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Mental Health Symptoms Among US Medical School Applicants During the COVID-19 Pandemic

Matthew P. Light, MD^a; Deepti Gunge, BS^b; Jamie Nicole LaBuzetta, MD, MSc, MPhil^c; Ira Advani, BS^b; Laura E. Crotty Alexander, MD^b; and Biren B. Kamdar, MD, MBA, MHS^a

The coronavirus disease 2019 (COVID-19) pandemic, and the measures taken to contain it, has complicated the already stressful medical school application process. To evaluate its impact on depression and anxiety, we disseminated a survey to applicants using popular social media platforms.

METHODS

We distributed an anonymous, web-based survey to pre-health applicants via Facebook, Twitter, Reddit, Slack, and college/university pre-health advisors (Supplementary Appendix 1). Survey items addressed the COVID-19 pandemic's impact on medical school applications and evaluated for depression and anxiety symptoms that could affect applicants' motivation and performance (Supplementary Appendix 2). Major depressive disorder (MDD) and generalized anxiety disorder (GAD) symptoms were evaluated using the Patient Health Questionnaire (PHQ)^{1,2} and Hospital Anxiety and Depression Scale–Anxiety subscale (HADS-A), respectively (Supplementary Appendix 3).^{1,3} The associations between MDD/GAD symptoms and anticipated COVID-related application delays were evaluated using χ^2 tests, and factors associated with MDD/GAD symptoms were evaluated using multivariable logistic regression. The University of California San Diego Institutional Review Board approved the study, and all respondents provided informed consent.

RESULTS

Of 735 surveys collected, 712 (97%) were complete, of which 556 (78%) were from medical school applicants completing the mental health assessments and representing

43 US/Canada states and provinces and 180 colleges and universities. Applicants' mean \pm SD age was 22 ± 4 years, 77% were women, 12% were Hispanic, 7% were Black, and 51% planned to graduate from college/university in 2021 or beyond. Overall, 73% ($n = 407$) of respondents indicated COVID-19 had adversely affected their medical school applications, with 76% ($n = 400$) anticipating COVID-19-associated application delays (Table 1).

Regarding mental health, 31% ($n = 174$) and 70% ($n = 389$) reported MDD and GAD symptoms, respectively; 29% ($n = 160$) reported both; and 92% ($n = 160$) of 174 respondents with MDD symptoms had comorbid GAD symptoms (Supplementary Figure 1). Notably, 11% ($n = 60$) reported suicidal symptoms several days and 5% ($n = 29$) more than half or nearly every day each week.

Among respondents with MDD and GAD symptoms, respectively, 103 (59%) and 197 (51%) reported COVID-19 pandemic-associated delays or new uncertainty regarding their application timeline (versus unaffected or accelerated timeline, $P < .01$). In multivariable regression, female sex (odds ratio = 2.70 [1.73–4.20]) was associated with MDD and/or GAD symptoms, while race and undergraduate characteristics (graduation year, institution, grade point average) were not.

DISCUSSION

This survey demonstrated an alarmingly high prevalence of depression and anxiety in a diverse population of medical school applicants. Notably, 31% of applicants reported MDD symptoms, which is more than twice that in a similar cohort a decade ago (15%).¹ Additionally, 70% reported GAD symptoms, which far exceeds the findings of 12%–22% reported previously in large, national mental health surveys.^{4,5}

Medical school applications have surged during the COVID-19 pandemic⁶—consistent with rising interest in the profession and despite concerning population-level mental health trends.⁷ However, we observed a cross-sectional relationship between MDD/GAD symptoms and COVID-associated application delays. While appearing discordant, these findings more likely highlight a previously unidentified applicant subpopulation whose mental health symptoms render them vulnerable to stressors that may jeopardize their career plans. Follow-up surveys may identify those at risk for downstream mental health impairment, burnout, and suicide.

