

# Knowledge of patient emotional health status: impact on clinical care in glaucoma and retinal services

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## ABSTRACT

**Objective** Knowledge of a patient's emotional health status and using patient-centred communication may be key to providing early intervention and referral to appropriate treatment/support services for ophthalmology patients. This study aims to determine if and how ophthalmologists use anxiety and depression scores to determine clinical care of patients with chronic eye disease.

**Methods and analysis** This cross-sectional study included 10 ophthalmologists and a convenience sample of 100 of their patients (>18 years). The Patient Health Questionnaire (PHQ-9) for depression and the Generalised Anxiety Disorder (GAD-7) tool were administered to patients. Scores from these instruments were provided to ophthalmologists just prior to the clinic visit. After the visit, ophthalmologists were given a questionnaire to assess self-reported change in clinical practice and whether knowledge of scores impacted their communication style, treatment plan and follow-up protocol.

**Results** Of these patients (mean age=63), 27% reported mild-moderate anxiety or depression as their worst score, while 2% reported suicidal thoughts; 20% reported neither anxiety nor depression. Ophthalmologists' response to patients with mild or worse anxiety or depression was to change clinical approach (28%) and communication style (31%), both metrics increasing with severity of symptoms (Fisher's exact  $p<0.05$ ). None reported changing their choice of treatment or modifying follow-up protocols; referral to social work/psychiatry services was 60%, 3.7% and 0% for patients with moderately severe or worse, mild-to-moderate, or minimal scores, respectively.

**Conclusion** Providing ophthalmologists with knowledge of the emotional health of their patients may change the clinical approach and referral pattern.

## INTRODUCTION

Vision impairment can drastically impact quality of life and can affect emotional well-being in addition to loss in functional ability.<sup>1-4</sup> Emotional well-being may or may not be associated with the impact of vision loss itself<sup>5,6</sup> and could be related to the diagnosis<sup>7</sup> or patient-reported loss of visual function as well as fear of visual impairment.<sup>3,8</sup> Furthermore, the association between vision impairment and emotional well-being has been examined in

## Key messages

### What is already known about this subject?

- ▶ Anxiety and depression are relatively common in patients who have visual impairment associated with glaucoma or retinal diseases.
- ▶ Untreated depression and anxiety can affect patients' adherence to treatment for comorbid conditions including ophthalmic disorders.
- ▶ During routine eye care, it may be difficult to appreciate or ascertain the symptoms of emotional health.
- ▶ Early detection and intervention can manage emotional health symptoms with the potential for resolution over time with adjustment to vision loss.
- ▶ However, there is scant evidence that even with knowledge of patients' emotional status, changes to clinical eye care would follow.

### What are the new findings?

- ▶ Our results indicate that knowledge of emotional health status of ophthalmology patients may change clinical and communication practices of ophthalmologists during clinic visits.
- ▶ Furthermore, referral to psychiatric and social services was greater as the severity of anxiety or depression increased.

### How might these results change the focus of research or clinical practice?

- ▶ Knowledge of an ophthalmology patient's emotional health may improve detection and management of emotional health disorders that may have been previously missed.
- ▶ Increased awareness by ophthalmologists of patients' emotional health status may provide an opportunity to improve ophthalmic clinical interactions at the very least, but more research is needed to capture the patient experience with any proposed changes in the way care is delivered.

studies across all age groups and is no longer thought to occur only later in life.<sup>3,7,9,10</sup>

Anxiety and depression, in particular, are relatively common in patients who have visual impairment associated with glaucoma or retinal diseases.<sup>7,11-13</sup> Court *et al* reported that individuals with visual impairment had 1.6 times greater odds of anxiety/stress-related



disorders and 1.5 times greater odds of depression compared with those without visual impairment.<sup>11</sup> Evans *et al*, in a large population of 13 900 individuals, reported a significantly higher prevalence of depression in those with visual acuity worse than 6/18 (13.5%) compared with those without visual impairment (4.6%).<sup>7</sup> In a study of patients with glaucoma, Mabuchi *et al* reported that both anxiety and depression were significantly higher in patients with primary open-angle glaucoma compared with age-matched and sex-matched individuals with no chronic conditions other than cataracts.<sup>12</sup> Scott *et al* reported in individuals with retinal diseases that emotional distress significantly worsened with increasing severity of the condition.<sup>13</sup>

