# ผลกระทบของการระบาดของโรคติดเชื้อไวรัสโคโรนา 2019 ต่อความวิตกกังวลของนักศึกษาหลักสูตรทัศนมาตรศาสตร์ในประเทศไทย: การศึกษาภาคตัดขวางทั้งประชากร

# The impact of the coronavirus disease 2019 (COVID-19) outbreak on anxiety of Thai optometry students: a population-based cross-sectional study

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**บทคัดย่อ**

การวิจัยในครั้งนี้มีวัตถุประสงค์เพื่อ 1) ศึกษาผลกระทบของการระบาดของโรคติดเชื้อไวรัสโคโรนา 2019 ต่อความวิตกกังวลของนักศึกษาหลักสูตรทัศนมาตรศาสตร์ในประเทศไทย 2) เพื่อเปรียบเทียบความวิตกกังวลของนักศึกษาในมิติต่าง ๆ จำแนกตามลักษณะส่วนบุคคล 3) เพื่อวิเคราะห์องค์ประกอบความวิตกกังวลในมิติต่าง ๆ จากสถานการณ์การแพร่ระบาดของโรคติดเชื้อไวรัสโคโรนา 2019 ของนักศึกษาหลักสูตรทัศนมาตรศาสตร์ในประเทศไทย เก็บข้อมูลจากนักศึกษาหลักสูตรทัศนมาตรศาสตร์ทั้งประเทศไทย ในปีการศึกษา 2564 จำนวน 689 คน แบบสอบถามประกอบด้วยข้อมูลส่วนบุคคล และแบบวัดภาวะซึมเศร้า ความวิตกกังวล และความเครียดฉบับ 21 ข้อ พัฒนาแบบประเมินโดยอิงมิติความวิตกกังวลจากการศึกษาก่อนหน้า ตรวจสอบความเที่ยงตรงของเนื้อหาด้วยการหาดัชนีความตรงตามเนื้อหาและดัชนีความสอดคล้องกับวัตถุประสงค์จากผู้เชี่ยวชาญด้านจิตวิทยาจำนวน 3 ท่าน ตรวจสอบความเที่ยงโดยการหาสัมประสิทธิ์แอลฟาของครอนบาค จากนั้นวิเคราะห์องค์ประกอบเชิงสำรวจด้วยวิธีการวิเคราะห์องค์ประกอบหลักและค่าไอเกนมากกว่าหนึ่ง ผลการศึกษาพบว่าการระบาดของโรคติดเชื้อไวรัสโคโรนา 2019 ส่งผลกระทบต่อความวิตกกังวลของนักศึกษาในทุกมิติ การศึกษานี้ค้นพบ 2 องค์ประกอบหลัก ได้แก่ ความวิตกกังวลเกี่ยวกับการเรียนในระดับน้อย และ ความวิตกกังวลเกี่ยวกับการเงินในระดับปานกลาง มาตรวัดความพอเพียงการสุ่มของไคเซอร์-ไม-เยอร์โอคินแสดงให้เห็นว่าโมเดลมีความเหมาะสมสูง (KMO = .923) ค่าสถิติการทดสอบบาร์ทเลทท์แสดงว่าตัวแปรต่าง ๆ มีความสัมพันธ์กันเพียงพอ นอกจากนี้เพศหญิงและคะแนนเฉลี่ยสะสมต่ำ มีความสัมพันธ์กับระดับความวิตกกังวลอย่างมีนัยสำคัญทางสถิติ โดยสรุปนักศึกษาทัศนมาตรศาสตร์ชาวไทยส่วนใหญ่มีความวิตกกังวลเกี่ยวกับการเงิน ดังนั้นจึงแนะนำให้สมาคมวิชาชีพ ผู้กำหนดนโยบาย สถาบันการศึกษา และ ผู้ปกครองร่วมกันบรรเทาลดความวิตกกังวลของนักศึกษา

