Association between myopia and anxiety: a cross-sectional study based on Chinese university freshmen

Ziye Li^, Jing Wei, Song Lu, Feiyan Wang, Yifan Xia

Department of Ophthalmology, The First Affiliated Hospital of Henan University of Science and Technology, Luoyang, China
Contributions: (I) Conception and design: J Wei, Z Li; (II) Administrative support: J Wei; (III) Provision of study materials or patients: Z Li, S Lu, F Wang, Y Xia; (IV) Collection and assembly of data: Z Li, S Lu; (V) Data analysis and interpretation: Z Li, S Lu; (VI) Manuscript writing: All authors; (VII) Final approval of manuscript: All authors.
Correspondence to: Jing Wei, Doctor/Chief physician. Department of Ophthalmology, The First Affiliated Hospital of Henan University of Science and Technology, No. 24, Jinghua Road, Luoyang 471000, China. Email: 200320281421@hsust.edu.cn.

Background: At least 1 billion people are affected by blindness or vision impairment worldwide, and in China, the proportion of myopia among college students is even higher. Anxiety and self-harm are becoming more and more common among college students, which indicates the importance of paying attention to their mental health. Previous studies have demonstrated that vision impairment has a negative impact on the mental health of adults. However, few studies have focused on the effects of myopia on college freshmen's mental health, and the association between the two factors in college students remained elusive.

Methods: This is a large cross-sectional study. A total of 5,519 college freshman would be assessed for the eligibility of the present study, and the inclusion criteria of this study were as follows: (I) first-year college student; (II) diagnosed as myopia and emmetropia through vision test; (III) gave informed consent. Five questionnaires were utilized to collect anxiety data, which include the National Eye Institute Visual Function Questionnaire-25 (NEI-VFQ-25), the Self Esteem Scale (SES), the Self Rating Anxiety Scale (SAS), the Self Rating Depression Scale (SDS), and the Social Avoidance and Distress Scale (SAD), for data collection. In addition, a socio-demographic questionnaire was designed and utilized to collect corresponding information. All enrollees were required to complete the all the above questionnaires.

Results: In total 4,984 college students were enrolled. The proportion of males is 60.43%, and the mean age was 19.8 years old. Both right and left vision had a statistically significant association with NEI-VFQ-25 score (P=0.006, r=0.070; and P=0.021, r=0.060, respectively; Pearson correlation analysis) and SAS score (P=0.003, r=0.075 and P=0.004, r=0.075, respectively; Pearson correlation analysis). However, the correlation coefficient was very low (all less than 0.1). No significant correlation was observed between eye vision and other questionnaire scores.

Conclusions: Our data suggested that there is week correlation between myopia and anxiety. However, since this is a single-center study, the observed weak correlation may be caused by selection bias. Therefore, our results still need to be validated in further studies with a larger sample size.

Keywords: Anxiety; college students; myopia; Pearson correlation analysis

---

^ ORCID: 0000-0001-9184-9605.

Introduction

At least 1 billion people are affected by blindness or vision impairment worldwide, and in China, the proportion of myopia among college students is even higher (1). Myopia may have a negative impact on students' mental health because physical activity is more difficult, academic performance is affected, and they may be more socially isolated (2). Vision impairment has been associated with the incidence of anxiety (3-6), but studies have mostly focused on older people (>60 years) and data specific to college students are limited.