In addition to the impact on long-term quality of life, emotional distress impacts daily functioning, leading to further decline in health.<sup>7 14</sup> Untreated depression and anxiety can also affect the patient's adherence to treatment for comorbid conditions including eye disorders.<sup>15 16</sup> This can lead to further decline in overall health if the care needs are not met.<sup>16 17</sup>

During routine eye care, it may be difficult to appreciate or ascertain the symptoms of emotional health. Early detection and intervention can manage these symptoms with the potential for resolution over time with adjustment to vision loss.<sup>18</sup> Moreover, knowledge of a patient's emotional health status and good provider-patient communication may be key to providing early intervention and referral to appropriate treatment and support services.<sup>1 19</sup>

Although there are many simple instruments that provide indices or degree of emotional well-being,<sup>20</sup> these assessments are not routinely used in eye care settings. Furthermore, there is very little evidence that even with knowledge of patients' emotional status, changes to clinical eye care would follow.<sup>21</sup> This study aims to investigate if and how ophthalmologists report they alter clinical practice, interpersonal communication style and treatment strategies for patients with chronic eye disease when presented with individualised patient anxiety and depression scores.

## MATERIALS AND METHODS

This cross-sectional study was undertaken as a part of a multicentre initiative by the WHO Prevention of Blindness Programme to investigate patient-centred eye care. Our study was conducted in the Glaucoma and Retina Divisions of the Wilmer Eye Institute, the divisions being prespecified in the protocol. Ratio of recruitment of 1:1.5 from the Glaucoma and Retina services was used due to the relative distribution of ophthalmologists and patients scheduled in these two divisions on the days of the survey. We estimated the sample size of patients assuming type-1 error of 0.05, type-2 error of 0.20, that about one-third of patients would have at least mild or worse anxiety/depression, and of those without either symptom, that 5% of them would result in ophthalmologists change in behaviour versus 30% in those with

mild to worse anxiety/depression; the resulting sample size was 84 patients. As we had no idea at the outset what behaviour change might be seen, we added an additional 16 patients to allow for more power. Ten ophthalmologists (four glaucoma/six retina specialists) were enrolled and agreed to have their clinic patients contacted on the day of their appointment for potential participation in the study.

Patients older than 18 years were recruited, consented to participate and enrolled in this study between 1 April and 30 June 2019. All patients in the glaucoma/retina waiting rooms were informed of the study. Only the patients who expressed interest in participating were approached for consent and enrolled before being seen by their ophthalmologists. All study activities were held in a private room.

Two internationally validated screening questionnaires were selected to acquire data on emotional well-being: the Patient Health Questionnaire (PHQ-9) for depression and the Generalised Anxiety Disorder (GAD-7) tool for anxiety symptoms.<sup>22-24</sup> PHQ-9 scores above 5, 10 and 20 are classified as mild, moderate and severe depression, respectively.<sup>22</sup> GAD-7 scores above 5, 10 and 15 are classified as mild, moderate and severe anxiety, respectively.<sup>24</sup> The patients were given the two questionnaires to self-administer and any difficulties in reading or understanding the questions were addressed by a study coordinator.

The questionnaires were scored and created into a report containing both PHQ-9 and GAD-7 scores with their corresponding severity grades, which was made available for the ophthalmologist to review prior to seeing the patient. Following the clinical appointment, ophthalmologists were queried to determine whether knowledge of these scores impacted their clinical approach (unspecified), communication style, treatment plan, follow-up protocol and referral to social work/psychiatry. If necessary, the study provided immediate referral or offered to assist with referral to psychiatric services if asked by the patient or the provider. Demographic information on the clinician, as well as their view of the utility of these questionnaires, was also collected. Demographic information was abstracted from the medical record for each patient and other characteristics were part of the self-administered questionnaire.