**คำสำคัญ:** ความวิตกกังวล โควิด-19 นักศึกษาหลักสูตรทัศนมาตรศาสตร์ การศึกษาภาคตัดขวางทั้งประชากร

**Abstract**

The objectives of this research were 1) to study the impacts of the COVID-19 pandemic on the anxiety levels of optometry students in Thailand, 2) to compare anxiety levels across different dimensions based on personal characteristics, and 3) to analyze the components of anxiety in various dimensions arising from the COVID-19 pandemic among optometry students in Thailand. Data were collected from all 689 enrolled optometry students in the academic year of 2021. The questionnaire included personal information and a 21-item scale for measuring depression and anxiety scales (DASS-21). The assessment tool was developed based on anxiety dimensions from previous studies. The content validity was confirmed by obtaining three psychology experts' content validity index and index of item objective congruence. The reliability was verified using Cronbach's alpha coefficient. Then, exploratory factor analysis was performed by principal component analysis with the eigenvalues greater than one. The result found that the COVID-19 pandemic impacts students' anxiety across all dimensions. This study revealed two-factor structures among Thai optometry students: the anxiety about learning was mild, while the anxiety about finance was moderate. The Kaiser-Meyer-Olkin measure of sampling adequacy indicated high model adequacy (KMO = .923). Bartlett's test of sphericity suggests the variables were sufficiently correlated. Moreover, females and lower cumulative grade point averages were statistically significantly related to anxiety levels. In summary, most Thai optometry students were concerned about their finances. Therefore, we recommend collaboration among professional optometry associations, policymakers, optometry institutions, and parents to alleviate student anxiety levels.

**Keywords:** anxiety, COVID-19, optometry student, population-based cross-sectional study

**Introduction**

At the end of 2019, the Coronavirus disease 2019 (COVID-19) emerged and quickly spread around the world. Many rigorous public health interventions, such as social distancing, reduced indoor and outdoor activities, and state quarantine for COVID-19 high-risk individuals, were implemented worldwide to minimize disease transmission (Wang et al., 2020). This pandemic impacted every aspect of life. Higher education was also severely affected by the pandemic. On March 12, 2020, Thailand's Ministry of Higher Education, Science, Research, and Innovation mandated that all tertiary institutions manage education through online approaches to prevent the spreading of the virus. This situation had an impact on students' mental health and increased the prevalence of anxiety among them (Liyanage et al., 2021).

As a result, mental health problems became more common health conditions following community-wide periods of social isolation. Prior to the COVID-19 pandemic, anxiety disorders were the third most common mental illness in Thailand, followed by alcohol use disorders and depressive disorders (Udomratn, 2007). Furthermore, a systematic review demonstrated that 6.33-50.9% of the general population worldwide had symptoms of anxiety from the COVID-19 pandemic (Xiong et al., 2020). Moreover 31% of Thai public health students had anxiety due to the same reason (Chutipattana et al., 2022).

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Additionally, Chinese college students were concerned about their employment prospects and career opportunities (Zheng et al., 2022). Previous research revealed that the exploratory factor analysis of COVID-19's socio-educational consequences on Portuguese students had six components comprising education context (online learning, teacher attention, and test results), working conditions (lack of online learning equipment), psychological and physical well-being (increased anxiety, increased exhaustion, peer pressure, and own personality), social interactions (socialization, group work in the classroom, and interaction with friends), family context (family support for online learning), and financial situation (family's financial situation, paying for equipment/devices for online learning, and paying tuition fees for the next semester) (Oliveira et al., 2021). Thailand's optometry institutions offer six-year programs. In 2021, Thailand had three optometry schools: Ramkhamhaeng University, Rangsit University, and Naresuan University. There had never been any form of study that had been previously connected to a pandemic and Thai optometry students' anxiety.

**Research Objective**

The objectives were as follows:

1. To study the impacts of the COVID-19 pandemic on the anxiety levels of optometry students in Thailand.

2. To compare anxiety levels across different dimensions based on personal characteristics.

3. To analyze the components of anxiety in various dimensions arising from the COVID-19 pandemic among optometry students in Thailand.