Although compared with older people, the risk of anxiety among college students is much lower, the increased academic pressure during these years of study can become a psychological burden. The mental health of college students is affected by many factors, such as employment, economic, and emotional pressure. In addition, bad campus culture and inappropriate education methods may also have negative effects on students' mental health. Possibly due to these reasons, depression, anxiety and self-harm are becoming more and more common among college students (7-10), which indicates the importance of paying attention to their mental health. Few studies have focused solely on myopia rather than impaired vision; other research has revealed the impact of common chronic ocular morbidities, such as strabismus, on mental health in adults. However, college freshmen are a special group of young adults who have experienced the great challenges of college entrance examination, entering a new environment, and facing social development transformation. And unfortunately, few studies have focused on the effects of myopia on college freshmen's

mental health, possibly due to that myopia has become commonplace in today's society, and college freshmen are generally considered as the most energetic group of people, who are considered to be not so likely to suffer from mental problems. Here, we hypothesized that myopia in college students might have an impact on their mental health. Although myopia is not as serious as vision impairment, its impact should not be underestimated, considering its high incidence rate. Exploring the relationship between myopia and anxiety will help us better understand the mental health of college students, and help the public pay more attention to the prevention of myopia and mental diseases. We present the following article in accordance with the STROBE reporting checklist (available at https://atm.amegroups.com/article/view/10.21037/atm-23-743/rc).

Methods

Study design

We conducted a large cross-sectional study focused on freshmen enrolled in September 2021 in a Chinese university. We focused on college freshman but not all college students since freshman are a special group of young adults who have experienced the great challenges of college entrance examination, entering a new environment, and facing social development transformation. A total of 5,519 college freshman would be assessed for the eligibility of the present study. The major method of the study and data collection was by questionnaires, which comprised the National Eye Institute Visual Function Questionnaire-25 (NEI-VFQ-25), the Self Esteem Scale (SES), the Self Rating Anxiety Scale (SAS), the Self Rating Depression Scale (SDS), and the Social Avoidance and Distress Scale (SAD). In addition, a socio-demographic questionnaire was designed and utilized to collect corresponding information. All enrollees were required to complete all the above questionnaires. The study was conducted in accordance with the Declaration of Helsinki (as revised in 2013). Informed consent was taken from all the participants.

Participant selection

The inclusion criteria of this study were: (I) first-year college student; (II) diagnosed as myopia and emmetropia through vision test; (III) gave informed consent. The exclusion criteria were: (I) previous eye disease history, with definite diagnosis of acute and chronic conditions affecting

---

Highlight box

Key findings
• There was no significant correlation between myopia and anxiety in college student.

What is known and what is new?
• Previous studies have demonstrated that vision impairment has a negative impact on the mental health of adults.
• We studied the relationship between these two factors among young college students, and found that myopia seemed to have little effect on mental health.

What is the implication, and what should change now?
• Considering the observational design of our study, the results should be validated in further studies with a larger sample size.

Table 1 Proportions of myopia among the student cohort

Content	Mild MG	Secondary MG	Severe MG	Ultra-high MG
SE scale (D)	<300	300–<600	600–900	>900

MG, myopia group; SE, spherical equivalent; D, degree.

vision other than myopia (hereditary retinoschisis, etc.); (II) history of eye surgery, ophthalmic drugs in the last one year or psychiatric trauma.

Study protocol

All ocular examinations were performed and recorded by an ophthalmologist. Participants underwent a routine ocular examination, including naked eyesight, corrected eyesight, eye location, foregoing proportion and bottom inspections. Next, the students were examined with mydriasis and optometry (two drops of compound tropicamide eye drops in both eyes every 5 min; after 20 min, if there was still pupillary light reflection, another drop was instilled then). The light catoptric and pupillary inflation were inspected after an interval of 15 min. The inflation and light reflection were registered 40–60 min after the first drops. If the pupil enlarged by ≥6 mm and there was no light reflection, mydriasis was successful. A Topcon KR-8900 Automatic Refractive Keratometer (optometer) was used to perform computer optometry for all students. The spherical equivalent (SE) mirror degree was calculated as the algebraic sum of 0.5 × SE and the cylindrical mirror degree (i.e., equivalent SE = 0.5 × SE + cylindrical mirror degree). In line with the lens equivalent SE value of the subject and the national standard for refractive status, emmetropia means normal vision, defined as binocular naked eye vision ≥5.0. In line with the equivalent SE value of the subject, myopia was defined as the naked eye vision <5.0 in either eye, and the equivalent SE of computer optometry under non-ciliary muscle paralysis <50 D. If one eye was myopic and the other was hyperopic, vision was still defined as myopia. Myopic students were divided into four groups: mild myopia group (MG, SE <300 D), secondary MG (SE 300–<600 D), severe MG (SE 600–900 D) and ultra-high myopia (SE >900 D) (*Table 1*).