All study questionnaire responses were entered into REDCap (Research Electronic Data Capture) following the completion of the participant encounter. Data were deidentified prior to export for analysis. Best-corrected visual acuity of the better eye was abstracted from the patient record using Early Treatment Diabetic Retinopathy Study chart (ETDRS) and Snellen acuity in the cases of the retina and glaucoma services, respectively. The patients were categorised according to the WHO criteria for visual impairment, except that mild impairment was defined as worse than 20/40 to 20/70. Moderate impairment was defined as worse than 20/70 to 20/200 and severe impairment as worse than 20/200.

A summary score of the patient's emotional status was created, using the results from the anxiety and depression scales, as follows: if the patients scored below the 'mild' cut-off on both scales, they were deemed to have neither anxiety nor depression. If the highest score on either questionnaire was in the mild or moderate category, they were categorised as 'mild to moderate depression or anxiety'; similarly, if the highest score on either questionnaire was categorised as moderately severe or severe, they were categorised as such.

Patient and provider characteristics were tabulated by service. Responses regarding any change in clinical approach or communication style were tabulated and compared across severity of emotional health status. The Fisher's exact test was used to test for significant differences in the reported change to clinical approach and communication style according to the severity of anxiety and depression.

All statistical analyses were performed using STATA V.15 (StataCorp LP, College Station, Texas, USA). The study protocol was approved by the Johns Hopkins School of Medicine Institutional Review Board. Informed written consent was obtained from all participants. This study adhered to the tenets of the Declaration of Helsinki. Patients were not involved in the design and conduct of this research as the study focused primarily on ophthalmologists and their change in behaviour in response to PHQ-9 and GAD-7 scores.

## RESULTS

A total of 100 patients (mean age=64 years) were enrolled in this study, of which 54% were female (table 1). A total of 38% reported no anxiety, 25% reported mild to moderate anxiety and 1% reported moderately severe or worse anxiety. Patients with glaucoma were more likely to have no anxiety compared with retina patients ( $p<0.05$ ). Depression scores, however, were not significantly different between the two divisions. Overall, 32% reported no depression, 17% reported mild to moderate depression, and 4% reported moderately severe or worse depression. Of all patients, 6% reported mild to moderate symptoms of both anxiety and depression, and 2% reported suicidal thoughts. Moderate or worse visual impairment was diagnosed in 9% of participants. Patient age, gender, race/ethnicity, education level, self-reported duration of eye condition, and visual acuity were not associated with anxiety and depression scores; patients with higher anxiety or depression scores were more likely to report using medical or non-medical treatment ( $p<0.001$ ) (online supplemental table 1).

All but one of the 10 participating physicians were under age 60 years, and one physician was female (table 2). All agreed that there is insufficient training for ophthalmologists on the effect of emotional health on adherence to treatment. All but one respondent stated they try to pay attention to the emotional health of their patients and stated the results from the questionnaires were useful.

**Table 1** Patient demographics

	Overall (n=100)	Glaucoma (n=40)	Retina (n=60)
Age (years)	63.6	65.6	62.3
Under 60 years	35 (35%)	9 (22.5%)	26 (43.3%)
60 years and over	65 (65%)	31 (77.5%)	34 (56.7%)
Gender			
Female	54 (54%)	17 (42.5%)	29 (48.3%)
Male	46 (46%)	23 (57.5%)	31 (51.7%)
Race/Ethnicity			
White	59 (59%)	23 (57.5%)	36 (60%)
Not white	41 (41%)	17 (42.5%)	24 (40%)
Visual acuity (WHO classification of visual impairment)*			
No visual impairment	79 (79%)	33 (82.5%)	46 (76.7%)
Mild visual impairment	12 (12%)	3 (7.5%)	9 (15%)
Moderate visual impairment	4 (4%)	2 (5%)	2 (3.3%)
Severe visual impairment	5 (5%)	2 (5%)	3 (5%)
Emotional well-being			
No anxiety or depression	20 (20%)	11 (27.5%)	9 (15%)
Minimal anxiety or depression as worst score	48 (48%)	15 (37.5%)	33 (55%)
Mild to moderate anxiety or depression as a worst score	27 (27%)	12 (30%)	15 (25%)
Moderately severe to severe anxiety or depression as a worst score	5 (5%)	2 (5%)	3 (5%)
Suicidal thoughts	2 (2%)	0 (0%)	2 (3.3%)
Anxiety†			
No anxiety	38 (38%)	20 (50%)	18 (30%)
Minimal anxiety	36 (36%)	8 (20%)	28 (46.7%)
Mild to moderate anxiety	25 (25%)	11 (27.5%)	14 (23.3%)
Moderately severe to severe anxiety	1 (1%)	1 (2.5%)	0 (0%)
Depression‡			
No depression	32 (32%)	15 (37.5%)	17 (28.3%)
Minimal depression	47 (47%)	14 (35%)	33 (55%)
Mild to moderate depression	17 (17%)	10 (25%)	7 (11.7%)
Moderately severe to severe depression	4 (4%)	1 (2.5%)	3 (5%)