**Research Hypothesis**

1. There are significant differences in the anxiety caused by the COVID-19 pandemic that affect optometry students in various dimensions based on their personal characteristics.

2. Among optometry students in Thailand, there are many dimensions of anxiety arising from the COVID-19 pandemic.

**Definitions**

1. Anxiety is a feeling of worry, nervousness, and discomfort about uncertain events. When it becomes overwhelming and interferes with daily life, it can develop into a disorder.

2. Optometry is a healthcare field focused on diagnosing, treating, and managing vision and eye disorders. Optometrists prescribe corrective lenses, administer vision therapy, address eye diseases, and identify systemic health conditions through eye examinations.

**Methods**

**Study design, participants, and inclusion and exclusion criteria**

This was a population-based cross-sectional study of optometry students in Thailand in 2021. This study included all enrolled optometry students for the academic year 2021 who were at least 18 years old. Thailand has three optometry schools: Ramkhamhaeng University, Rangsit University, and Naresuan University. All optometry students totaling 689 persons from the first to sixth years were able to participate. Students were excluded from the study if they were unable to complete the questionnaires.

**Questionnaire**

The Depression Anxiety Stress Scale-21 (DASS-21) is a self-report questionnaire used to measure the symptoms of depression, anxiety, and stress. DASS-21 has various advantages over the original 42-item DASS-42, including fewer items, better factor structure, and lower inter-factor correlations. Each of the three DASS-21 scales has seven items, which are separated into three subscales consisting of depression (DASS 21-D), anxiety (DASS 21-A), and stress (DASS 21-S) (Antony et al., 1998).

DASS-21 has been validated across cultures among Asian residents in the Thai environment as part of numerous initiatives and research purposes (Oei et al., 2013). Moreover, the DASS-21 questionnaire has been used to investigate the prevalence of depression, anxiety, and stress symptoms among Thai preclinical medical students (Nimkuntod et al., 2016). DASS 21-A has seven

anxiety-related questions. Each question is scored on a four-point Likert scale, with 0 denoting "did not apply to me at all" and 3 denoting "applied to me a lot." DASS 21-A received validation in the Thai language among nursing students during the COVID-19 outbreak. The Cronbach's alpha coefficient of anxiety for the Thai version is 0.968 (Wittayapun et al., 2023). The DASS 21-A interpretation tool indicates that a score of 0-3 signifies normal levels of anxiety, a score of 4-5 indicates mild anxiety, a score of 6-7 indicates moderate anxiety, a score of 8-9 indicates severe anxiety, and a score of 10 or more indicates very severe anxiety (Oei et al., 2013). In this study, we employed the Thai version of the DASS 21-A. This tool was translated from English into Thai as part of the cross-cultural translation process.

According to the previous study, we were interested in 12 dimensions of anxiety: 1) online learning, 2) online examination, 3) test results, 4) graduation within six years, 5) group work in the classroom, 6) career opportunities, 7) teacher's attention, 8) socialization, 9) peer pressure, 10) own personality, 11) paying tuition for the next semester, and 12) family's financial situation. The questionnaire validity and reliability were analyzed by three qualified psychology lecturers into the content validity index (CVI) and item objective congruence index (IOC). We designed the pilot study and provided it to other medical students to ensure the validity and reliability of the questionnaire. The reliability of the instrument was calculated by the Cronbach's alpha coefficient.

**Data collection**

This study was conducted in accordance with the Ramkhamhaeng Research Ethics Committee (RU-HRE 65/0037) on February 3, 2022, the Research Ethics Office of Rangsit University (RSU-ERB 2022-016) on February 25, 2022, and the Naresuan University Institutional Review Board (NU-IRB 0144/2022) on April 26, 2022. The data collection was conducted from April 27 to June 30, 2022. Prior to selecting research respondents, obtaining informed consent was a prerequisite. Due to the online questionnaire, the first page provided information documents for the participants. The participants were asked to click whether they agreed as informed consent.