Limitations to our study include its cross-sectional design and “snowball sampling” method, which is vulnerable to

^aDivision of Pulmonary, Critical Care and Sleep Medicine, Department of Medicine, University of California San Diego, La Jolla, California

^bPulmonary Critical Care Section, Veterans Affairs San Diego Healthcare System, La Jolla, California

^cDivision of Neurocritical Care, Department of Neurosciences, University of California San Diego, La Jolla, California

*Corresponding author: Matthew P. Light, MD, Division of Pulmonary, Critical Care and Sleep Medicine, University of California San Diego, 9300 Campus Point Drive #7381, La Jolla, CA 92037 (milight@health.ucsd.edu). *Prim Care Companion CNS Disord* 2021;23(5):21br03024

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Table 1. Premedical Applicant Characteristics

Characteristic	All Participants (N = 556)	MDD ^a and GAD ^b Symptoms				
		Any Symptoms ^c (n = 403)	MDD and GAD (n = 160)	MDD Only (n = 14)	GAD Only (n = 229)	No Symptoms (n = 153)
Age, mean (SD), y	22 (4)	22 (3)	22 (3)	20 (1)	22 (3)	23 (5)
Female, n (%)	428 (77)	332 (82)	134 (84)	7 (50)	191 (83)	96 (63)
Race/ethnicity, n (%)						
White	268 (48)	195 (48)	64 (40)	6 (43)	125 (55)	73 (48)
Asian	138 (25)	104 (26)	58 (36)	2 (14)	44 (19)	34 (22)
Hispanic	69 (12)	49 (12)	17 (11)	2 (14)	30 (13)	20 (13)
Black	40 (7)	30 (7)	11 (7)	2 (14)	17 (7)	10 (7)
Other ^d	41 (7)	25 (6)	10 (6)	2 (14)	13 (6)	16 (10)
Undergraduate institution type, n (%)						
Public ^e	400 (72)	293 (73)	120 (75)	10 (71)	163 (71)	107 (70)
Private	156 (28)	110 (27)	40 (25)	4 (29)	66 (29)	46 (30)
Region of undergraduate institution, n (%)						
South	219 (39)	152 (38)	58 (36)	8 (57)	86 (38)	67 (44)
West	201 (36)	149 (37)	65 (41)	5 (36)	79 (34)	52 (34)
Midwest	74 (13)	55 (14)	16 (10)	...	39 (17)	19 (12)
Northeast	45 (8)	33 (8)	13 (8)	1 (7)	19 (8)	12 (8)
Undergraduate graduation year, n (%)						
2018 and earlier	98 (18)	70 (17)	23 (14)	...	47 (21)	28 (18)
2019–2020	174 (31)	132 (33)	57 (36)	4 (29)	71 (31)	42 (27)
2021 and onward	284 (51)	201 (50)	80 (50)	10 (71)	111 (48)	83 (54)
Undergraduate GPA quartile, n (%)						
3.87–4.00	158 (28)	104 (26)	35 (22)	4 (29)	65 (28)	54 (35)
3.69–3.86	141 (25)	105 (26)	33 (21)	3 (21)	69 (30)	36 (24)
3.45–3.68	132 (24)	99 (25)	45 (28)	4 (29)	50 (22)	33 (22)
2.27–3.44	124 (22)	94 (23)	46 (29)	3 (21)	45 (20)	30 (20)
Application affected by COVID-19, n (%) ^f	407 (73)	310 (77)	135 (84)	11 (79)	164 (72)	97 (63)
Application delayed by COVID-19, n (%) ^f	400 (76)	315 (81)	134 (88)	9 (69)	172 (77)	85 (60)

^aDefined as "More than half/nearly every day" responses on ≥ 5 questions (1 anhedonia/depressed) on the 9-item Patient Health Questionnaire.

^bDefined as a score ≥ 8 on the Hospital Anxiety Depression Scale-Anxiety subscale.

^cMDD, GAD, or both MDD and GAD symptoms.

^dIncludes Native American (n = 2), Pacific Islander (n = 2), Middle Eastern/North African (n = 12), and biracial/mixed/other/unknown (n = 25).

^eIncludes community college (n = 4) and other (n = 6).

^fMedical school application adversely affected or delayed by COVID-19.