For the data processing we used the double entry mode, and a third person would enter the final data. If any suspicious answers were found, the original questionnaire was checked and verified again. Each questionnaire had a unique number, which would be randomly selected for review.

Questionnaire content

NEI-VFQ-25

The NEI-VFQ-25 is a self-reported vision-related quality of life assessment (11). The missing rate of the driving dimension is high in Asian countries, so it was deleted in the present survey.

SES

SES is a 10-item self-reported measure of self-worth or self-acceptance. The items are answered on a 4-point scale ranging from strongly approve to strongly disapprove (12).

SAS

The Zung SAS measures somatic symptoms associated with anxiety. The scale is centered on 4 common disorders: anxiety and panic; vestibular manifestations; somatic control; and gastrointestinal/muscular sensations (13).

SDS

SDS is a 20-item measure, with each item bears a 4-point scale, which demands around 5–10 mins to accomplish. Gentle to secondary depression, secondary to severe depression, and senior depression ranged from 50–59, 60–69, and above 70, respectively (14).

SAD

SAD is a 28-item true/false scale that measures solitude. Wanting to escape or avoid being around, talking to, or interacting with other people for any reason is called social avoidance (15).

Statistical analysis

The Shapiro-Wilk test was first fulfilled to conclude if the data were evenly distributed. Outliers were detected using boxplots and removed from subsequent analysis to reduce the bias. The correlation between the anxiety-associated factors and myopia-associated factors was determined using Pearson correlation analysis if both factors were normally distributed; otherwise, Spearman correlation analysis was performed. All statistical analyses were performed using R software (Version
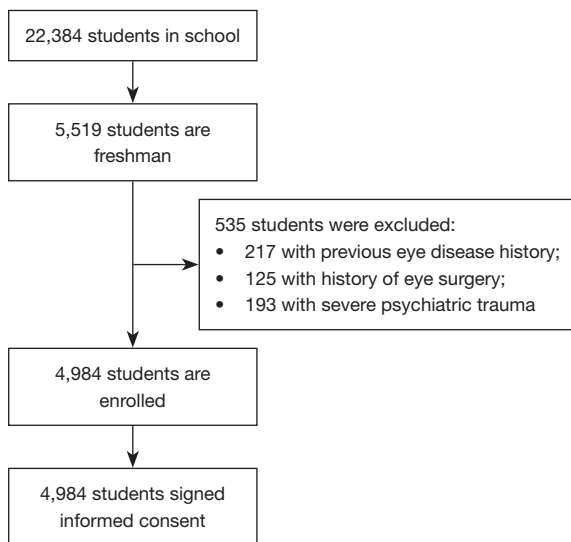
Page 4 of 8

Li et al. Association between myopia and anxiety

Figure 1 Flow diagram of the present study.

4.2.0). A P value <0.05 was considered statistically significant. All the P values in the present study are two-sided.

Results

Baseline characteristics

A total of 5,519 college students were registered, and 4,984 students were finally enrolled, as shown in *Figure 1*. The general baseline information of these participants, such as female/male ratio, age, myopia degree, course of myopia, course of wearing glasses, daily sleep duration, daily outdoor activity duration, and daily duration of using of electronic products, are summarized in *Table 2*. All continuous variables were normally distributed, so Pearson correlation analysis was performed to test the correlation.

Association between myopia and questionnaire scores

NEI-VFQ-25 score

As showed in *Figure 2*, both right and left vision had a statistically significant association with NEI-VFQ-25 score (P=0.006 and P=0.021, respectively; Pearson correlation analysis). However, both correlation coefficients were less than 0.1 (r=0.070 and r=0.060, respectively; Pearson correlation analysis).