**Data analysis**

The study's entire statistical analysis was conducted using IBM SPSS version 28. To describe the demographic characteristics of the participants, descriptive statistics with the mean and standard deviation for the continuous variables, counts, and percentages for categorical data were utilized.

EFA was performed by principal component analysis (PCA) using maximum likelihood extraction and an eigenvalue > 1. The Kaiser-Meyer-Olkin Measure of Sampling Adequacy and Bartlett's test of sphericity were used to determine whether the data were suitable for the factor analysis (Dziuban & Shirkey, 1974). Principal axis factoring with varimax rotation was used to examine the factor structure. Factor loadings less than 0.5 were suppressed, while item cross loadings greater than 0.2 were deleted sequentially. Furthermore, parallel analysis (using principal axis factoring) and Velicer's minimum average partial test were performed (O'Connor, 2000). An

independent sample t-test and one-way ANOVA statistics were employed to evaluate the relationship between the anxiety components and the personal information.

## Results

### Questionnaire reliability and validation

We conducted pilot tests on 30 medical students. The Cronbach's alpha coefficient was 0.84, which was greater than 0.70, thus indicating that this questionnaire had a high level of reliability. Three qualified psychology lecturers analyzed the validity. The CVI was 0.988, while the IOC was 0.996. These results signified that this questionnaire was competent, legitimate, and reliable.

### Demographics data

A total of 689 optometry students were invited to this study. We received responses from 520 optometry students (75.47%). The demographic characteristics were presented in Table 1. The majority were from Rangsit University (n = 199; 38.27%), female (n = 418; 80.38%), studying in the fifth year (n = 98; 18.85%), had a cumulative grade point average (GPA) of more than 3.50 (n = 182; 35%), family paid for the education (n = 300; 57.69%), and did not have any underlying diseases (n = 416; 80%).

**Table 1** Demographics of the participants (N = 520)

| Personal Information | | Total *n* (%) |
|---|---|---|
| 1. Academic Institution | Ramkhamhaeng University | 183 (35.19) |
| | Rangsit University | 199 (38.27) |
| | Naresuan University | 138 (26.54) |
| 2. Gender | Male | 102 (19.62) |
| | Female | 418 (80.38) |
| 3. College Year | First | 90 (17.31) |
| | Second | 53 (10.19) |
| | Third | 88 (16.92) |
| | Fourth | 94 (18.08) |
| | Fifth | 98 (18.85) |
| | Sixth | 97 (18.65) |
| 4. Cumulative Grade Point Average | 0.00-1.99 | 13 (2.50) |
| | 2.00-2.49 | 63 (12.11) |
| | 2.50-2.99 | 107 (20.58) |
| | 3.00-3.49 | 155 (29.81) |
| | 3.50-4.00 | 182 (35.00) |
| 5. Financial support for Education | Parents or family | 300 (57.69) |
| | Funding or loan | 213 (40.96) |
| | Own income | 7 (1.35) |
| 6. Average Monthly Household Income (THB) | 0-15,000 | 92 (17.69) |
| | 15,001-30,000 | 143 (27.50) |
| | 30,001-45,000 | 103 (19.81) |
| | 45,001-60,000 | 65 (12.50) |
| | > 60,000 | 117 (22.50) |
| 7. Parents' Occupation | Business owner | 153 (29.42) |
| | Private company employee | 39 (7.50) |
| | Government services employee | 88 (16.92) |
| | Freelance | 233 (44.81) |
| | Unemployed | 7 (1.35) |
| 8. Underlying Disease | Have | 104 (20.00) |
| | Do not have | 416 (80.00) |

**Thai students' anxiety levels**

According to the results of the DASS 21-A questionnaire, Thai optometry students had moderate anxiety levels in two dimensions: 1) family's financial situation (mean = 7.25; standard deviation = 5.25) and 2) paying tuition for the next semester (mean = 6.79; standard deviation = 5.42). The details of the anxiety level in all dimensions are described in Table 2.