Abbreviations: COVID-19 = coronavirus disease 2019, GAD = generalized anxiety disorder, GPA = grade point average, MDD = major depressive disorder.

nonresponse bias. We designed our approach to minimize bias by targeting college-age applicants, a population with high social media use. Moreover, the large percentage of female respondents may have skewed our results; however, we believe this effect is modest and highlights a population likely to report psychiatric symptoms and to respond to surveys, as noted in prior research.¹

In conclusion, our survey reveals concerning levels of depression and anxiety symptoms among premedical undergraduates, which may be associated with delays and uncertainty surrounding medical school applications. Record applicant numbers may be misleading and neglect a subpopulation of qualified applicants whose careers may be jeopardized by debilitating mental health symptoms.

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Supplementary material: See accompanying pages.

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See supplementary material for this article at PSYCHIATRIST.COM.



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Supplementary Material

Article Title: Mental Health Symptoms Among US Medical School Applicants During the COVID-19 Pandemic

Author(s): Matthew P. Light, MD; Deepti Gunge, BS; Jamie Nicole LaBuzetta, MD, MSc, MPhil^c; Ira Advani, BS; Laura E. Crotty Alexander, MD; and Biren B. Kamdar, MD, MBA, MHS

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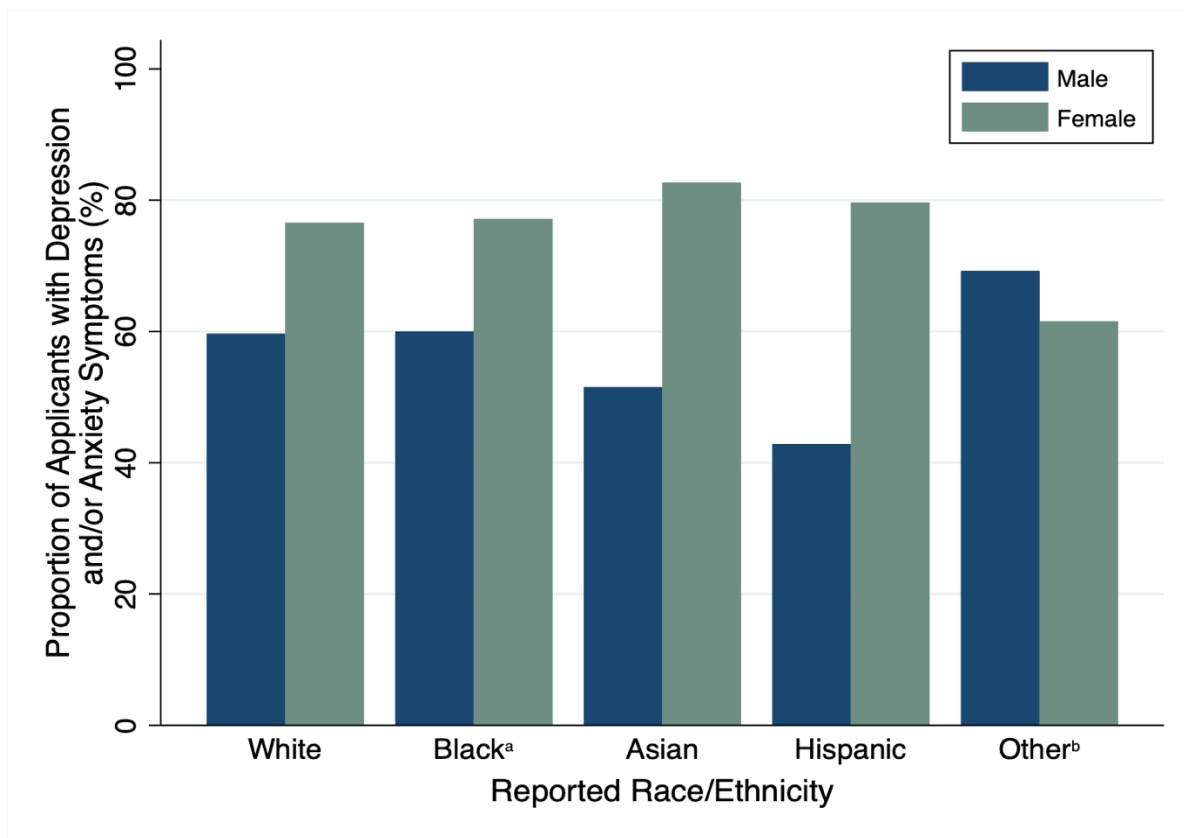
List of Supplementary Material for the article

1. [Supplementary Figure 1](#)
2. [Appendix 1: Survey Distribution](#)
3. [Appendix 2: Survey](#)
4. [Appendix 3: Depression and Anxiety Scoring](#)

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This Supplementary Material has been provided by the author(s) as an enhancement to the published article. It has been approved by peer review; however, it has undergone neither editing nor formatting by in-house editorial staff. The material is presented in the manner supplied by the author.

