Malaysia, which is the national language.<sup>27,32,39–41</sup> We selected HADS as it was the most commonly used in clinical studies. The items used in the scales are also suitable for a non-psychiatric setting.

The findings in this study are in agreement with previous studies that found patients with more severe glaucoma are predisposed to a higher risk of depression and anxiety.<sup>8,9,12,16,18</sup> A lower MD value reflects the patient's functional visual status; several studies have shown that diminished functional vision affects their quality of life. Activities adversely affected include walking, standing, reading, sleep quality; impaired ability to perform these daily activities may eventually lead to depression.<sup>8,9,20,23</sup>

Our study found that higher IOP in the affected eye is associated with increased anxiety, in contrast with other studies that did not find any association with IOP.<sup>9,10,12,16</sup> Uncontrolled or high IOP in glaucoma patients might lead to significant anxiety due to worry about the loss of sight in the affected eye. Physical manifestations of anxiety include fatigue, restlessness, and difficulty sleeping, which may mimic the

side effects of an antiglaucoma medication.<sup>42-44</sup> Thus, the treating physician should attempt to discern the root cause of the symptoms before stopping any topical antiglaucoma medication. If it is attributable to anxiety, the patient may require psychological intervention rather than cessation of medication or even surgery.

Lack of perceived social support was highly associated with depression and anxiety in this study. This is the first study to show its link with depression and anxiety in glaucoma patients. It is in agreement with many other studies conducted in Malaysia among the general population, where a lack of social support is a predisposing factor for depression.<sup>27,43</sup> Strong social support is also needed to improve the patients' quality of life and eventually leads to good adherence to antiglaucoma medications and compliance to follow-up in clinics.<sup>46-48</sup> In Malaysia, like most Asian nations, societal support is heavily dependent on close family ties or extended relatives. A systematic review by Tengku Mohd *et al.* concluded that the family institution plays a big role in addressing intervention programmes for depression in the Asian population.<sup>49</sup>

Interestingly, widowed status in glaucoma patients was found to be a significant risk factor for depression in our study. This contrasts with a study by Tastan *et al.* in Turkey that found unmarried glaucoma patients had higher levels of depression.<sup>9</sup> Yet another study in Singapore found no association between marital status and depression or anxiety.<sup>8</sup> This factor may be related to the level of perceived social support, as a widowed status implies a patient may have less immediate family support. Other sociodemographic variables such as age, occupation, financial status, and education level were not significantly associated with depression or anxiety among glaucoma patients in this study. This finding differs from those in the general population, where certain sociodemographic variables are risk factors for psychiatric conditions.<sup>48</sup>

Our study also found the use of topical beta-blockers was not found to be associated with depression. While there has been one study in India that reported an association between a self-reported measure of depression and the use of topical beta-blockers, many other studies found no significant association.<sup>8,9,43,50,51</sup> Thus, there is more evidence in the literature that proves that the use of beta-blockers in glaucoma patients does not seem to increase the risk of depression and anxiety.

This study has several strengths. This is the first study in Malaysia to report the prevalence and risk factors of depression and anxiety among patients with glaucoma. We also studied the relationship between depression and anxiety with perceived social support using the MSPSS questionnaire. It is the first time this scale has been used in a psychological study involving glaucoma patients. Our study also has several limitations. The psychological status of glaucoma patients is multifactorial and the independent variables in our study had limited explanatory effects. Other factors not included in our study should also be considered, such as other health comorbidities, side effects of treatment, and somatization. Another limitation is the study design itself, given that a cross-sectional study is unable to analyse behaviour over a specific period. The timing of the sampling is not guaranteed to be a true

representation. Future research should examine these relationships over a longer period in a larger sample size. Lastly, the nature of the assessment questionnaire, where patients may take time to recall the symptom and need to be prompted for answers, may result in recall bias.

In conclusion, the prevalence of depression and anxiety among glaucoma patients in our centre is relatively low compared to other countries.<sup>52,53</sup> Severe disease with low MD scores and lack of perceived social support are risk factors for both depression and anxiety. Additionally, widowed patients are more likely to suffer from depression compared to their married or single counterparts. Uncontrolled IOP constitutes an additional risk factor for anxiety disorder among glaucoma patients. Ophthalmologists and supporting staff should consider screening for depression and anxiety in glaucoma patients in order to provide psychosocial intervention where needed.

## Declarations

### Ethics approval and consent to participate

This study was approved by the institution's Medical Research Ethics Committee (MREC 201873-6439). All participants signed an informed consent form before starting the interview session. The study adhered to the tenets of the declaration of Helsinki.

### Competing interests

None to declare.

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