Thai optometry students had mild anxiety levels in nine dimensions: 1) Career opportunities (mean = 5.73; standard deviation = 4.76), 2) test results (mean = 5.41; standard deviation = 4.78), 3) online examinations (mean = 5.18; standard deviation = 4.70), 4) peer pressure (mean = 4.85; standard deviation = 5.24), 5) online learning (mean = 4.15; standard deviation = 3.89), 6) graduation within six years (mean = 4.05; standard deviation = 4.45), 7) socialization (mean = 3.92; standard deviation = 4.72), 8) group work in the classroom (mean = 3.70; standard deviation = 4.18), and 9) own personality (mean = 3.32; standard deviation = 4.18). On the other hand, Thai optometry students had normal anxiety levels in the dimension of the teacher's attention (mean = 2.48; standard deviation = 3.88).

**Table 2** Anxiety level in all dimensions

| Dimension of anxiety | Mean (SD) | Anxiety level |
|---|---|---|
| 1. Online learning | 4.15 (3.89) | Mild |
| 2. Online examinations | 5.18 (4.70) | Mild |
| 3. Test results | 5.41 (4.78) | Mild |
| 4. Graduation within six years | 4.05 (4.45) | Mild |
| 5. Group work in the classroom | 3.70 (4.18) | Mild |
| 6. Career opportunities | 5.73 (4.76) | Mild |
| 7. Teacher's attention | 2.48 (3.88) | Normal |
| 8. Socialization | 3.92 (4.72) | Mild |
| 9. Peer pressure | 4.85 (5.24) | Mild |
| 10. Own personality | 3.32 (4.18) | Mild |
| 11. Paying tuition fees for the next semester | 6.79 (5.42) | Moderate |
| 12. Family's financial situation | 7.25 (5.25) | Moderate |

**Exploratory factor analysis**

The EFA revealed two factor components. The first component was called 'Anxiety about Learning', which consisted of 10 dimensions of anxiety: 1) test results, 2) online examinations, 3) group work in the classroom, 4) peer pressure, 5) socialization, 6) online learning, 7) career opportunities, 8) own personality, 9) graduation within six years, and 10) teacher's attention. These dimensions had a factor loading ranging from 0.542 to 0.806. The second component was called 'Anxiety about Finance', which consisted of two dimensions of anxiety: 1) paying tuition for the next semester and 2) family's financial situation. These dimensions had a factor loading ranging from 0.907 to 0.919.

The EFA suggested that the eigenvalues of each component should be greater than 1.0 and the total variance explained should be greater than 60% (Shkeer & Awang, 2019). The two-factor components (eigenvalues = 7.246 and 1.046, respectively) were demonstrated by a scree plot, and the eigenvalues were higher than the requirements. As such, this model explained 69.10% of the original data's variance. The Kaiser-Meyer-Olkin Measure of Sampling Adequacy was 0.923, hence indicating that the model was highly adequate ($\chi 2$ = 4,780; degree of freedom = 66), and Bartlett's test of sphericity had a statistically significant result (p-value < 0.001). Table 3 shows

the factor loadings for each dimension of anxiety with factor loadings greater than 0.50, therefore indicating acceptable factor loadings. In Thai optometry students, the anxiety about learning was low, whereas the anxiety about finance was moderate. The histogram of the anxiety level in each component is shown in Figure 1.

