

A PRE-POST STUDY EVALUATING AN ONLINE CBT-BASED INTERVENTION TO IMPROVE ACADEMIC PERFORMANCE IN STUDENTS WITH LOW MOOD

Suheir Awadalla^{2*}, E Bethan Davies^{1,3}, and Cris Glazebrook^{1,3}

¹ Division of Psychiatry and Applied Psychology, University of Nottingham, Medical School, Nottingham, NG7 2UH

² College of Natural and Health Sciences Department of Psychology, Zayed University, U.A.E.

³ NIHR MindTech MedTech Cooperative Institute of Mental Health, University of Nottingham Innovation Park, Jubilee Campus, Triumph Road, Nottingham, NG7 2TU

Corresponding author:

Suheir Awadalla, College of Natural and Health Sciences Department of Psychology, Zayed University, U.A.E

ABSTRACT¹

Online CBT-based interventions have shown potential in improving the mental health of university students. However, their impact on West Asian cultures and educational achievement are yet to be fully investigated. This study aims to explore the feasibility, acceptability, and potential effectiveness of a self-directed, internet-delivered, cognitive-behavioural skills training program (MoodGYM) in reducing depression and improving academic performance in university students in the United Arab Emirates (UAE). This exploratory pre-post intervention study with an historic control group recruited 50 students from one UAE university, with GPA <2 and self-reporting at least one of two key depressive symptoms. Results demonstrated that the total Hospital Depression and Anxiety (HADS) depression scores (HADS-D) decreased at post intervention ($P=0.004$) and the proportion of participants scoring above the cut-off for depression ($HADS-D \geq 8$) reduced from 77.2% to 27.3% ($p<0.001$). There was also a significant reduction in HADS-Anxiety scores ($p<0.001$) and the proportion of participants above the cut-off for anxiety ($HADS-A \geq 8$) dropped from 50% to 11.4 % ($p=0.001$). GPA improved significantly over time ($p<0.001$, $d=1.3$) and attendance warnings reduced ($p = 0.008$, $d = 0.6$). Most students (79.6%) evaluated MoodGYM as useful, and all students completed at least two MoodGYM modules. This study provides support for a web based mental health promotion intervention (MoodGYM) in improving academic achievement in university students with depressive symptoms. Further research is needed to explore how MoodGYM can be best implemented within university settings.

Keywords: academic performance, MoodGYM, depression, anxiety, online intervention

¹ Abbreviations: ACT – Acceptable and Commitment Therapy, CBT – Cognitive Behavioural Therapy, GPA – Grade Point Average, HADS – Hospital Anxiety and Depression Scale, DASS-21 – Depression Anxiety and Stress Scale, BDI-II – Beck Depression Inventory II, ANOVA – Analysis of Variance, UAE – United Arab Emirates



All the articles published by YUGATO are licensed under a [Creative Commons Attribution-NonCommercial 4.0](https://creativecommons.org/licenses/by-nc/4.0/) International License Based on a work at <https://www.yugato.org/>

BACKGROUND

Empirical evidence suggests high prevalence of mental health problems, such as depression, among university students compared to their non-student peers (Ibrahim, Kelly, Adams, & Glazebrook, 2013). This is concerning, as depression has been shown to impact all aspects of student well-being, including academic achievement. Students with depressive symptoms tend to have poor classroom engagement, peer interactions, and attendance (Abu Ruz, Al-Akash, & Jarrah, 2018). Thus, depression negatively influences academic progress and fosters under-achievement among university students.

A recent representative survey (Awadalla, Davies, & Glazebrook, 2020) reported that over one-third of Emirati students at one university scored above the threshold for major depressive disorder; depressive symptoms at baseline, but not anxiety symptoms, predicted academic performance (grade point average [GPA]) at follow-up. This supports previous evidence that depression negatively impacts university students' academic performance (DeRoma, Leach, & Leverett, 2009) and suggests that an intervention to help students manage their low mood could reduce this educational disadvantage.

In many Arab countries, established mental health resources are limited, and negative beliefs about mental health care act as barriers to help-seeking behaviour (Dardas & Simmons, 2015). In this context, online therapeutic interventions can offer considerable advantages in terms of access and privacy. Technology-based interventions could fill the gap between the need for and access to mental health services among university students (Harrer et al., 2018). There is a growing need to create supportive environments for students who may experience emotional difficulties during university life (January et al., 2018). 'Internet-delivered technology' in counselling refers to psychological online interventions provided by utilising various multimedia formats and interactive features to engage users and promote intervention effectiveness (Grist, Croker, Denne, & Stallard, 2019). Customisation to student needs, anonymous access, and a more comfortable setting to access sensitive information are advantages of internet-delivered interventions (Harrer et al., 2018); these advantages have led to an increased focus on the use of online interventions, with several studies examining such programs (Farrer et al., 2013).

Online interventions can effectively improve university students' mental health (Barrable, Papadatou-Pastou, & Tzotzoli, 2018; Davies, Morriss, & Glazebrook, 2014). However, their impact on educational attainment has yet to be fully explored. Bolinski et al. (2020), conducted a systematic review to evaluate the impact of online mental health interventions on academic performance. A meta-analysis of the six randomised-controlled trials which included academic performance as an outcome showed beneficial effects for depression but revealed only a small, non-significant effect for academic achievement. However, none of the six studies targeted students who had symptoms of depression and struggled academically at baseline.

Cognitive behavioural therapy (CBT) is a collaborative therapy that focuses on how a person's thoughts, beliefs, and attitudes affect their emotions and behaviours (Gaudiano, 2008). CBT is the recommended treatment for mild to moderate depression and has been proven effective (Lopez & Basco, 2015). However, limited access—particularly in middle- and low-income countries—and stigma associated with poor mental health, may hinder access to physical treatment resources (Sweetland et al., 2014). Thus, cost-effective and widely accessible alternatives to in-person treatment are required. Adolescents use technology at high rates (Anderson, Howarth, Vainre, Jones, & Humphrey, 2017), yet innovative methods of online treatment have not fully exploited students'

proficiency. For example, despite evidence confirming the effectiveness of computerised CBT for reducing depressive and anxiety symptoms, to our knowledge, no study has evaluated a CBT-based online intervention targeting students with depressive symptoms who are struggling academically.