Supplementary Figure 1. Major Depressive Disorder (MDD) and/or Generalized Anxiety Disorder (GAD) symptoms among medical school applicants completing the Patient Health Questionnaire (PHQ-9) and Hospital Anxiety and Depression Scale–Anxiety subscale (HADS-A), stratified by race/ethnicity and sex. Bars represents the proportion of respondents within each sub-category.



^a Black or African American

^b Includes Native American, Pacific Islander, Middle Eastern/North African, biracial/mixed/other/unknown

Appendix 1. Survey Distribution

We posted a link to our survey on popular prehealth and premedical applicant group pages using the following social media platforms: Facebook (Menlo Park, CA), Twitter (San Francisco, CA), Reddit (San Francisco, CA), Slack (San Francisco, CA). Posting permission was obtained when necessary. Additionally, 170 college/university prehealth advising and postbaccalaureate program offices were contacted directly via email and asked to distribute the survey to interested students.

Appendix 2. Survey

The survey “The Impact of the COVID-19 Pandemic on US Medical School Applicants” consisted of 54 items. Responses necessary for a survey to be considered complete are indicated as “Essential”. Responses for items with multiple options are provided below each question; all other items involved free text responses. Items 40 and 41-55 correspond to the Patient Health Questionnaire and Hospital Anxiety and Depression Scale, respectively; these surveys were presented in standard fashion.^{1,2}

1. (Essential) Thank you for participating in this research study on the effects of COVID-19 on health care field applicants. As described in the Informed Consent, all research data from this online survey is anonymous and will be kept confidential. Please click "I agree to participate" to start this UCSD IRB approved survey. No provider will review your data from this survey in the coming days. If you are feeling very stressed, anxious and/or depressed, please contact your therapist, mental health provider, or primary care physician. If you are feeling suicidal, please call the national suicide hotline.

I agree to participate

I'm not interested in participating in this survey (this will end the survey)

2. (Essential) What is your age?
3. (Essential) To which gender identity do you most identify with? (choose 1)

Female

Male

Transgender female

Transgender male

Gender variant/non-conforming

Prefer not to answer

Not listed (please specify)

4. (Essential) What is your race or ethnicity?
White or Caucasian
Black or African American
Hispanic or Latino
Asian or Asian American
American Indian or Alaska Native
Native Hawaiian or other Pacific Islander

Prefer not to answer
Other (please specify)

5. Were both of your parents born in the United States?
Yes
No
6. Have you contracted COVID-19?
Yes, and tested positive
No, but I was a person under investigation (PUI)
No
Unsure
7. Have any friends or family members contracted COVID-19?
Yes, and tested positive
No, but I was a person under investigation (PUI)
No
Unsure
8. Are any of your friends or family members frontline healthcare workers caring directly for COVID-19 patients?
Yes
No
Unsure
9. (Essential) What year did you begin your undergraduate education?
10. (Essential) What is your expected or actual year of graduation (undergraduate)?
11. What is the name of the most recent undergraduate college you attend(ed)?
12. (Essential) What is your cumulative undergraduate GPA (unweighted)?
13. (Essential) If you have already completed your undergraduate education, have you pursued any postgraduate studies? (e.g., postbaccalaureate premedical program, master's program, etc.)
No
Yes - please specify which program(s)
14. Which pre-health entrance examination(s) have you taken, if any? (e.g., None, MCAT, DAT, PCAT)
15. How many times have you taken a pre-health entrance examination? (Please respond using the examination you have taken the most.)
16. (Essential) What is your ideal healthcare profession? Choose one.

