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ประสิทธิผลของการให้สุขภาพจิตศึกษาตามหลักจิตบำบัดการปรับเปลี่ยนความคิดและพฤติกรรมเพื่อจัดการความเครียดแบบออนไลน์ ในนักศึกษาแพทย์ชั้นปีที่ 5 คณะแพทยศาสตร์ มหาวิทยาลัยขอนแก่นที่เรียนออนไลน์ ในสถานการณ์การระบาดของ COVID-19

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Efficacy of Online CBT-based Psychoeducation for Stress Management in Fifth-year Medical Students at Khon Kaen University During the COVID-19 Pandemic

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บทคัดย่อ

หลักการและวัตถุประสงค์: นักศึกษาแพทย์มักเผชิญกับระดับความเครียดสูงและมีเวลาจำกัดในการเข้ารับการสนับสนุนด้านสุขภาพจิต การศึกษานี้จึงมุ่งประเมินประสิทธิผลของการให้ความรู้ทางจิตบำบัดที่มุ่งเน้นการปรับเปลี่ยนความคิดและพฤติกรรมในรูปแบบออนไลน์ ในการจัดการความเครียดของนักศึกษาแพทย์ชั้นปีที่ 5 ณ มหาวิทยาลัยขอนแก่น ในช่วงการระบาดของ COVID-19

วิธีการศึกษา: การศึกษากึ่งทดลองนี้ใช้รูปแบบการทดลองแบบกลุ่มเปรียบเทียบที่มีการวัดผลก่อนและหลังการให้สุขภาพจิตศึกษาตามหลักจิตบำบัดการปรับเปลี่ยนความคิดและพฤติกรรมเพื่อจัดการความเครียดแบบออนไลน์ ดำเนินการช่วงเดือนธันวาคม พ.ศ. 2563 ถึงเมษายน พ.ศ. 2564 ผู้เข้าร่วมถูกสุ่มให้เข้ากลุ่มที่ได้รับการให้ความรู้ทางจิตบำบัดออนไลน์ จำนวน 4 ครั้ง (สัปดาห์ละ 1 ครั้ง เป็นเวลา 4 สัปดาห์) หรือกลุ่มควบคุม ภายหลังครบ 4 สัปดาห์ กลุ่มควบคุมได้เข้าโปรแกรมเช่นเดียวกับกลุ่มทดลอง และดำเนินการประเมินผลลัพธ์ต่อเนื่อง การประเมินความรุนแรงของความเครียดใช้แบบวัด perceived stress scale (T-PSS-10) ขณะที่ปัญหาสุขภาพจิตและความสามารถในการฟื้นคืนสภาพ วัดโดยใช้แบบสอบถาม GHQ-28 และ CD-RISC จำนวน 25 ข้อ การวัดผลดำเนินการ ณ จุดเริ่มต้น (T0) หลังการเข้าโปรแกรม (T1) และติดตามผลที่ 12 สัปดาห์ (T2) การวิเคราะห์สถิติใช้สถิติเชิงพรรณนา (ค่าเฉลี่ย ส่วนเบี่ยงเบนมาตรฐาน มัธยฐาน และพิสัยระหว่างควอไทล์) ความแตกต่างระหว่างกลุ่มใช้ t-test หรือ Mann-Whitney U test และความแตกต่างภายในกลุ่มแต่ละช่วงเวลาวิเคราะห์ด้วย ANOVA และการปรับแก้ Bonferroni หรือ Friedman และ Wilcoxon signed-rank test ขึ้นอยู่กับการแจกแจงของข้อมูล