MoodGYM (<https://moodgym.anu.edu.au/welcome/faq>) is an online CBT-based program designed to prevent symptoms of emotional distress and various mental health disorders in adolescents, which has shown promise in Australian studies (Gratzer & Khalid-Khan, 2016). MoodGYM consists of five modules involving written information, animations, interactive exercises, and quizzes designed to teach skills known to prevent depression and anxiety among young people (Christensen, Griffiths, Groves, & Korten, 2006; Farrer, Christensen, Griffiths, & Mackinnon, 2012).

Research has investigated the effects of MoodGYM across a variety of settings and using different study designs. Twomey and O'Reilly (2016), conducted a systematic review of 11 studies to evaluate the effectiveness of MoodGYM in reducing depressive symptoms and general psychological distress in adults. They found that studies with no treatment controls, face-to-face guidance, and high adherence to MoodGYM modules revealed a more positive effect on depression symptoms and other psychological stresses. Furthermore, a stronger effect was found in studies conducted in Australia compared with Europe. The authors concluded that MoodGYM could provide primary support to participants with mental health issues. However, it should be noted that adherence rates and cross-cultural factors may affect the influence of CBT web-based programs. Furthermore, more studies are needed to investigate the impact of MoodGYM and other CBT web-based interventions in West Asian cultures, including Arab communities in that region.

There is some evidence that MoodGYM may be more effective when the intervention is targeted. Christensen, Griffiths, and Korten (2002) found that for people with baseline levels of anxiety and depression who accessed MoodGYM, symptoms significantly decreased after program completion. Furthermore, at a four-month follow-up, Canadian university students at risk of depression randomly assigned to MoodGYM showed a greater reduction in depressive symptoms and were significantly less likely to be diagnosed with a major depressive disorder compared to attentional control (McDermott & Dozois, 2019).

This study aims to evaluate the feasibility, acceptability, and effectiveness of targeting MoodGYM for academically struggling Emirati students with symptoms of depression.

Objectives

The objectives of the present study were as follows:

- To explore the acceptability and feasibility of using MoodGYM in improving academic achievement in university students with low mood and poor academic performance in the UAE.
- To investigate the potential effectiveness of a self-directed, internet-delivered cognitive-behavioural skills therapy (MoodGYM) in improving academic performance (GPA) and mood in university students in the UAE with poor academic performance.
- To investigate the relationship between MoodGYM uptake and improvement in GPA post-intervention.

We hypothesise that students using MoodGYM would have a higher GPA at follow-up compared to the control group of students not receiving MoodGYM.

METHODS

Design

This study used a pre-post pilot, non-randomised trial design with a historical control group to evaluate changes in GPA. Data were collected via online surveys administered at baseline and at follow-up two months after using MoodGYM.

Participants and recruitment

Participants were undergraduate students at a public university in the UAE, aged 18 and above. Students were selected from two campuses (Dubai and Abu-Dhabi), and recruited through their academic advisors. The recruitment target was 50 participants.

The target sample size was 50 male and female undergraduate students that met the following inclusion criteria:

- Undergraduate students in their second, third, or fourth year of study at a university in the UAE.
- Scheduled to attend an academic advisory seminar to address poor academic performance (GPA less than 2.0).
- 18 years of age or older.
- Self-identified as having at least one of two key symptoms of low mood (Kroenke, Spitzer, Williams, & Löwe, 2009) .

Historical control group

Students from a previous longitudinal cohort study of UAE university students (Awadalla et al., 2020) were selected as the comparison group if they had a GPA < 2.0 at baseline and a GPA reported at the two-month follow-up. The control group students ($n = 19$) had similar GPAs, attendance warnings, and demographic characteristics at baseline as the intervention group ($n = 44$). This group (no intervention) was used as a comparison group to evaluate the academic improvement in the group receiving the intervention.

Power calculation

With a historic control group of $n=19$ and assuming a 70% response rate at follow-up in the intervention group (35/50), it was estimated that the study would have 90% power to detect a 1 SD difference ($d=1$) in GPA between groups at follow-up with a probability of a type 1 error < 0.05 (Faul, Erdfelder, Lang, & Buchner, 2007) .

Ethical approval

Ethical approval was obtained from the Division of Psychiatry and Applied Psychology Ethics Subcommittee (reference number: 0397) and the Research Ethics Committee at Zayed University (ref ZU19_46_F). Participation was voluntary. Students completed an online, written consent form to participate in the two anonymous online surveys. These surveys were linked through self-generated identifiers.

Measures

Mental health

The Hospital Anxiety and Depression Scale (HADS) is a self-assessment tool developed to detect states of depression and anxiety in non-psychiatric settings (Zigmond & Snaith, 1983). The HADS consists of 14 items, with 7 assessing anxiety (HADS-A) and 7 assessing depression (HADS-D). For both subscales, scores of ≤ 7 indicate non-cases, while scores of 8–10, 11–14, and 15–21 indicate mild, moderate, and severe depression and anxiety, respectively (Stern, 2014). Cronbach's alpha ranged from 0.68 to 0.93 (mean = 0.83) for the HADS-A and from 0.67 to 0.90 (mean = 0.82) for the HADS-D; (Bjelland, Dahl, Haug, & Neckelmann, 2002). For anxiety and depression caseness, the optimal cut off is HADS-A ≥ 8 (sensitivity 0.89, specificity 0.78) and HADS-D ≥ 8 (sensitivity 0.83 and specificity 0.79), respectively (Bjelland et al., 2002). The HADS has been validated in many languages, countries, and settings, including with university students (Andrews, Hejdenberg, & Wilding, 2006). An Arabic version of the HADS has been validated in Saudi Arabia (El-Rufaie & Absood, 1987), Kuwait (Malasi, Mirza, & El-Islam, 1991), and the UAE (El-Rufaie & Absood, 1995) in primary-care settings and, recently, in hospitalised patients (Terkawi et al., 2017).

Considering that all the courses at the university are taught in English, and the students are proficient in the English language, HADS was provided in English. There were no missing values in the HADS and alpha values for HADS-D ($\alpha = 0.61$) and HADS-A ($\alpha = 0.77$) indicated acceptable internal consistency.

Academic performance

Participants reported their most recent GPA and the number of poor attendance academic warnings received during the last semester. The GPA scores range from 0–4, with higher scores indicating better academic performance. In the present study, a GPA below 2.0 was considered a sign of academic difficulties.