SES score

As shown in *Figure 3*, no remarkable association was found

Table 2 Baseline characteristics of participants before exclusion criteria applied

Characteristics	n	%
Total	5,519	100
Sex		
Male	3,335	60.43
Female	2,184	39.57
Age, years	19.8	–
Myopia degree of right eye		
Not nearsighted	977	17.70
<300°	1,607	29.12
300–<600°	2,430	44.03
600–900°	484	8.77
>900°	21	0.38
Myopia degree of left eye		
Not nearsighted	1,111	20.13
<300°	1,611	29.19
300–<600°	2,324	42.11
600–900°	450	8.15
>900°	23	0.42
Course of myopia, years		
Not nearsighted	835	15.13
<1	184	3.33
1–<3	805	14.59
3–<5	1,560	28.27
5–10	1,769	32.05
>10	366	6.63
Course of wearing glasses, years		
<1	1,291	23.39
1–<3	897	16.25
3–<5	1,505	27.27
5–10	1,560	28.27
>10	266	4.82
Daily sleep duration, h		
<7	1,885	34.15
7–9	3,511	63.62
>9	123	2.23

Table 2 (*continued*)

Table 2 (*continued*)

Characteristics	n	%
Daily outdoor activity, h		
<1	2,107	38.18
1–2	2,832	51.31
>2	580	10.51
Daily use of electronic devices, h		
<2	322	5.83
2–<4	1,646	29.82
4–<6	1,761	31.91
6–8	1,064	19.28
>8	726	13.15
Monthly household income, ¥		
<1,000	339	6.14
1,000–<3,000	1,252	22.69
3,000–<5,000	1,865	33.79
5,000–9,000	1,431	25.93
>9,000	632	11.45

between SES score and eye vision, no matter if the right eye (RE, P=0.877) or left eye (LE, P=0.719).

SAS score

As shown in *Figure 4*, both right and left vision had a statistically significant correlation with SAS score (P=0.003 and P=0.004, respectively). However, both correlation coefficients were less than 0.1 (r=0.075 and r=0.075, respectively).

SDS score

As shown in *Figure 5*, no remarkable association was found between SDS score and eye vision, whether the RE (P=0.226) or LE (P=0.402).

SAD score

As shown in *Figure 6*, no remarkable association was established between SAD score and eye vision, whether the RE (P=0.758) or LE (P=0.562).

Discussion

We found a significant association between vision and the NEI-VFQ-25 and SAS scores, but the correlation coefficients were very low, which indicated that although myopia had an impact on the students' mental health, the impact was not great. Additionally, no remarkable association was established between myopia and other anxiety-associated scales such as SES, SDS, and SAD.

Previous studies have demonstrated a link between vision impairment and anxiety in adults (3-6). In a recent systematic review, higher scores of depression and anxiety were associated with children's vision impairment (16). However, the association between vision impairment and depression/anxiety has not been reported in young adults, such as college students. On entry to higher education, all college students experience a period of rapid psychological and physiological change, which may develop into an emotional disorder.

Thus, we hypothesized that myopia, although less severe than vision impairment, might affect the mental health of college students. However, our primary results indicated that the impact of myopia on mental health was very slight, even negligible, which negated our hypothesis. Although there was a significant correlation between vision and the NEI-VFQ-25 and SAS scores, the P value is greatly affected by the sample size. Therefore, based on the correlation coefficients, we concluded that there was no correlation between vision and the scores of the two scales. It was previously reported that the greater the degree of myopia, the higher the anxiety score. However, myopia was not found to be associated with depression. The inconsistency between our findings might be due to Bias caused by differences in sample size and geographical differences. In addition, that study was conducted during the COVID-19 pandemic, which might also have some impact on the final conclusions. Collectively, myopia seemed to have little effect on mental health, but considering that this was a cross-sectional study, its results only reflect the students' status at a certain time point and there was not enough follow-up, so caution should be taken with accepting the conclusion.