ผลการศึกษา: การศึกษานี้วัดผลการให้สุขภาพจิตศึกษาตามหลักจิตบำบัดการปรับเปลี่ยนความคิดและพฤติกรรมเพื่อจัดการความเครียดแบบออนไลน์ ในกลุ่มผู้เข้าร่วมจำนวน 21 ราย อายุระหว่าง 22-24 ปี โดยแบ่งเป็นกลุ่มได้รับสุขภาพจิตศึกษาและกลุ่มควบคุมในอัตราส่วน 4:1 กลุ่มได้รับสุขภาพจิตศึกษามีการเปลี่ยนแปลงที่มีนัยสำคัญทางสถิติในคะแนนรวม GHQ-28 และด้าน social dysfunction รวมทั้งคะแนนรวม CD-RISC-25 และด้าน personal competence/tolerance of negative affect แต่ไม่พบการเปลี่ยนแปลงที่มีนัยสำคัญทางสถิติในคะแนนรวมและรายด้านของ T-PSS-10 หลังการได้รับสุขภาพจิตศึกษา 4 สัปดาห์ ($p<0.05$) หลังจากนั้นกลุ่มควบคุมถูกย้ายมาร่วมกลุ่มได้รับสุขภาพจิตศึกษาและมีการประเมินผลอีกครั้งที่ 4 และ 12 สัปดาห์ หลังการได้รับสุขภาพจิตศึกษา ณ จุดประเมิน12 สัปดาห์ พบว่าการเปลี่ยนแปลงที่มีนัยสำคัญเพียงรายการเดียวคือด้าน depressive ของ GHQ-28 ($p = 0.046$)

สรุป: การให้สุขภาพจิตศึกษาตามหลักจิตบำบัดการปรับเปลี่ยนความคิดและพฤติกรรมเพื่อจัดการความเครียดแบบออนไลน์ ไม่ได้ช่วยลดความเครียดที่รับรู้ได้ในนักศึกษาแพทย์ชั้นปีที่ 5 แต่สามารถเพิ่มความยืดหยุ่นทางจิตใจและสุขภาพจิต โดยเฉพาะการลดลงของอาการซึมเศร้าในระยะยาว

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Abstract

Background and Objective: Medical students experience high stress levels and often lack time to seek mental health support. Aim of study evaluates the efficacy of online cognitive behavior therapy (CBT)-based psychoeducation for stress management among fifth-year medical students at Khon Kaen University during the COVID-19 pandemic.

Methodology: This quasi-experimental study with a parallel group and pre- and post-test design was conducted from December 2020 to April 2021. The participants were selected into two either the 4 sessions online CBT-based psychoeducation once a week for 4 weeks or the control group. After the initial 4 weeks, the control group received the intervention and subsequent outcome measurements were conducted. The severity of stress was assessed using PSS-10, while levels of mental health problems and resilience were assessed using the Thai GHQ-28 and 25-item CD-RISC. All outcomes were measured at baseline (T0), post-intervention (T1), and 12-week (T2) follow-up. Statistical analysis was conducted using descriptive statistics, including mean, standard deviation, median, and IQR. Group differences were assessed using t-tests or Mann-Whitney U test, whereas within-group differences across time points were analyzed with ANOVA and Bonferroni correction or the Friedman and Wilcoxon signed-rank tests, depending on data distribution.

Results: A total of 21 students aged 22–24 years participated in the study. Participants were assigned to the intervention and control groups at a 4:1 ratio. After 4 weeks, the intervention group showed statistically significant improvements in the GHQ-28 total score and social dysfunction subscale, as well as in the CD-RISC-25 total score and the personal competence/tolerance of negative affect subscale ($p<0.05$). No significant changes were observed in the T-PSS-10 total or subscale scores. The control group later received the same intervention, and assessments were repeated at 4 and 12 weeks post-intervention. At the 12 weeks follow-up, a significant improvement was found only in the depressive subscale of the GHQ-28 ($p = 0.046$).

Conclusion: Online CBT-based psychoeducation did not significantly reduce perceived stress among fifth-year medical students but improved resilience and mental health at 4-week follow-up. However, these benefits were not sustained at 12 weeks, except for reduced depressive symptoms.

Keywords: stress, online intervention, cognitive behavioral therapy, medical student

Introduction

Recent studies have found a high prevalence of mental health problems across all population groups. Higher education students are considered a particularly vulnerable group, as they must navigate both physical and mental adjustments during the transition from adolescence to adulthood.[1,2] The medical student's group was considered a group of high-stress students.[3] Prior research has reported that the stress experienced by medical students ranges from 28.5% to 78%, stemming from the demands of their education and adaptation to the medical program.[4] Furthermore, previous research has indicated that fifth-year medical students in Thailand experience significant stress, largely attributed to the pressure of upcoming national medical licensing examinations.[5] The COVID-19 pandemic from late 2019 to the present has led to a shift in teaching from in-person to online platforms, which has contributed to increased stress among medical students.[6,7] Despite the high prevalence of stress and its negative consequences, many medical students do not seek help for their mental health issues. The reasons for this reluctance include stigma associated with mental health treatment, lack of time due to demanding schedules, and insufficient awareness about available support services.[8] Therefore, there should be support and enthusiasm for providing valid solutions to address this disruption, such as online interventions for medical students.