Intervention

MoodGYM is an internet-based CBT program to prevent depression and teach coping skills and can be provided with or without clinician guidance. It was developed by researchers at the Australian National University in 2013 (www.moodgym.anu.edu.au). In this study, MoodGYM was entirely self-directed. The program teaches key components of CBT for depression in five modules: feelings, thoughts, unwrapping, de-stressing, and relationships as shown in Table 1. Each module contains exercises to be completed during the module, homework to be completed during the week, and a workbook to record progress throughout the program. The modules are completed sequentially, with each module estimated to take 30–45 minutes to complete, with total 28 exercises and 13 across all modules (Christensen, Griffiths, & Jorm, 2004).

Table 1. Modules of MoodGYM (www.ehubhealth.com)

Modules	Descriptions
<i>Feelings</i>	The <i>Feelings</i> module focuses on the basic tenets of CBT by highlighting connections between events, thoughts, feelings, and behaviours. Users are introduced to six characters that have unique thought patterns and feelings which are either adaptive or maladaptive.
<i>Thoughts</i>	The second module focuses on <i>Thoughts</i> , teaching users how to challenge what the program identifies as their ‘warped thoughts’, by exploring the reasons behind their thinking.
<i>Unwarping</i>	The third module is <i>Unwarping</i> . It has a total of ten exercises, which is the most of any module. These exercises aim to attack distorted thinking and build self-esteem. One part of this module offers techniques on how to address the areas of vulnerability identified by the Warpy Thoughts Quiz.
<i>Destressing</i>	The fourth module is <i>Destressing</i> , which on recognising the different sources of stress and learning how to deal with them. An exercise known as ‘Life Whacks’ consists of major stressful events, such as losing someone who is important or having a conflict with parents. This module also focuses on relaxation programs.
<i>Relationships</i>	The fifth module, <i>Relationships</i> , focuses on emotional and behavioural reactions to relationship breakups and offers more ways to argue against related distorted thoughts.

Procedure

Academic advisors sent invitation emails and participant information sheets to all academically failing students, explaining the study to students scheduled to attend a seminar addressing their poor academic performance in the previous semester (GPA < 2.0). Students who reported feeling down, depressed, or hopeless, or had had little interest or pleasure in doing things, in the previous two weeks, were invited to participate in the study by emailing

the researcher. The academic advisor reminded students about the study invitation during the scheduled remedial class. All participants who contacted the researcher within the study timeframe (September 2019) were sent the baseline survey's link. All parts of this study were conducted online, and data at baseline and eight-week follow-up were collected via anonymous surveys hosted by JISC Online Surveys. Students were able to re-read the participant information sheet before completing the online consent form. Participants created their own unique study ID code by providing their birthday and the last three digits of their mobile phone number, which was used to link baseline and follow-up data. Participants then completed the baseline survey, which included demographics, GPA, number of attendance warnings in the previous semester, previous help-seeking for mental health problems, and the HADS. At the end of the survey, students were thanked for their time and asked to click on a second survey link, which allowed them to enter their email address in order to receive a link and user code for MoodGYM. They were also provided with information regarding the University Counselling Centre for any further support. For those who provided their emails, the researcher sent them an email with instructions and a user code for accessing MoodGYM. All participants received a reminder about using MoodGYM four weeks after entering the study. Eight weeks after the baseline survey, they were emailed a link to the follow-up survey, which collected data on their GPA, number of attendance warnings in the current semester, and the HADS. The follow-up survey also included text boxes to allow participants to comment on the positive and negative aspects of MoodGYM. A reminder email was sent to all participants two weeks after the follow-up survey email.

Data analysis

Data from the baseline and follow-up surveys were imported into SPSS (version 26). After cleaning and checking the data, HADS and GPA scores were compared pre- and post-intervention, using appropriate paired statistics. Univariate correlations and regression analysis were used to explore the relationship between self-reported MoodGYM use and changes in GPA. A repeated-measures ANOVA with group (historic control/ intervention) as the independent factor, time of testing as the within-subjects factor, and GPA score as the dependent variable was conducted to analyse group-by-time interaction. Descriptive statistics were used to explore the acceptability and usability of MoodGYM. Content analysis was used to classify and group participants' responses to the open-ended question for evaluating MoodGYM.

RESULTS

Fifty respondents (36 women and 14 men) completed the baseline survey and received access to the MoodGYM program. Of the 50 students, 47 accessed the program, and 44 completed the post-intervention survey, forming the study sample (88.0% follow-up). The mean age was 20.7 years ($SD=1.55$; range 18–24) and the majority were women (72%) (Table 2). At baseline, there were no detectable differences in demographic characteristics, baseline GPA, depressive symptoms, or number of attendance warnings between respondents at follow-up (intervention group, $n=44$) and non-responders at follow-up ($n = 6$) or between the intervention group respondents at follow-up and the historic control group ($n = 19$) (all $p \geq 0.05$). However, non-respondents were significantly more anxious at baseline than respondents ($M = 11.00$, $SD = 3.63$, $n = 6$, vs. $M = 7.61$, $SD = 2.57$, $n = 44$, $p = 0.006$, $d = 1.2$). There was no difference in baseline anxiety between the intervention and historic control groups.

Table 2. Demographic characteristics of the sample and comparison groups at baseline

Variables	Intervention group (n=44)	Non-respondents (n=6)	Historic control group (n=19)
Gender			
Men	13 (29.5%)	1 (16.7%)	6 (31.6%)
Women	31 (70.5%)	5 (83.3%)	13 (68.4%)
Age			
18–20	19 (43.2%)	4 (66.6%)	8 (42.1%)
21–24	23 (52.3%)	2 (33.3%)	11 (57.9%)
Mean age (SD)	20.7 (1.46)	20.4 (1.95)	20.00 (1.84)
Marital status			
Married	4 (9.1%)	2 (33.3%)	2 (10.5%)
Single	40 (90.9%)	4 (66.6%)	17 (89.5%)
Year of study			
2 nd year	24 (54.5%)	4 (66.6%)	12 (63.2%)
3 rd year	18 (40.9%)	2 (33.3%)	6 (31.6%)
4 th year	2 (4.5%)	0	1 (5.3%)
Department of study			
Business	22 (50.0%)	2 (33.3%)	7 (36.9%)
Humanities & Social Sciences	2 (4.5%)	0	2 (10.5%)
Technological Innovation	6 (13.6%)	0	3 (15.8%)

Communication & Medical Sciences	8 (18.2%)	2 (33.3%)	4 (21.0%)
Natural Health Sciences	6 (13.6%)	2 (33.3%)	3 (15.8%)

Help seeking

Prior to using MoodGYM, nearly half of the students reported seeking help for their mental health from their friends ($n= 19, 43.2\%$), followed by internet sources ($n=11, 25.0\%$). Two participants (4.5%) sought help from family, four (9.1%) from their university tutor, and only three (6.8%) from university counselling services. Five students (11.4%) had not sought any help for their mental health.