We speculated that emotional anxiety may cause tension in the extraocular muscles. Prolonged tension in the extraocular muscles can easily lead to visual fatigue and insufficient eye regulation, which can lead to an increase in myopia when overused. Myopia may also cause anxiety through indirect effects. For example, nearsightedness may increase students' academic pressure, and wearing glasses may increase appearance anxiety.

Considering the correlation between myopia and anxiety, we recommend that clinical physicians should pay attention
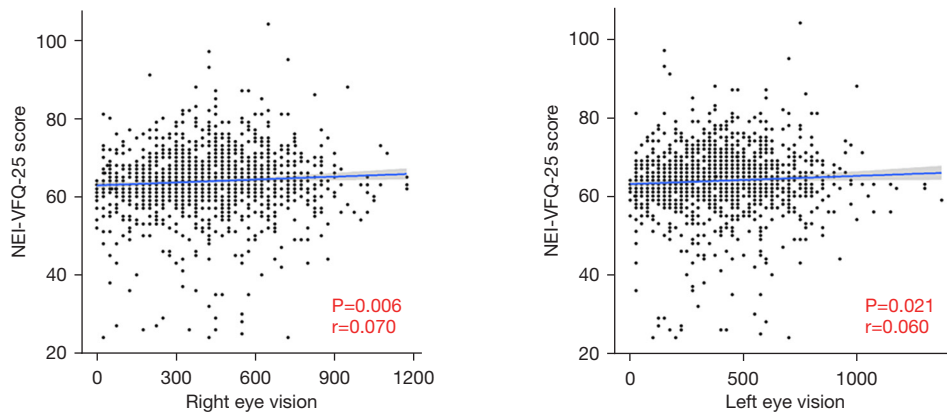
Page 6 of 8

Li et al. Association between myopia and anxiety

Figure 2 Association between myopia and NEI-VFQ-25 score. NEI-VFQ-25, National Eye Institute Visual Function Questionnaire-25.
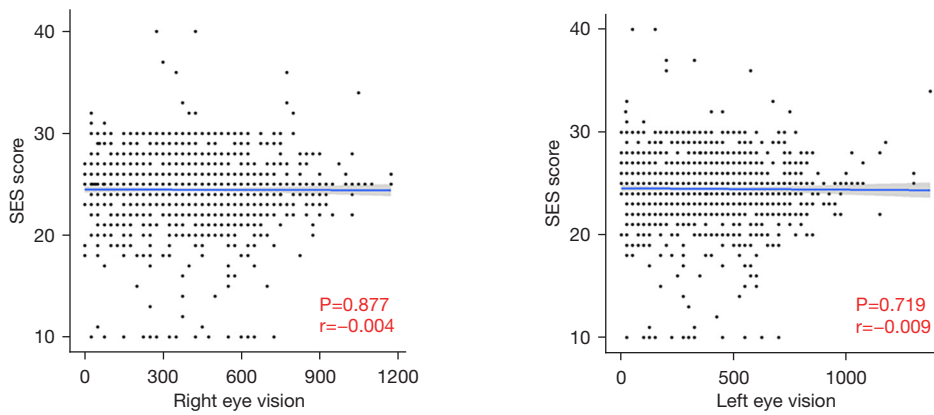