Dentist
Dietician or Nutritionist
Hygienist
Nurse
Nurse Practitioner
Optometrist
Pharmacist
Physical or Occupational Therapist
Physician
Physician Assistant
Radiology Technician
Respiratory Therapist
Speech Therapist
Other (please specify)

17. What other careers are you considering? Choose all that apply.

Dentist
Dietician or Nutritionist
Hygienist
Nurse
Nurse Practitioner
Optometrist
Pharmacist
Physical or Occupational Therapist
Physician
Physician Assistant
Radiology Technician
Respiratory Therapist
Speech Therapist
Other (please specify)

18. How will you finance your healthcare education? (Check all that apply)

Student loans
Parental/family assistance
Personal funds
Gift/scholarship
Prefer not to answer
Other (please specify)

19. How competitive do you consider these elements of your pre-health application?

Not competitive
Somewhat competitive
Competitive
Highly competitive
N/A

a) Participation in research

- b) Volunteer experience (non-clinical)
- c) Volunteer experience (clinical)
- d) Shadowing or other clinical experience (including paid positions)
- e) Letters of recommendation

20. I decided to pursue a premedical education:

- Before high school*
- During high school*
- After high school, before college/university*
- During college/university*
- After graduating from college/university*
- Unsure*

21. I decided to pursue a career in medicine:

- Before the COVID-19 pandemic began*
- After the COVID-19 pandemic began*
- Unsure*

22. (Essential) In terms of my motivation to become a physician, the COVID-19 pandemic has made me:

- Much less motivated*
- Less motivated*
- Equally as motivated*
- More motivated*
- Much more motivated*

23. (Essential) In terms of my motivation to apply to medical school, the COVID-19 pandemic has made me:

- Much less motivated*
- Less motivated*
- Equally as motivated*
- More motivated*
- Much more motivated*

24. Prior to the COVID-19 pandemic, I was committed to pursuing a particular medical specialty (e.g., cardiology, neurosurgery, pediatrics, etc.)

- Yes, I had a specific specialty in mind*
- No, I was planning to learn about different options in medical school*

25. Prior to the COVID-19 pandemic, which medical specialties were you considering? (Please rank three)

- Anesthesiology*
- Cardiology*
- Critical care*
- Dermatology*
- Emergency medicine*

Family medicine
General internal medicine
Infectious disease
Neurology
Obstetrics and gynecology
Oncology
Ophthalmology
Pediatrics
Psychiatry
Pulmonology
Surgery
Other (please specify)

26. The COVID-19 pandemic has made me reconsider my choice of specialty.

Yes
No

27. Which medical specialties are you now considering? (Please rank three)

Anesthesiology
Cardiology
Critical care
Dermatology
Emergency medicine
Family medicine
General internal medicine
Infectious disease
Neurology
Obstetrics and gynecology
Oncology
Ophthalmology
Pediatrics
Psychiatry
Pulmonology
Surgery
Other (please specify)

28. Since the COVID-19 pandemic began, the following people have been ____ regarding my future career in healthcare.

More supportive
No change in support
Less supportive
N/A

- a) Parents/Family
- b) Spouse/Partner
- c) Friends/Peers
- d) Career Mentor(s)

e) Career Counselor(s)

29. My medical school application timeline has been ____ by the COVID-19 pandemic.
Significantly delayed
Somewhat delayed
Unaffected
Somewhat accelerated
Significantly accelerated
30. (Essential) I anticipate the COVID-19 pandemic will:
Add more than 1 gap-year to my timeline
Add 1 gap-year to my timeline
Add less than 1 year to my timeline but not affect my intended application cycle
31. (Essential) I anticipate the COVID-19 pandemic will:
Accelerate my application timeline by more than 1 year
Accelerate my application timeline by 1 year
Reduce the time I need to submit my application but not affect my application cycle
32. (Essential) The quality of my medical school application (i.e., candidacy) has been ____ by the COVID-19 pandemic.
Adversely affected
Unaffected
Enhanced
33. Please explain (briefly) how your application has been enhanced by the COVID-19 pandemic.
34. I am most concerned that the COVID-19 pandemic will adversely affect my application in the following ways (rank up to three):
GPA issue (e.g., I cannot raise my GPA because my college has changed to a pass/ fail system)
MCAT delay
New financial limitations
College graduation delay
Difficulty completing prerequisite coursework
Difficulty obtaining letters of recommendation
Difficulty completing community service/volunteer work
Difficulty completing physician shadowing/clinical observation requirements
Difficulty fulfilling a research commitment
Decreased access to premedical school advisors
35. (Essential) Before the COVID-19 pandemic, I had planned to:
Take more than 1 gap-year
Take 1 gap-year