Depression and anxiety before and after MoodGYM

A paired-samples t-test found a significant reduction in HADS-D scores ($t(43) = 3.07, p = 0.004, d=0.5$) and HADS-A scores ($t(43) = 5.67, p \leq .001, d = 1.1$), post-intervention compared to baseline, indicating a significant reduction in depressive and anxiety symptoms (Table 3). The proportion of participants scoring above the cut-off for depression caseness decreased from 77.2% to 27.3% ($n=34$ to $n = 12$; McNemar = $p < 0.001$) and for anxiety caseness decreased from 50% to 11.4% ($n= 22$ to $n = 5$; McNemar = $p < 0.001$).

Table 3. Participants’ depression and anxiety levels before and after MoodGYM

	Pre-intervention (n=44)	Post-intervention (n=44)
HADS-D Group		
Normal	10 (22.7%)	32 (72.7%) ***
Borderline	30 (68.2%)	5 (11.4%)
Clinical	4 (9.1%)	7 (15.9%)
HADS-D Mean (SD)	8.32 (1.72)	6.64 (3.72) **
HADS-A group		
Normal	22 (50.0%)	39 (88.6%) ***
Borderline	18 (40.9%)	2 (4.6%)
Clinical	4 (9.1%)	3 (6.8%)

HADS-A Mean (SD)	7.61 (2.57)	4.77 (2.67) **
------------------	-------------	----------------

Note: * $p \leq 0.05$, ** $p \leq 0.01$, *** $p \leq 0.001$

Academic performance before and after MoodGYM

Pre-intervention student GPA ranged from 0.33–1.90, with a mean of 1.55 (SD = 0.32) and increased significantly at post-intervention ($t(43) = -9.26, p \leq .001, d = 1.3$), indicating significant improvement in academic performance after using MoodGYM (Table 4). At baseline, all students in the intervention group had a GPA below 2.0 indicating academic weakness. After using MoodGYM, 19 (43.2%) students had a GPA of 2.0 or above, thereby moving out of the academic warning zone.

At baseline, half of the sample had received at least one attendance warning ($n = 22, 50.0%$); however, this number decreased by nearly half after using MoodGYM (8 week intervention) ($n = 11, 22.0%$), with a significant reduction in the number of attendance warnings between pre- and post-intervention ($Z = -2.66, p = 0.008, d = 0.6$) (Table 4).

Table 4. Academic outcomes pre- and post-intervention and in historic control group

	Intervention group (n=44)		Historic control (n=19)	
	Baseline	Follow-up	Baseline	Follow-up
Mean GPA (SD)	1.54 (0.33)	1.99 (0.33) **	1.56 (0.39)	1.75 (0.51)
Mean number of attendance warnings (SD)	1.05 (0.75)	0.61 (0.78) **	1.17 (1.09)	1.21 (1.08)

Note: * $p \leq 0.05$, ** $p \leq 0.01$

Academic performance outcomes compared to historic control group

At baseline, the intervention group ($n = 44$) and the comparison group ($n = 19$) had similar GPAs and number of attendance warnings. A repeated-measures ANOVA with group (intervention/historic control) as the between-subjects factor and time found a significant time by group interaction ($F = 5.96, df = 1.61, p = 0.018$). At follow-up, the intervention group had significantly higher GPAs compared to historic control group ($t(61) = 2.22, p = 0.030, d = 0.6$) and fewer attendance warnings ($Z = -2.10, p = 0.036, d = 0.7$) (Table 4).

Completed MoodGYM modules and outcome improvements

All students in the intervention group reported completing at least two modules, with nearly half of them reporting completing all five modules (mean of completed modules = 3.75, SD = 1.52, $n = 44$). Almost all participants completed the *Feelings* module ($n = 42, 95.5%$), followed by *Thoughts* (36, 81.8%), *Unwrapping* (34, 77.3%), *De-stressing* (29, 65.0%), and *Relationships* (24, 54.0%). There was a significant positive correlation between GPA improvement and the number of modules completed ($r_s = 0.388, n = 44, p = 0.009$). Completing more

modules was also associated with a greater reduction in anxiety scores ($r_s = 0.348, n = 44, p = 0.020$); however, no relationship was found between changes in depression scores and the number of completed modules.

Regression analysis (entry method) with the difference between pre- and post-intervention GPAs as the dependent variable (higher scores indicating greater GPA improvement), and baseline anxiety and depression scores, completed MoodGYM modules, and improved attendance as the independent variables, revealed that greater improvement in GPA was associated with a higher number of completed MoodGYM modules ($\beta = .392, p = 0.005$) and improved attendance ($\beta = .388, p = 0.007$; total adjusted $r^2 = 0.35$) (Table 5).

Table 5. Regression analysis for depression, anxiety, completed MoodGYM modules, attendance, and GPA pre- and post-intervention

Predictors	Post-intervention GPA			
	<i>B</i>	<i>SE B</i>	<i>B</i>	<i>T</i>
Depression scores (pre-intervention)	.024	.028	.125	.837
Anxiety scores (pre-intervention)	-.022	.018	-.171	-1.194
Total number of modules completed	.083	.028	.392	2.985**
Improved attendance	.126	.044	.388	2.857*

Dependent Variable: Change in GPA score (pre-GPA – post-GPA)

Note: * $p < .05$, ** $p < 0.01$

Evaluation of MoodGYM

The time period over which the participants used MoodGYM ranged from 2 weeks to 8 weeks; however, the highest proportion of students used the program for more than 4 weeks ($n = 16, 36.4%$) (Table 6).

Table 6. Number of weeks students spent completing MoodGYM modules

Number of weeks	Number of students (%)
Two weeks	4 (9.0%)

Three weeks	5 (11.4%)
Four weeks	9 (20.5%)
Five to eight weeks	16 (36.4%)
Not sure about time spent	10 (22.7%)

Participant ratings of MoodGYM were generally either overwhelmingly positive or neutral. Most students ($n = 31$, 70.5%) rated MoodGYM as good or very good, and 35 (79.6%) found it very or slightly helpful. More than half ($n = 26$, 59.1%) found MoodGYM easy or very easy to use, and 33 (75.0%) stated they would recommend it to a friend or family member.