**Table 3** Factor loading of the dimensions of anxiety via the exploratory factor analysis

| Dimension of anxiety | Factor Loadings | |
|---|---|---|
| | Learning | Finance |
| 1. Online learning | 0.806 | |
| 2. Online examinations | 0.798 | |
| 3. Test results | 0.777 | |
| 4. Graduation within six years | 0.777 | |
| 5. Group work in the classroom | 0.769 | |
| 6. Career opportunities | 0.766 | |
| 7. Teacher's attention | 0.762 | |
| 8. Socialization | 0.748 | |
| 9. Peer pressure | 0.706 | |
| 10. Own personality | 0.542 | |
| 11. Paying tuition fees for the next semester | | 0.919 |
| 12. Family's financial situation | | 0.907 |
| Eigenvalue | 7.246 | 1.046 |
| Percentage of variance | 60.384 | 8.720 |
| Kaiser-Meyer-Olkin Measure of Sampling Adequacy = 0.923<br>Bartlett's Test of Sphericity: Approx. Chi-square = 4,780.184;<br>degree of freedom = 66; p-value < 0.001 | | |

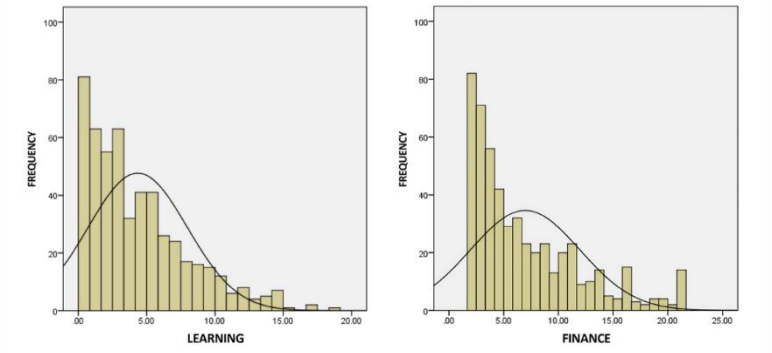


**Figure 1** Histogram of anxiety level in each component

**Association of the anxiety components among the demographic characteristics**

Personal information was utilized to categorize the descriptive data for the anxiety component. The relationship between the anxiety component and demographic characteristics is demonstrated in Table 4.

Regarding the anxiety about learning, the highest anxiety level in each item of the personal information was from Naresuan University (mean = 4.45; standard deviation = 3.78), female (mean = 5.20; standard deviation = 3.51), studying in the fifth year (mean = 4.93; standard deviation = 3.63), cumulative GPA of 0.00-1.99 (mean = 14.37; standard deviation = 2.68), funding or loan for education (mean = 4.54; standard deviation = 3.52), average monthly household income less than ฿15,000 (mean = 4.93; standard deviation = 3.64), parent's occupation is a business owner (mean =4.59; standard deviation = 3.97), and had an underlying disease (mean = 5.18; standard deviation = 3.95).

As for anxiety about finance, the highest anxiety level in each item of the personal information was from Rangsit University (mean = 7.31; standard deviation = 5.39), female (mean = 7.87; standard deviation = 5.09), studying in the second year (mean = 7.93; standard deviation = 5.91), cumulative GPA of 2.00-2.49 (mean = 12.60; standard deviation = 5.68), own income for education (mean = 8.35; standard deviation = 6.06), average monthly household income less than $15,000 (mean = 8.91; standard deviation = 5.55), parent's occupation is unemployed (mean = 9.85; standard deviation = 6.15), and had an underlying disease (mean = 7.38; standard deviation = 5.31).

The anxiety about learning was statistically significant at level 0.05 to the gender, cumulative GPA, and underlying disease. On the other hand, the anxiety about finance showed statistical significance at level 0.05 to the gender, cumulative GPA, financial support for education, average monthly household income, and the parents' occupation.