Start professional school immediately
My plans are undecided

36. Why were you planning on taking one or more gap-years? (Select all that apply)

Financial reasons
Take the MCAT
Improve my MCAT score
Conduct research
Community service/volunteer work
Shadowing/clinical observation
To get another graduate degree
To complete a postbaccalaureate program or additional prerequisite coursework
Other (please specify)

37. (Essential) Because of the COVID-19 pandemic I now plan to:

Take an additional gap-year(s)
Take fewer gap-year(s)
My plans have not changed
My plans are now undecided

38. Why are you now taking an additional gap-year(s)? (Select all that apply)

Financial reasons
Take the MCAT
Improve my MCAT score
Conduct research
Community service/volunteer work
Shadowing/clinical observation
To get another graduate degree
To complete a postbaccalaureate program or additional prerequisite coursework
Other (please specify)

39. Please explain (briefly) why you are taking fewer gap-year(s) due to the COVID-19 pandemic.

40. Patient Health Questionnaire (PHQ-9).¹

Over the last 2 weeks, how often have you been bothered by any of the following problems?

Not at all
Several days
More than half the days
Nearly every day

- a. Little interest or pleasure in doing things
- b. Feeling down, depressed, or hopeless
- c. Trouble falling or staying asleep, or sleeping too much
- d. Feeling tired or having little energy
- e. Poor appetite or overeating

- f. Feeling bad about yourself - or that you are a failure or have let yourself or your family down
- g. Trouble concentrating on things, such as reading the newspaper or watching television
- h. Moving or speaking so slowly that other people could have noticed. Or the opposite - being so fidgety or restless that you have been moving around a lot more than usual
- i. Thoughts that you would be better off dead, or of hurting yourself

41-54. Hospital Anxiety and Depression Scale (HADS)² (questions used for HADS-A anxiety score highlighted in **bold**)

In the following questions, please tick the box beside the reply that is closest to how you have been feeling in the past week.

41. I feel tense or "wound up":

Most of the time
A lot of the time
From time to time, occasionally
Not at all

42. I still enjoy the things I used to enjoy:

Definitely as much
Not quite so much
Only a little
Hardly at all

43. I get a sort of frightened feeling as if something awful is about to happen:

Very definitely and quite badly
Yes, but not too badly
A little, but it doesn't worry me
Not at all

44. I can laugh and see the funny side of things:

As much as I always could
Not quite so much now
Definitely not so much now
Not at all

45. Worrying thoughts go through my mind:

A great deal of the time
A lot of the time
From time to time, but not too often
Only occasionally

46. I feel cheerful:

Not at all

Not often
Sometimes
Most of the time

47. I can sit at ease and feel relaxed:

Definitely
Usually
Not often
Not at all

48. I feel as if I am slowed down:

Nearly all the time
Very often
Sometimes
Not at all

49. I get a sort of frightened feeling like 'butterflies' in the stomach:

Not at all
Occasionally
Quite often
Very often

50. I have lost interest in my appearance:

Definitely
I don't take as much care as I should
I may not take quite as much care
I take just as much care as ever

51. I feel restless as I have to be on the move:

Very much indeed
Quite a lot
Not very much
Not at all

52. I look forward with enjoyment to things:

As much as I ever did
Rather less than I used to
Definitely less than I used to
Hardly at all

53. I get sudden feelings of panic:

Very often indeed
Quite often
Not very often
Not at all

54. I can enjoy a good book or radio or TV program:

Often

Sometimes

Not often

Very seldom

Appendix 3. Depression and Anxiety Scoring

Depression was assessed using the Patient Health Questionnaire (PHQ-9),¹ with the presence of major depressive disorder (MDD) symptoms defined as having 5 of 9 PHQ items with a score ≥ 2 including either item #1 (anhedonia), and/or item #2 (feeling depressed).³ Generalized anxiety disorder (GAD) was evaluated using the Hospital Anxiety and Depression Scale-Anxiety subscale (HADS-A), with a score of ≥ 8 indicating GAD symptoms.²

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