Students were asked through an open-ended question to summarise how MoodGYM was helpful to them, and 70.5% ($n=31$) responded. Content analysis found that 20 (45.5%)

students reported that MoodGYM was helpful in reducing anxiety and depressive symptoms by teaching them different coping skills and strategies to address their negative thoughts. Of the 20 students; four mentioned that the program helped them reflect on themselves more by completing different exercises and conducting self-assessments at the end of each module; five stated that MoodGYM increased their knowledge of mental health; one specifically suggested that it was a very good tool to deal with self-criticism; and ten mentioned that MoodGYM helped them acquire new self-help techniques and strategies to deal with their negative thoughts and change their daily routines by implementing some of the exercises. For example, one student stated, '*MoodGYM helped me to deal with my worrying thoughts and to understand why I get them very often*'.

Eight (18.2%) students found MoodGYM helpful, but felt the modules were too long and time-consuming, and two (4.6%) felt that MoodGYM was unhelpful due to its lack of clarity and complexity. For example, one student was not able to understand the purpose of some assessments, stating, 'In all, I don't think it was clear enough'.

DISCUSSION

In the present study, students with poor academic achievement who self-reported symptoms of low mood demonstrated significant improvements in GPA ($d=1.3$) and attendance ($d=0.6$) after using an online CBT-based intervention (MoodGYM). Comparison with a previous cohort of students with low GPAs found a significant time by group interaction, with the MoodGYM group having very similar GPA scores to the historic control group at baseline, but significantly higher GPA scores at the equivalent follow-up point. Attendance also improved compared to the control group. GPA improvement was predicted independently by MoodGYM usage and improved attendance. MoodGYM was also associated with significant reductions in depressive and anxiety symptoms and there were substantial reductions in the proportion of students scoring above the cut-off for anxiety and depression caseness. Most participants positively evaluated MoodGYM and remarked that they would recommend the program to friends or family members.

Although this study lacked a control group for evaluating the substantial improvement in depressive and anxiety symptoms, the findings are in line with previous research using MoodGYM with student populations. A study

comparing MoodGYM with the school's standard development activities for female secondary school students ($n = 157$), reported that MoodGYM usage significantly decreased rate of self-reported depressive symptoms, compared to the usual curriculum, and the effect of MoodGYM was more significant after 20 weeks (O'Kearney, Kang, Christensen, & Griffiths, 2009). A recent study compared MoodGYM to two other internet-based preventative activities: attentional bias modification and an active attentional condition in the prevention and treatment of major depressive disorder among high-risk first- and second-year university students (McDermott & Dozois, 2019). Depressive symptoms were assessed at three points: baseline, post-intervention, and four-month follow-up using the Depression, Anxiety and Stress Scale 21 (DASS-21) depression scale and the Beck Depression Inventory II (BDI-II). The results indicated that MoodGYM was a more effective intervention at both the diagnostic and symptom levels with effect sizes for change in the BDI-II and DASS-21 depression scales of $d = 0.40$ and 0.51 , respectively, at the four-month follow-up. These were similar to the effect size ($d = 0.5$) for change in HADS-D observed in the current study at eight weeks post-intervention. Conversely, Twomey et al. (2014) found no significant improvements in anxiety or depressive symptoms in a clinical sample group with reported mental health issues using MoodGYM compared to a waitlist control group, despite showing some decrease in general psychological distress. However, the mean age of 35 in the intervention group was substantially older than the present sample, and the follow-up rate was only 18%.

In the present sample, 70.5% ($n = 31$) considered MoodGYM to be an effective program for reducing depressive and anxiety symptoms and felt it enhanced their knowledge of mental health. This is consistent with a study by Farrer et al. (2012), which suggested that CBT interventions can effectively reduce depressive symptoms and promote knowledge about effective strategies for dealing with depression and self-management. Lintvedt et al. (2013) reported that an unguided intervention (MoodGYM) effectively improved depressive symptoms and negative automatic thoughts in a university population. The study had a high dropout rate (62% of the participants responded post-intervention). In their study with university students experiencing depressive symptoms, they also found that participants who used MoodGYM were very satisfied, and 90% stated that they would recommend the program to others.

The results of the present study indicate a significant improvement in academic performance and a significant reduction in attendance warnings after using MoodGYM. To our knowledge, this is the first study to explore the potential of a CBT-based online intervention in improving academic outcomes. However, previous studies that studied different online interventions have reported some improvements in academic achievement. For example, Viskovich and Pakenham (2020) explored the effectiveness of web-based Acceptance and Commitment Therapy (ACT) in promoting mental health in university students and reported pre- to post-intervention improvements for the study's primary outcomes—including academic performance—these improvements were maintained throughout the follow-up period. The study used a four-week web-based ACT mental health promotion intervention called 'YOLO'. Academic performance was measured using a brief, 12-item self-report scale measuring facets of academic performance, including study habits, study motivation, and overall grades. It was not known which items contributed to the score, as the study used a factor analysis method; however, results indicated that the intervention improved participants' perceived performance, although objective performance was not assessed.

In the present sample, the comparison group ($n = 19$) was from a recent cohort study conducted by Awadalla et al. (2020), to explore the effects of depression and anxiety on academic performance among university students. Essentially, the historic control group was from the same sample population as the current study (i.e. same university and very similar sample characteristics). Like the intervention group, the students in this group had GPAs below 2.0 at recruitment and were considered in the academic warning (failing) category. In comparison with the intervention group ($n = 44$), they had similar GPAs and attendance warnings at baseline; however, the comparison group (no-intervention) had significantly lower GPAs and more attendance warnings at follow-up, demonstrating that the intervention group had better academic outcomes over a similar period.

There are many societal, attitudinal, and cultural reasons why university students with emotional difficulties may not seek professional help (Heath, Vogel, & Al-Darmaki, 2016). The present study results demonstrate a gap in the proportion of students experiencing emotional difficulties and those who have sought professional help. For example, although 77% scored above the cut-off for depression caseness and nearly half of the intervention group had sought help from their friends, only three students had sought professional help.

These data are particularly valuable in highlighting the poor uptake of professional support as there is a lack of data, including reliable record references for the number of people seeking mental health help in the UAE. Overall, in the UAE, a lack of awareness of the availability of mental health services and the stigma of seeking psychological help may affect the help-seeking behaviour of several university students (Sayed, 2013). MoodGYM appears to offer an effective and acceptable method of increasing access to evidence-based therapies. The fact that 88% of the students responded to the post-intervention survey shows that MoodGYM might be culturally and socially accepted.