\*Visual acuity: No visual impairment: equal to or better than 20/40. Mild visual impairment: worse than 20/40, equal to or better than 20/70. Moderate visual impairment: worse than 20/70, equal to or better than 20/200. Severe visual impairment: worse than 20/200.

†GAD-7 score: Minimal (1–4); mild to moderate (5–14); moderately severe to severe (>14). Difference between glaucoma and retina patients was significant ( $p<0.05$ ).

‡PHQ-9 score: Minimal (1–4); mild to moderate (5–14); moderately severe to severe (>14). Difference between glaucoma and retina patients was not significant ( $p>0.05$ ).

GAD, Generalised Anxiety Disorder-7; PHQ, Patient Health Questionnaire-9.

Overall, a self-reported change in ophthalmologist behaviour in response to knowledge of emotional outcomes was noted for 18% of the patients seen, and higher for patients seen in the glaucoma service compared with the retina service (OR 3.86, 95% CI 1.17 to 13.7;  $p=0.01$ ) (table 3). These changes were in both the communication style and the clinical approach to the

**Table 2** Physician demographics and practice preferences

	Overall (n=10)	Glaucoma (n=4)	Retina (n=6)
Gender	F: 1 (10%) M: 9 (90%)	F: 0 (0%) M: 4	F: 1 (16.7%) M: 5 (83.3%)
Years of service (median)	9.5 years	17.5 years	6 years
Q1 In your clinical practice, do you pay attention to anxiety and depression in the global assessment of the patient?	Y: 9 (90%) N: 1 (10%)	Y: 4 N: 0 (0%)	Y: 5 (83.3%) N: 1 (16.7%) (I do not know the consequences on adherence to the prescribed therapy)
Q2 Overall, in your opinion the use of the questionnaire is:	Useful: 9 (90%) Useless: 1 (10%)	Useful: 4 Useless: 0 (0%)	Useful: 5 (83.3%) Useless: 1 (16.7%)
Q3 Do you think that ophthalmologists are sufficiently trained on how the presence of anxiety and depression affects treatment adherence?	No: 10	No: 4	No: 6

patient, although none of the ophthalmologists changed the choice of ophthalmic treatment and only one patient had his/her follow-up modified. Other changes in clinical approach were not elicited. The primary reasons that ophthalmologist did not change their clinical approach was either the patient scores did not indicate anxiety or depression, or they reported that patient emotional well-being was already considered in their assessment. A total of 4% of all patients were referred to a social worker or psychiatric services, including 12.5% of patients with at least mild depression or anxiety.

Increased time spent listening to the patient and providing more information to the patient were examples of changes in communication style (table 4). These changes were spread across the participating ophthalmologists and not concentrated among a few.

For the 32 patients with mild or greater severity of either depression or anxiety, the ophthalmologist

response was to change clinical approach in 9 (28%) patients and communication style in 10 (31%) patients. Reported changes to clinical approach ( $p=0.03$ ) and communication style ( $p<0.001$ ) were increased as the severity of anxiety and depression increased. Of note, the change in communication style went from 2% in those with minimal depression or anxiety ( $n=48$ ) to 80% in those with moderately severe to severe depression or anxiety ( $n=5$ ). While ophthalmologists reported not changing their clinical approach in most patients with severe anxiety or depression, all five patients were either referred for further psychological care or were asked if they were currently under such care or needed a referral (table 5). In one patient with a score indicating no anxiety or depression, the ophthalmologist noted that the change to clinical approach was to decrease time spent communicating with the patient since he/she seemed to have no emotional distress.