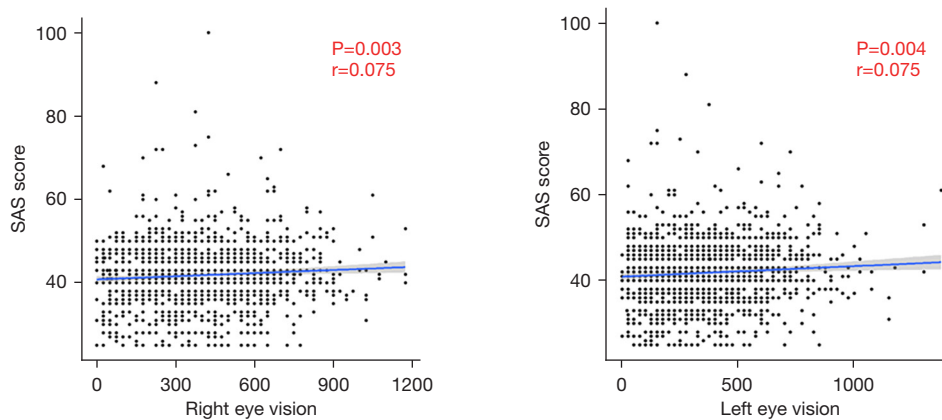**Figure 3** Association between myopia and SES score. SES, Self Esteem Scale.

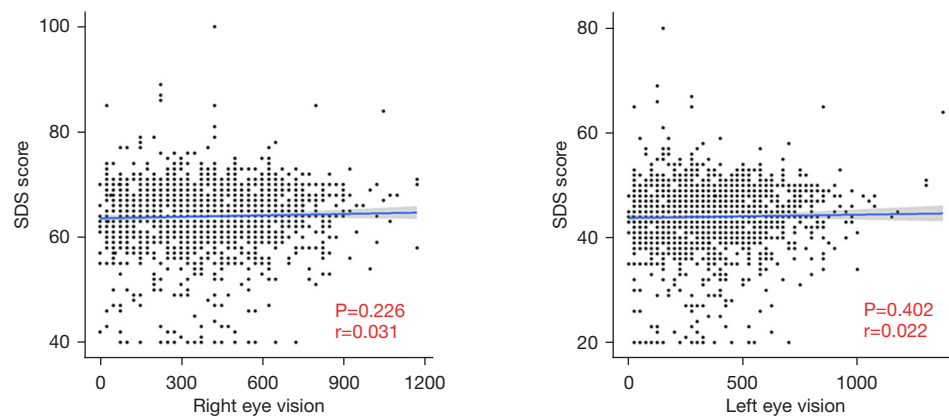**Figure 4** Association between myopia and SAS score. SAS, Self-Rating Anxiety Scale.

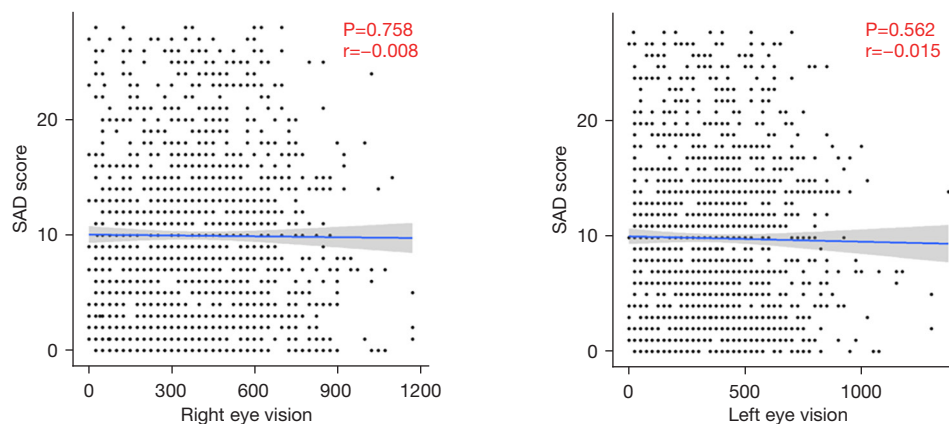**Figure 5** Association between myopia and SDS score. SDS, Self-Rating Depression Scale.

Figure 6 Association between myopia and SAD score. SAD, Social Avoidance and Distress Scale.

to the psychological status of myopia patients and the visual health of anxiety patients, in order to prevent the mutual promotion of myopia and anxiety.