In this study, out of the 47 students who accessed MoodGYM, half completed all five modules. The results indicated that the students who completed more MoodGYM modules performed better academically than those who completed fewer modules. The findings support the importance of the dose of the intervention. However, the bias of self-report measures and the need to assess the fidelity of MoodGYM use should also be considered. These findings are consistent with those of Caelear, Christensen, Mackinnon, and Griffiths (2013), who investigated the effects of adolescent adherence to MoodGYM in schools. They reported that participants who maintained high intervention adherence reported more substantial intervention effects six months post-intervention compared with participants with low adherence.

In the current study, more than half (59.1%) of the students found MoodGYM easy to use, and three-quarters of the students would recommend it to a family member or friend. This is consistent with another study that evaluated MoodGYM in primary care patients with mild to moderate depression. The study reported that MoodGYM was rated positively by more than half of the participants and suggested that low non-adherence rates were a sign of positive evaluation, indicating the intervention's acceptability (Høifødt et al., 2013). The study concluded that significant improvements were found at the two-month follow-up. Also, the level of satisfaction among the participants was high, as 90% reported they would recommend MoodGYM to others.

Even though most of the students in the present study found MoodGYM to be helpful and easy to access, some found the modules to be very long and time-consuming. These students may require additional therapy support. A systematic review by Knowles et al. (2014) investigated qualitative studies exploring user experience with web-

based therapies for anxiety and depression. From the eight included studies, six used CBT treatment, and were found to show more concern regarding improving access to therapy than patient experience. The review suggested that considering the sensitivity and personalising the program's content to be more relevant to users could increase engagement and adherence. Furthermore, Neil, Batterham, Christensen, Bennett, and Griffiths (2009) proposed that internet-based interventions should precisely record user activity to accurately measure adherence. Estimating the time spent on modules is significant given that a user could also spend considerable time reading the modules but not complete the exercises and yet still display some benefits from the program.

Strengths and limitations of the study

To our knowledge, this is the first study to evaluate an online CBT-based intervention to support students with low mood and academic difficulties in the UAE. The study used a pre- and post-intervention design, which can be valuable for providing preliminary evidence for intervention effectiveness. The fact that 88% of the students responded to the post-intervention survey supports the credibility of the study and its subsequent results. Furthermore, the scale used in this study for anxiety and depression (HADS) has been validated and shows good sensitivity and specificity. The HADS questionnaire has been validated in many languages, countries, and settings, including in the UAE (O’Kearney et al., 2009). Another strength of this study was the use of a historical control group for GPAs, recruited from the same university and showing data at the same time points during the previous year. The results of this pilot study constitute an important step towards further longitudinal studies that can explore the effectiveness of online interventions in supporting academic progress for university students with mental health issues.

Some limitations of this study should be noted. Due to the small sample size and short follow-up period, the results reflect only a short ‘window of time’, and within a limited university population. Thus, with more students and an extended follow-up period, the results could be more accurate and less biased, thereby more reliably estimating the intervention’s benefits. Other limitations are that this study was not a randomised trial, had no control group for depressive and anxiety symptoms, and used self-reported GPAs. Finally, limited qualitative data to support the quantitative findings, and the bias related to being in a study and the expectation of completing the survey can produce inauthentic answers.

Conclusions

Results indicate that MoodGYM is a convenient, acceptable, and effective therapeutic intervention when targeted at academically struggling students with low mood. The observed improvements in mood, GPA, and attendance suggest that MoodGYM may be a cost-effective way to overcome barriers to mental health support for academically struggling students. However, more research is needed to explore whether improvements are sustained and how MoodGYM can be best implemented within the curriculum.

DECLARATIONS

Availability of data and materials

The datasets generated during and/or analysed during the current study are not publicly available (PhD study under progress) but are available from the corresponding author on reasonable request.

Competing interests

The authors declare they have no competing interests.

Funding

This work was supported by the Ph.D. studentship awarded to SA by the Ministry of Higher Education and Zayed University, United Arab Emirates. The funding source had no involvement in the study design, data collection, data analysis and interpretation, writing of the report, and in the decision to submit the article for publication.

Authors' contributions

SA, CG, and EBD designed the study protocol and surveys. SA analysed the data under CG's supervision. SA prepared the first draft of the paper and CG and EBD reviewed the subsequent drafts. All authors read and approved the final manuscript.

Acknowledgements

SA would like to acknowledge and thank all the students who took part in this study as well as the academic advisors who helped in recruiting the students for this study.

References

- Abu Ruz, M. E., Al-Akash, H. Y., & Jarrah, S. (2018). Persistent (anxiety and depression) affected academic achievement and absenteeism in nursing students. *Open Nursing Journal*, *12*, 171–179. doi:[10.2174/1874434601812010171](https://doi.org/10.2174/1874434601812010171)
- Anderson, J. K., Howarth, E., Vainre, M., Jones, P. B., & Humphrey, A. (2017). A scoping literature review of service-level barriers for access and engagement with mental health services for children and young people. *Children and Youth Services Review*, *77*, 164–176. doi:[10.1016/j.childyouth.2017.04.017](https://doi.org/10.1016/j.childyouth.2017.04.017)
- Andrews, B., Hejdenberg, J., & Wilding, J. (2006). Student anxiety and depression: Comparison of questionnaire and interview assessments. *Journal of Affective Disorders*, *95*(1–3), 29–34. doi:[10.1016/j.jad.2006.05.003](https://doi.org/10.1016/j.jad.2006.05.003)
- Awadalla, S., Davies, E. B., & Glazebrook, C. (2020). A longitudinal cohort study to explore the relationship between depression, anxiety and academic performance among Emirati university students. *BMC Psychiatry*, *20*(1), 448. doi:[10.1186/s12888-020-02854-z](https://doi.org/10.1186/s12888-020-02854-z)
- Barrable, A., Papadatou-Pastou, M., & Tzotzoli, P. (2018). Supporting mental health, wellbeing and study skills in Higher Education: An online intervention system. *International Journal of Mental Health Systems*, *12*(1), 54. doi:[10.1186/s13033-018-0233-z](https://doi.org/10.1186/s13033-018-0233-z)
- Bjelland, I., Dahl, A. A., Haug, T. T., & Neckelmann, D. (2002). The validity of the Hospital Anxiety and Depression Scale. An updated literature review. *Journal of Psychosomatic Research*, *52*(2), 69–77. doi:[10.1016/s0022-3999\(01\)00296-3](https://doi.org/10.1016/s0022-3999(01)00296-3)
- Bolinski, F., Boumparis, N., Kleiboer, A., Cuijpers, P., Ebert, D. D., & Riper, H. (2020). The effect of e-mental health interventions on academic performance in university and college students: A meta-analysis of randomized controlled trials. *Internet Interventions*, *20*, 100321. doi:[10.1016/j.invent.2020.100321](https://doi.org/10.1016/j.invent.2020.100321)