**Table 3** Per-patient physician responses to knowledge of emotional outcomes by division

	Overall (n=100)	Glaucoma (n=40)	Retina (n=60)
Overall physician reported behaviour change per-patient encounter ( $p<0.05$ )*	Y: 18 (18%) N: 82 (82%)	Y: 12 (30%) N: 28 (70%)	Y: 6 (10%) N: 54 (90%)
Did you use the scores from the questionnaires to change your clinical approach to this patient today? (reported per patient) ( $p<0.05$ )*	Y: 16 (16%) N: 84 (84%)	Y: 11 (27.5%) N: 29 (72.5%)	Y: 5 (8.3%) N: 55 (91.7%)
▶ Did you modify the choice of treatment based on the scores? (reported per patient)	N: 100	N: 40	N: 60
▶ Did you modify the follow-up protocol/frequency? (reported per patient)	Y: 1 (1%) N: 99 (99%)	Y: 1 (2.5%) N: 39 (97.5%)	Y: 0 (0%) N: 60
▶ Did you refer the patient to the study team social worker or a psychologist/psychiatrist for a complete diagnosis today? (reported per patient)	Y: 4 (4%) N: 96 (96%)	Y: 2 (5%) N: 38 (95%)	Y: 2 (3.3%) N: 58 (96.7%)
Did you change your communication style with the patient following the scores from the questionnaire? (reported per patient) ( $p<0.05$ )*	Y: 12 (12%) N: 88 (88%)	Y: 9 (22.5%) N: 31 (77.5%)	Y: 3 (5%) N: 57 (95%)

\*Fisher's exact test p value.

**Table 4** Types of changes in communication style by division

	Overall (n=100)	Glaucoma (n=40)	Retina (n=60)
None	88 (88%)	31 (77.5%)	57 (95%)
More time listening to the patient	5	3	2
Gave more information to the patient	4	2	2
Other*	4	4	0

\*Discussed scores, discussed reasons for anxiety, less discussion as patient was not worried.

## DISCUSSION

This study provided some evidence that knowledge of patient emotional well-being influences ophthalmologists' self-reported behaviour during patient encounters. They reported that knowledge of the scores was useful and changed their clinical approach and communication style with patients. The results were not uniform, as one clinician reported the information was useless and that increased attention was not paid to emotional health because there was uncertainty over the beneficial effect on therapy. In fact, however, there are data showing that depression is a risk factor for lower adherence with medical therapies.<sup>15 16</sup>

The reported change in communication style and clinical approach increased as emotional well-being scores worsened, providing some evidence that the patient's scores were driving the change in self-reported behaviours. However, the fact that for nearly three-fourths or more of the patients with mild to moderate anxiety or depression, no change in clinical approach or communication style was reported is concerning and suggests a rather high threshold for behaviour change in providers. The demands of busy clinical practices, coupled with

teaching time in academic practices, may make it difficult to add more time to patient encounters however much it is indicated.

One proposed method of improving efficiency and saving time when using the PHQ-9 questionnaire was to use only the first two questions and going further only if patients endorse either of them.<sup>25</sup> However, we note that more than 30% of patients in our study had mild or worse symptoms of anxiety and/or depression, so some time would need to be allocated to screening.

The fact that no ophthalmologist reported changing treatment regimen may reflect the limited options available for changing these regimens in clinical practice. However, the lack of significant change in follow-up protocol regardless of the severity of depression or anxiety is of concern if a more holistic approach to patient well-being is desired. Providers concerned about emotional well-being or the effect of depression on adherence to treatment might have considered telephone follow-up or scheduled an earlier appointment.