**Table 4** Association of the anxiety components among the demographic characteristics

| Personal Information | | Learning | | Finance | |
|---|---|---|---|---|---|
| | | Mean (SD) | *p*-Value | Mean (SD) | *p*-Value |
| 1. Academic Institution | Ramkhamhaeng University | 4.37 (3.40) | 0.884[a] | 7.16 (4.72) | 0.107[a] |
| | Rangsit University | 4.25 (3.73) | | 7.31 (5.39) | |
| | Naresuan University | 4.45 (3.78) | | 6.20 (4.72) | |
| 2. Gender | Male | 0.89 (1.13) | < 0.01*, d | 3.22 (2.01) | < 0.01*, d |
| | Female | 5.20 (3.51) | | 7.87 (5.09) | |
| 3. College Year | First | 3.90 (3.42) | 0.533[a] | 6.91 (5.22) | 0.503[a] |
| | Second | 4.46 (4.31) | | 7.93 (5.91) | |
| | Third | 4.31 (3.38) | | 6.56 (4.40) | |
| | Fourth | 4.24 (3.61) | | 7.11 (4.99) | |
| | Fifth | 4.93 (3.63) | | 7.27 (4.88) | |
| | Sixth | 4.25 (3.66) | | 6.39 (4.91) | |
| 4. Cumulative Grade Point Average | 0.00-1.99 | 14.37 (2.68) | < 0.01*, b | 11.42 (7.35) | < 0.01*, b |
| | 2.00-2.49 | 10.30 (1.84) | | 12.60 (5.68) | |
| | 2.50-2.99 | 5.53 (2.09) | | 8.38 (4.76) | |
| | 3.00-3.49 | 3.06 (2.07) | | 5.61 (3.84) | |
| | 3.50-4.00 | 1.97 (1.54) | | 5.01 (3.48) | |
| 5. Financial support for Education | Parents or family | 4.22 (3.71) | 0.551[a] | 6.35 (4.72) | 0.004*(a) |
| | Funding or loan | 4.54 (3.52) | | 7.78 (5.24) | |
| | Own income | 3.67 (2.96) | | 8.35 (6.06) | |
| 6. Average Monthly Household Income (THB) | 0-15,000 | 4.93 (3.64) | 0.189[a] | 8.91 (5.55) | < 0.01*, b |
| | 15,001-30,000 | 4.57 (3.52) | | 7.46 (4.78) | |
| | 30,001-45,000 | 4.29 (3.66) | | 6.83 (5.06) | |
| | 45,001-60,000 | 4.16 (3.40) | | 6.62 (4.44) | |
| | > 60,000 | 3.77 (3.80) | | 5.12 (4.42) | |
| 7. Parents' Occupation | Business owner | 4.59 (3.97) | 0.483[a] | 6.49 (4.97) | 0.002*, a |
| | Private company employee | 4.22 (3.26) | | 6.77 (4.67) | |
| | Government services employee | 3.82 (3.46) | | 5.57 (4.35) | |
| | Freelance | 4.44 (3.54) | | 7.74 (5.13) | |
| | Unemployed | 3.19 (2.29) | | 9.85 (6.15) | |
| 8. Underlying Disease | Have | 5.18 (3.95) | < 0.01*, c | 7.38 (5.31) | 0.341[c] |
| | Do not have | 4.14 (3.52) | | 6.86 (4.92) | |

a – p-Value of one-way ANOVA, b – p-Value of Welch's ANOVA, c – p-Value of independent sample t-test (equal variances assumed), d – p-Value of independent sample t-test (equal variances not assumed), SD – Standard Deviation, * significant

**Discussion**

This was the first study that assessed and investigated the anxiety components of optometry students in Thailand during the COVID-19 pandemic. We evaluated the psychometric properties of DASS21-A among Thai optometry students participating in online classes during the pandemic. Using EFA conducted on the dimensions of anxiety, we identified two main anxiety components: anxiety about learning (Factor 1) and anxiety about finance (Factor 2). The EFA appeared to mainly favor a one-factor solution, which was demonstrated to explain more than 60% of the variance. Nonetheless, this model was highly adequate and a good fit to the data.