- Calear, A. L., Christensen, H., Mackinnon, A., & Griffiths, K. M. (2013). Adherence to the MoodGYM program: Outcomes and predictors for an adolescent school-based population. *Journal of Affective Disorders, 147*(1–3), 338–344. doi:[10.1016/j.jad.2012.11.036](https://doi.org/10.1016/j.jad.2012.11.036)
- Christensen, H., Griffiths, K. M., Groves, C., & Korten, A. (2006). Free range users and one hit wonders: Community users of an internet-based cognitive behaviour therapy program. *Australian and New Zealand Journal of Psychiatry, 40*(1), 59–62. doi:[10.1080/j.1440-1614.2006.01743.x](https://doi.org/10.1080/j.1440-1614.2006.01743.x)
- Christensen, H., Griffiths, K. M., & Jorm, A. F. (2004). Delivering interventions for depression by using the internet: Randomised controlled trial. *BMJ, 328*(7434), 265. doi:[10.1136/bmj.37945.566632.EE](https://doi.org/10.1136/bmj.37945.566632.EE)
- Christensen, H., Griffiths, K. M., & Korten, A. (2002). Web-based cognitive behavior therapy: Analysis of site usage and changes in depression and anxiety scores. *Journal of Medical Internet Research, 4*(1), e3. doi:[10.2196/jmir.4.1.e3](https://doi.org/10.2196/jmir.4.1.e3)
- Dardas, L. A., & Simmons, L. A. (2015). The stigma of mental illness in Arab families: A concept analysis. *Journal of Psychiatric and Mental Health Nursing, 22*(9), 668–679. doi:[10.1111/jpm.12237](https://doi.org/10.1111/jpm.12237)
- Davies, E. B., Morriss, R., & Glazebrook, C. (2014). Computer-delivered and web-based interventions to improve depression, anxiety, and psychological well-being of university students: A systematic review and meta-analysis. *Journal of Medical Internet Research, 16*(5), e130. doi:[10.2196/jmir.3142](https://doi.org/10.2196/jmir.3142)
- DeRoma, V. M., Leach, J. B., & Leverett, J. P. (2009). The relationship between depression and college academic performance. *College Student Journal, 43*, 325–335.
- El-Rufaie, O. E., & Absood, G. (1987). Validity study of the Hospital Anxiety and Depression Scale among a group of Saudi patients. *British Journal of Psychiatry, 151*, 687–688. doi:[10.1192/bjp.151.5.687](https://doi.org/10.1192/bjp.151.5.687)
- El-Rufaie, O. E., & Absood, G. H. (1995). Retesting the validity of the Arabic version of the Hospital Anxiety and Depression (HAD) scale in primary health care. *Social Psychiatry and Psychiatric Epidemiology, 30*(1), 26–31. doi:[10.1007/BF00784431](https://doi.org/10.1007/BF00784431)
- Farrer, L., Christensen, H., Griffiths, K. M., & Mackinnon, A. (2012). Web-based cognitive behavior therapy for depression with and without telephone tracking in a national helpline: Secondary outcomes from a randomized controlled trial. *Journal of Medical Internet Research, 14*(3), e68. doi:[10.2196/jmir.1859](https://doi.org/10.2196/jmir.1859)
- Farrer, L., Gulliver, A., Chan, J. K., Batterham, P. J., Reynolds, J., Calear, A., . . . Griffiths, K. M. (2013). Technology-based interventions for mental health in tertiary students: Systematic review. *Journal of Medical Internet Research, 15*(5), e101. doi:[10.2196/jmir.2639](https://doi.org/10.2196/jmir.2639)
- Faul, F., Erdfelder, E., Lang, A. G., & Buchner, A. (2007). G*Power 3: A flexible statistical power analysis program for the social, behavioral, and biomedical sciences. *Behavior Research Methods, 39*(2), 175–191. doi:[10.3758/bf03193146](https://doi.org/10.3758/bf03193146)
- Gaudiano, B. A. (2008). Cognitive-behavioural therapies: Achievements and challenges. *Evidence-Based Mental Health, 11*(1), 5–7. doi:[10.1136/ebmh.11.1.5](https://doi.org/10.1136/ebmh.11.1.5)