In the exit survey, all ophthalmologists reported that there was insufficient training on the effects of anxiety or depression on patients. Education to improve

**Table 5** Physician qualitative questionnaire responses by severity of emotional health status

	Patients with no anxiety or depression (n=20)	Patients with minimal anxiety or depression as the worst score (n=48)	Patients with mild to moderate anxiety or depression as the worst score (n=27)	Patients with moderately severe to severe anxiety or depression as the worst score (n=5)
Did you use the scores from the questionnaires to change your clinical approach to this patient today? (p<0.05)*	Y: 4 (20%) N: 16 (80%)	Y: 3 (6.2%) N: 45 (93.8%)	Y: 7 (25.9%) N: 20 (74.1%)	Y: 2 (40%) N: 3 (60%)
▶ Did you modify the choice of treatment based on the scores?	N: 20	N: 48	N: 27	N: 5
▶ Did you modify the follow-up protocol /frequency?	Y: 0 (0%) N: 20	Y: 0 (0%) N: 48	Y: 1 (3.7%) N: 26 (96.3%)	Y: 0 (0%) N: 5
▶ Did you refer the patient to the study team social worker or a Psychologist / Psychiatrist for a complete diagnosis today?	Y: 0 (0%) N: 20	Y: 0 (0%) N: 48	Y: 1 (3.7%) N: 26 (96.3%)	Y: 3 (60%) N: 2 (40%)†
Did you change your communication style with the patient following the scores from the questionnaire? (p<0.001)*	Y: 1 (5%) N: 19 (95%)	Y: 1 (2.1%) N: 47 (97.9%)	Y: 6 (22.2%) N: 21 (77.8%)	Y: 4 (80%) N: 1 (20%)

\*Fisher's exact test p value.

†The two patients with moderately severe to severe anxiety and depression as their worst score who were not referred were already receiving psychological care.



ophthalmologists' understanding of the associations between psychosocial factors and eye disease, and the impact on treatment, maybe indicated.<sup>26</sup> In addition, knowledge of patient emotional health disorders as well as provider's self-confidence in managing these disorders have been shown to play a role in the ability of physicians who are not specialised in psychiatry to appropriately identify conditions and refer patients for specialised care.<sup>27</sup>

Although patient outcomes were not assessed directly in this study, ophthalmologists' knowledge of PHQ-9 and GAD-7 scores led to four patients being referred who may have otherwise been missed. However, advance knowledge of the scores may have had unintended consequences as in the case of one patient, with no anxiety or depression, where the ophthalmologist reported decreased time spent communicating since there was no reported emotional distress. This isolated response may indicate the potential risk for complacency if patients are identified as having low scores as even if no depressive symptoms or anxiety are reported, if there are other concerns about their eye care, the usual amount of communication may be warranted.

There was no association between higher anxiety or depression scores and visual acuity loss in our study, although this was not a primary analysis and with the low number of patients with moderate acuity loss, we were likely underpowered to detect a significant association. Of note, we did not have visual field test reports from a field analyser for most patients, and it may be that visual field loss is associated with anxiety or depression and was not captured. We report that ophthalmologists provided more information about the eye disease or vision loss to four patients because of the severity of depression or anxiety scores but two of these patients did not have any visual acuity loss and the other two had mild and moderate loss. We did not capture the reasons for the change in communication and this could be better assessed in more detail in future studies.

Our overall assumptions about sample size were reasonable. We anticipated that about 30% of patients would have mild or worse anxiety/depression and about 32% reported symptoms of mild or worse. We had no a priori knowledge of the likelihood of differential proportions of ophthalmologist behaviour change in the two patient groups, and chose 5% in one and 30% in the other; in fact, the separation was even more pronounced, with ophthalmologists reporting behaviour change in 6% of those with none to minimal anxiety/depression versus 50% in those with mild or worse anxiety/depression. However, we had more limited power to study associations in subgroups, for example, by division.