As aforementioned, recent research of the factorial structure of anxiety revealed the same two-factor structures. Chandu et al. performed the EFA of COVID-19-related anxiety. They obtained two-factor structures, which the authors labeled 'fear of social interaction' and 'illness anxiety' (Chandu et al., 2020). In addition, Seth et al. performed the EFA of a COVID-19 anxiety syndrome scale in Canadian dentists. They obtained two-factor structures, which the authors labeled 'perseveration factor' and 'avoidance factor' (Seth et al., 2023)

Nevertheless, the difference between the previous studies and our study was the number of factors obtained, the factor loadings, and the characteristics of the items comprising each of the factors. Moreover, abed et al. obtained seven-factor structures that performed the EFA of Iranians' COVID-19-related stressors (Abed et al., 2023). Additionally, Zainudin et al. obtained five-factor structures that performed the EFA of anxiety on statistics students (Zainudin et al., 2018).

The investigation of the Cronbach's alpha coefficient from our study demonstrated that the DASS21-A scores exhibited a high internal consistency. This coefficient was good in comparison to the previous studies (Oei et al., 2013; Wittayapun et al., 2023).

The relationship between the demographic characteristics and the anxiety components was investigated. There was a statistically significant relationship between the anxiety level and gender in our study. Female students reported higher levels of anxiety than male students in both learning and finance. These findings were consistent with numerous earlier publications (Biswas & Biswas, 2023). This was due to the fact that during the pandemic, women were more likely to be given additional caring responsibilities (Islam et al., 2020). The students with lower cumulative GPAs expressed a higher anxiety level in both learning and finance. Poorer academic achievement and cognition-related behavior were linked to lower self-esteem, less enjoyment, and higher levels of anxiety (Zapata-Lamana et al., 2021). Furthermore, the anxiety about finance was correlated with financial support for education, average monthly household income, and parents' occupation. As such, the optometry students from low-income households expressed more anxiety than those from wealthy families. The research findings also strongly agreed that financial issues were connected with anxiousness. Cao et al. indicated that family financial stability served as a barrier against student anxiety (Cao et al., 2020). Likewise, Demetriou et al. found that working students were more anxious than those who were not (Demetriou et al., 2021). Additionally, optometry

students with an underlying disease experienced a higher anxiety level about learning compared to other students. Moreover, children with an underlying disease, such as congenital heart disease, had significant levels of anxiety in their lives (Llewelyn-Williams et al., 2023).

Therefore, the strengths of this study were the anxiety level and anxiety components of the DASS 21-A that were evaluated for the first time in a large number of undergraduate optometry students in Thailand.

The limitation of the study was the diversity of students. Thailand has exceptionally high levels of inequality for a nation at this stage of development. As a result, Thai optometry students varied in terms of socioeconomic status, financial situation, health, and lifestyles. Since this study was a cross-sectional design, it was challenging to establish causal correlations between the exposure and outcome. Furthermore, the data could not demonstrate any test-retest consistency across time.

## Conclusions

Exploratory factor analysis was a significant method to discover the factor structure of the anxiety components among Thai optometry students during the COVID-19 pandemic. We revealed two factor structures in Thai optometry students; the anxiety about learning was mild, while the anxiety about finance was moderate. Female students and lower cumulative GPAs had a statistically significant relationship with the anxiety level. Most Thai optometry students were concerned about their family finances because COVID-19 emphasized the fragility of households' economic and financial well-being. In summary, COVID-19 pandemic anxiety had an effect on the students’ education and the quality of life. We suggested that professional optometry associations, policymakers, optometry institutions, and parents should collaborate together in order to relieve the anxiety level of the students. The researchers recommend that educational institutions should implement psychological counseling programs to provide effective support to students dealing with anxiety. This approach aims to control anxiety to a level that does not impede students' current and future development. Additionally, Thai optometry students should have strategies for managing risks arising from crisis situations to prepare for future emergencies.

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**Author's contribution**

All authors played roles in the conceptualization. T.K. and A.W. worked and contributed equally. T.K. focused on the methodology. A.W. focused on the data curation and writing the original draft. All authors edited, revised, and approved the final draft.

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