- Gratzer, D., & Khalid-Khan, F. (2016). Internet-delivered cognitive behavioural therapy in the treatment of psychiatric illness. *CMAJ: Canadian Medical Association Journal*, *188*(4), 263–272. doi:[10.1503/cmaj.150007](https://doi.org/10.1503/cmaj.150007)
- Grist, R., Croker, A., Denne, M., & Stallard, P. (2019). Technology delivered interventions for depression and anxiety in children and adolescents: A systematic review and meta-analysis. *Clinical Child and Family Psychology Review*, *22*(2), 147–171. doi:[10.1007/s10567-018-0271-8](https://doi.org/10.1007/s10567-018-0271-8)
- Harrer, M., Adam, S. H., Baumeister, H., Cuijpers, P., Karyotaki, E., Auerbach, R. P., . . . Ebert, D. D. (2018). Internet interventions for mental health in university students: A systematic review and Meta-Analysis. *International Journal of Methods in Psychiatric Research*, *28*(2), e1759. doi:[10.1002/mpr.1759](https://doi.org/10.1002/mpr.1759)
- Heath, P. J., Vogel, D. L., & Al-Darmaki, F. R. (2016) Help-Seeking Attitudes of United Arab Emirates Students. *Counseling Psychologist*, *44*(3), 331–352. doi:[10.1177/0011000015621149](https://doi.org/10.1177/0011000015621149)
- Høifødt, R. S., Lillevoll, K. R., Griffiths, K. M., Wilsgaard, T., Eisemann, M., Waterloo, K., & Kolstrup, N. (2013). The clinical effectiveness of web-based cognitive behavioral therapy with face-to-face therapist support for depressed primary care patients: Randomized controlled trial. *Journal of Medical Internet Research*, *15*(8), e153. doi:[10.2196/jmir.2714](https://doi.org/10.2196/jmir.2714)
- Ibrahim, A. K., Kelly, S. J., Adams, C. E., & Glazebrook, C. (2013). A systematic review of studies of depression prevalence in university students. *Journal of Psychiatric Research*, *47*(3), 391–400. doi:[10.1016/j.jpsychires.2012.11.015](https://doi.org/10.1016/j.jpsychires.2012.11.015)
- January, J., Madhombiro, M., Chipamaunga, S., Ray, S., Chingono, A., & Abas, M. (2018). Prevalence of depression and anxiety among undergraduate university students in low- and middle-income countries: A systematic review protocol. *Systematic Reviews*, *7*(1), 57. doi:[10.1186/s13643-018-0723-8](https://doi.org/10.1186/s13643-018-0723-8)
- Knowles, S. E., Toms, G., Sanders, C., Bee, P., Lovell, K., Rennick-Egglestone, S., . . . Bower, P. (2014). Qualitative meta-synthesis of user experience of computerised therapy for depression and anxiety. *PLOS ONE*, *9*(1), e84323. doi:[10.1371/journal.pone.0084323](https://doi.org/10.1371/journal.pone.0084323)
- Kroenke, K., Spitzer, R. L., Williams, J. B., & Löwe, B. (2009). An ultra-brief screening scale for anxiety and depression: The PHQ–4. *Psychosomatics*, *50*(6), 613–621. doi:[10.1176/appi.psy.50.6.613](https://doi.org/10.1176/appi.psy.50.6.613)
- Lintvedt, O. K., Griffiths, K. M., Sørensen, K., Østvik, A. R., Wang, C. E., Eisemann, M., & Waterloo, K. (2013). Evaluating the effectiveness and efficacy of unguided internet-based self-help intervention for the prevention of depression: A randomized controlled trial. *Clinical Psychology and Psychotherapy*, *20*(1), 10–27. doi:[10.1002/cpp.770](https://doi.org/10.1002/cpp.770)
- Lopez, M. A., & Basco, M. A. (2015). Effectiveness of cognitive behavioral therapy in public mental health: Comparison to treatment as usual for treatment-resistant depression. *Administration and Policy in Mental Health*, *42*(1), 87–98. doi:[10.1007/s10488-014-0546-4](https://doi.org/10.1007/s10488-014-0546-4)
- Malasi, T. H., Mirza, I. A., & El-Islam, M. F. (1991). Validation of the Hospital Anxiety and Depression Scale in Arab patients. *Acta Psychiatrica Scandinavica*, *84*(4), 323–326. doi:[10.1111/j.1600-0447.1991.tb03153.x](https://doi.org/10.1111/j.1600-0447.1991.tb03153.x)

- McDermott, R., & Dozois, D. J. A. (2019). A randomized controlled trial of Internet-delivered CBT and attention bias modification for early intervention of depression. *Journal of Experimental Psychopathology*, 10(2). doi:[10.1177/2043808719842502](https://doi.org/10.1177/2043808719842502)
- Neil, A. L., Batterham, P., Christensen, H., Bennett, K., & Griffiths, K. M. (2009). Predictors of adherence by adolescents to a cognitive behavior therapy website in school and community-based settings. *Journal of Medical Internet Research*, 11(1), e6. doi:[10.2196/jmir.1050](https://doi.org/10.2196/jmir.1050)
- O’Kearney, R., Kang, K., Christensen, H., & Griffiths, K. (2009). A controlled trial of a school-based internet program for reducing depressive symptoms in adolescent girls. *Depression and Anxiety*, 26(1), 65–72. doi:[10.1002/da.20507](https://doi.org/10.1002/da.20507)
- Sayed, M. A. (2013). Mental health services in the United Arab Emirates: Challenges and opportunities. *International Journal of Emergency Mental Health and Human Resilience*, 17(3). doi:[10.4172/1522-4821.1000263](https://doi.org/10.4172/1522-4821.1000263)
- Stern, A. F. (2014). The hospital anxiety and depression scale. *Occupational Medicine*, 64(5), 393–394. doi:[10.1093/occmed/kqu024](https://doi.org/10.1093/occmed/kqu024)
- Sweetland, A. C., Oquendo, M. A., Sidat, M., Santos, P. F., Vermund, S. H., Duarte, C. S., . . . Wainberg, M. L. (2014). Closing the mental health gap in low-income settings by building research capacity: Perspectives from Mozambique. *Annals of Global Health*, 80(2), 126–133. doi:[10.1016/j.aogh.2014.04.014](https://doi.org/10.1016/j.aogh.2014.04.014)
- Terkawi, A. S., Tsang, S., AlKahtani, G. J., Al-Mousa, S. H., Al Musaed, S., AlZoraigi, U. S., . . . Altirkawi, K. A. (2017). Development and validation of Arabic version of the Hospital Anxiety and Depression Scale. *Saudi Journal of Anaesthesia*, 11(Suppl 1), S11–S18. doi:[10.4103/sja.SJA_43_17](https://doi.org/10.4103/sja.SJA_43_17)
- Twomey, C., & O’Reilly, G. (2016). Meta-analysis looks at effectiveness of MoodGYM programme in computerised cognitive behavioural therapy. *BMJ*, 354, i4221. doi:[10.1136/bmj.i4221](https://doi.org/10.1136/bmj.i4221)
- Twomey, C., O’Reilly, G., Byrne, M., Bury, M., White, A., . . . Clancy, N. (2014). A randomized controlled trial of the computerized CBT programme, MoodGYM, for public mental health service users waiting for interventions. *British Journal of Clinical Psychology*, 53(4), 433–450. doi:[10.1111/bjc.12055](https://doi.org/10.1111/bjc.12055)
- Viskovich, S., & Pakenham, K. I. (2020). Randomized controlled trial of a web-based acceptance and Commitment Therapy (ACT) program to promote mental health in university students. *Journal of Clinical Psychology*, 76(6), 929–951. doi:[10.1002/jclp.22848](https://doi.org/10.1002/jclp.22848)
- Zigmond, A. S., & Snaith, R. P. (1983). The hospital anxiety and depression scale. *Acta Psychiatrica Scandinavica*, 67(6), 361–370. doi:[10.1111/j.1600-0447.1983.tb09716.x](https://doi.org/10.1111/j.1600-0447.1983.tb09716.x)