There are several limitations to the study that must be considered. First, since the study is not a randomised controlled trial, we do not know the referral rate to social work/psychiatry services when the PHQ-9 and GAD-7 scores are not provided to ophthalmologists. Given that we were asked to provide a referral network before study

recruitment began suggests that, in general, the referral rate is very low. However, it is not possible to imply a causal relationship between providing the questionnaire scores and improving referrals beyond establishing an association. Second, the patient sample was self-selected, as is often the case in clinic populations. We cannot infer the prevalence of anxiety or depression in general patients seen in glaucoma and retinal clinics from our study. There may be potential for selection bias as the sample may be over-represented or under-represented of patients who suffer from anxiety or depression. Third, our patient sample only included glaucoma and retina patients, and therefore may not be generalisable to patients in other ophthalmology subspecialties or settings. The ophthalmologists were also recruited from the glaucoma and retina divisions and may not be representative of all ophthalmology subspecialties and practice types. Provider selection bias is possible. We limited our recruitment to clinicians who saw patients on days in which the study team could manage recruitment. Nevertheless, the ophthalmologists who enrolled may be more sympathetic and willing to alter their clinical approach and communication style. In our study, 9 out of 10 ophthalmologists indicated that they pay attention to anxiety and depression in the global assessment of their patients. To better evaluate the effectiveness of the discussed approach, future studies may benefit from having a larger sample size and a more diverse sample from all subspecialties, private practice and across different regions. Fourth, we did not collect data on the patient perceptions of these clinical interactions. To what extent the behaviour changes that were reported were perceived during the visit or follow-up by patients will provide more information and should be addressed in future research. Finally, we sought ophthalmologists' self-reported behaviour change, recognising that the providers are reporting changes while under observation. We could have monitored just for referrals to social services, but we would have missed data on the content of the visits other than direct referrals, which were rare. The fact that 96% of those with mild to moderate anxiety/depression were not referred despite the ease of doing so in this study suggests that provider participation in the study did not greatly influence referral behaviours at least. For future research, we would suggest rewording the questions to allow data collection from providers who do not receive the scores, and as noted above, would augment findings using patient-reported outcomes.

Overall, our results indicate that knowledge of emotional health status of ophthalmology patients may change clinical and communication practices of ophthalmologists during clinic visits. However, assessing emotional well-being in ophthalmic clinical settings is not a straightforward process and requires an easily accessible referral system for those in acute need. Involving social workers in the care delivery process, training ophthalmic technicians to manage referrals to social work/psychiatry services or alerting the patients' primary care physician

may help better integrate the clinical management of decreased emotional well-being into routine care. Regardless of the possible solutions, our data suggest that increased awareness may lead to an opportunity to improve ophthalmic clinical interactions at the very least, but more research is needed to capture the patient experience on any changes in the way care is delivered.

**Contributors** FN, MD, Dana Center for Preventive Ophthalmology, Johns Hopkins Medicine, Baltimore, MD, USA. FN was involved in data collection, performed the data analysis and interpretation, wrote major parts of the manuscript, created the tables and legends, did the literature search, organised the references and submitted the manuscript. SW, PhD, Dana Center for Preventive Ophthalmology, Johns Hopkins Medicine, Baltimore, MD, USA. SW designed the study, interpreted the data, wrote major parts of the manuscript and edited the manuscript. SM, MD, World Health Organization, Geneva, Switzerland. SM helped design the study, and discussed and influenced many aspects of the manuscript. PG, MS, Dana Center for Preventive Ophthalmology, Johns Hopkins Medicine, Baltimore, MD, USA. PG directed data collection, submitted and got approval to perform the study from the institutional review board of the Johns Hopkins School of Medicine. RM, BA, Dana Center for Preventive Ophthalmology, Johns Hopkins Medicine, Baltimore, MD, USA. RM performed the majority of the data collection. MD, BA, Dana Center for Preventive Ophthalmology, Johns Hopkins Medicine, Baltimore, MD, USA. MD assisted in data collection.