The strength of this study lies in the large sample size. The limitation lies in its study design. Cross-sectional studies are susceptible to interference from various confounding factors, and the causal relationship between variables cannot be inferred. Taken together, although our data suggested no significant correlation between myopia and anxiety, our results should be validated in further studies.

Conclusions

Our data suggested that there is no significant week correlation between myopia and anxiety. However, since this

is a single-center study, the observed weak correlation may be caused by selection bias. Therefore, our results still need to be validated in further studies with a larger sample size.

Acknowledgments

Footnote

Ethical Statement: The authors are accountable for all aspects of the work in ensuring that questions related to the accuracy or integrity of any part of the work are appropriately investigated and resolved. The study was conducted in accordance with the Declaration of Helsinki (as revised in 2013). Informed consent was taken from all the participants.

References

1. Solebo AL, Rahi J. Epidemiology, aetiology and management of visual impairment in children. Arch Dis Child 2014;99:375-9.
2. Ma X, Zhou Z, Yi H, et al. Effect of providing free glasses on children's educational outcomes in China: cluster randomized controlled trial. BMJ 2014;349:g5740.
3. Parravano M, Petri D, Maurutto E, et al. Association Between Visual Impairment and Depression in Patients Attending Eye Clinics: A Meta-analysis. JAMA Ophthalmol 2021;139:753-61.
4. van der Aa HP, Comijs HC, Penninx BW, et al. Major depressive and anxiety disorders in visually impaired older adults. Invest Ophthalmol Vis Sci 2015;56:849-54.
5. Demmin DL, Silverstein SM. Visual Impairment and Mental Health: Unmet Needs and Treatment Options. Clin Ophthalmol 2020;14:4229-51.
6. Virgili G, Parravano M, Petri D, et al. The Association between Vision Impairment and Depression: A Systematic Review of Population-Based Studies. J Clin Med 2022;11:2412.
7. Fergusson DM, Horwood LJ, Ridder EM, et al. Subthreshold depression in adolescence and mental health outcomes in adulthood. Arch Gen Psychiatry 2005;62:66-72.
8. Tuisku V, Kiviruusu O, Pelkonen M, et al. Depressed adolescents as young adults - predictors of suicide attempt and non-suicidal self-injury during an 8-year follow-up. J Affect Disord 2014;152-154:313-9.
9. Dunn V, Goodyer IM. Longitudinal investigation into childhood- and adolescence-onset depression: psychiatric outcome in early adulthood. Br J Psychiatry 2006;188:216-22.
10. Weissman MM, Wolk S, Wickramaratne P, et al. Children with prepubertal-onset major depressive disorder and anxiety grown up. Arch Gen Psychiatry 1999;56:794-801.
11. Suzukamo Y, Oshika T, Yuzawa M, et al. Psychometric properties of the 25-item National Eye Institute Visual Function Questionnaire (NEI VFQ-25), Japanese version. Health Qual Life Outcomes 2005;3:65.
12. Martin CR, Thompson DR, Chan DS. An examination of the psychometric properties of the Rosenberg Self-Esteem Scale (RSES) in Chinese acute coronary syndrome (ACS) patients. Psychol Health Med 2006;11:507-21.
13. Dunstan DA, Scott N. Norms for Zung's Self-rating Anxiety Scale. BMC Psychiatry 2020;20:90.
14. Jokelainen J, Timonen M, Keinänen-Kiukaanniemi S, et al. Validation of the Zung self-rating depression scale (SDS) in older adults. Scand J Prim Health Care 2019;37:353-7.
15. Hofmann SG, DiBartolo PM, Holaway RM, et al. Scoring error of social avoidance and distress scale and its psychometric implications. Depress Anxiety 2004;19:197-8.
16. Li D, Chan VF, Virgili G, et al. Impact of Vision Impairment and Ocular Morbidity and Their Treatment on Depression and Anxiety in Children: A Systematic Review. Ophthalmology 2022;129:1152-70.