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SUPPLEMENTARY TABLE 1: PATIENT DEMOGRAPHICS STRATIFIED BY SEVERITY OF ANXIETY/DEPRESSION <sup>a</sup>		Patients with no anxiety or depression (N = 20)	Patients with minimal anxiety or depression as the worst score (N = 48)	Patients with mild to moderate anxiety or depression as the worst score (N = 27)	Patients with moderately severe to severe anxiety or depression as the worst score (N = 5)	Fisher Exact p-values
<b>Age</b>						
Between 18-29 years	1 (5%)	0	2 (7.4%)	0	0.423	
Between 30-39 years	0	3 (6.2%)	3 (11.1%)	0		
Between 40-59 years	6 (30%)	15 (31.2%)	4 (14.8%)	1 (20%)		
Over 60 years	13 (65%)	30 (62.5%)	18 (66.7%)	4 (80%)		
<b>Gender</b>						
Female (N = 54)	4 (20%)	30 (62.5%)	17 (63%)	3 (60%)	0.006	
Male (N = 46)	16 (80%)	18 (37.5%)	10 (37%)	2 (40%)		
<b>Race/Ethnicity</b>						
White	6 (30%)	25 (52.1%)	20 (74.1%)	4 (80%)	0.013	
Not white	14 (70%)	23 (47.9%)	7 (25.9%)	1 (20%)		
<b>New vs. Follow-up patient</b>						
New	4 (20%)	8 (16.7%)	10 (37%)	0	0.151	
Follow-up	16 (80%)	40 (83.3%)	17 (63%)	5 (100%)		
<b>Education</b>						
Less than high school diploma to High school degree or equivalent (e.g. GED)	4 (20%)	7 (14.6%)	4 (14.8%)	1 (20%)	0.685	
Some college, no degree; Associate degree (e.g. AA, AS); Bachelor's degree (e.g. BA, BS)	8 (40%)	25 (52.1%)	15 (55.6%)	4 (80%)		
Master's degree (e.g. MA, MS, MEd); Professional degree (e.g. MD, DDS, DVM); Doctorate (e.g. PhD, EdD)	8 (40%)	16 (33.3%)	8 (29.6%)	0		
<b>Medical Treatment for anxiety or depression<sup>b</sup></b>						
Yes	1 (5%)	4 (8.3%)	8 (29.6%)	4 (80%)	0.001	
No	19 (95%)	43 (89.6%)	19 (70.4%)	1 (20%)		
Unsure	0 (15%)	1 (2.1%)	0	0		
<b>Additional non-medical treatment for anxiety or depression</b>						
Yes	1 (5%)	2 (4.2%)	9 (33.3%)	3 (60%)	0.000	
No	19 (95%)	46 (95.8%)	18 (66.7%)	2 (40%)		
<b>Self-reported duration of eye condition<sup>c</sup></b>						
<1 year	3 (16.7%)	6 (13.6%)	4 (15.4%)	0	0.676	
1-2 years	3 (16.7%)	8 (18.2%)	2 (7.7%)	0		
>2-5 years	2 (11.1%)	7 (15.9%)	6 (23.1%)	3 (60%)		
>5 years	10 (55.6%)	23 (52.3%)	14 (53.8%)	2 (40%)		
<b>Visual acuity (WHO classification of visual impairment)<sup>d</sup></b>						
No visual impairment	16 (80%)	40 (83.3%)	21 (77.8%)	2 (40%)	0.367	
Mild visual impairment	2 (10%)	5 (10.4%)	3 (11.1%)	2 (40%)		
Moderate visual impairment	1 (5%)	1 (2.1%)	1 (3.7%)	1 (20%)		
Severe visual impairment	1 (5%)	2 (4.2%)	2 (7.4%)	0		

a. GAD-7 Score: Minimal (1-5); mild to moderate (6-15); moderately severe to severe (>15)

PHQ-9 Score: Minimal (1-4); mild to moderate (5-14); moderately severe to severe (>14)

b. Non-medical treatments included cognitive behavioral therapy; other forms of psychotherapy such as: interpersonal therapy, dialectical behavior therapy, psychodynamic therapy; lifestyle modifications (eg. meditation); support groups; other responses

c. Only 93 observations available for disease duration

d. Visual acuity:

No visual impairment: Equal to or better than 20/40

Mild visual impairment: Worse than 20/40, equal to or better than 20/70

Moderate visual impairment: Worse than 20/70, equal to or better than 20/200

Severe visual impairment: Worse than 20/200