Studies have found that medical students commonly use various stress-management methods, including mindfulness and cognitive behavioral therapy (CBT).[9,10] Both interventions can positively impact mental health. Mindfulness interventions have shown promise in enhancing self-compassion and reducing perceived stress,[11,12] though evidence for their effectiveness on depression and anxiety is inconclusive[13] while CBT, particularly when combined with mindfulness techniques, appears effective in reducing symptoms for helping people to learn that the negative thoughts that can signal the start of negative consequences.[14] If focusing on CBT technique, CBT focuses on modifying maladaptive thoughts and behaviors[15] whereas CBT-based psychoeducation primarily provides educational content on cognitive-behavioral principles without direct therapeutic intervention.[16] Given medical students' limited time and high stress, previous studies have developed online CBT-based psychoeducation programs due to their strong evidence base, structured approach, and flexible, accessible format. CBT-based psychoeducation focuses on delivering foundational cognitive-behavioral principles—such as attention training and cognitive restructuring—through structured, educational content without individualized therapeutic intervention.[17]

Due to the COVID-19 pandemic and increased digital connectivity, online self-directed learning and psychotherapy have become more popular. This provides easy access, saves travel time, offers privacy, and reduces stigma associated with seeking mental health services.[18] The aim of this study was to evaluate the efficacy of online CBT-based psychoeducation for stress management among fifth-year medical students at Khon Kaen University, who were transitioning to online learning amid the pandemic.

Study Method

Study design and setting

This quasi-experimental study employed a parallel group design with pre and post-test assessments to evaluate the efficacy of a weekly online CBT-based psychoeducation intervention. The study participants were fifth-year medical students from the Faculty of Medicine at Khon Kaen University during the 2020 academic year. The research was conducted from December 2020 to April 2021 and received approval from the institutional Review Board of Khon Kaen University, bearing the approval number HE631375.

Participants and eligibility criteria

Inclusion criteria: Fifth-year medical students at Khon Kaen university in the 2020 academic year who own a smartphone, tablet, or notebook with internet access, have an @kkumail.com email address for registering in the online CBT-based psychoeducation, and a Line account for receiving updates and weekly reminders about online sessions. Exclusion criteria: Students with a history of major psychiatric disorders currently undergoing treatment or who are receiving cognitive behavioral therapy (CBT) during the study period. This information is obtained through a self-report questionnaire that asks about previous psychiatric diagnoses and treatments received. We also followed up with additional inquiries to obtain further details as needed, while ensuring that confidentiality was strictly maintained. After the announcement for volunteers to participate in the research project, only 21 volunteers expressed interest. However, based on the sample size calculation, a sample size of 20 participants per group was required, totaling 40 participants. Therefore, the randomization ratio (intervention : control) was adjusted from 1:1 to 4:1 to increase the number of participants in the study group, resulting in 17 volunteers in the intervention group and 4 in the control group, respectively. The 4:1 allocation ratio was chosen to maximize access to the potentially beneficial intervention while maintaining a comparison group for preliminary effectiveness evaluation. Similar rationales have been discussed in the literature, including ethical considerations (ensuring greater access to potentially beneficial treatments), facilitating recruitment by increasing participants' likelihood of receiving treatment, and logistical needs for adequate intervention group size.[19]

Instruments:

1. The data record forms used via google form of the following:

1.1 General personal information including gender, age, marital status, cumulative grade point average, monthly income and expense, history of psychiatric illness and substance use, prior stress management techniques, availability and accessibility of online learning equipment.

1.2 Outcome assessments.

- The primary outcome measure was severity of stress by the self-rated Thai perceived stress scale (T-PSS-10).[20] Good concurrent validity with anxiety, depression, and self-esteem (r = 0.60-0.82). Reliability: Cronbach's alpha is 0.85, ICC = 0.82. Subscales and items: stress, control (10 items). interpretation: higher scores means greater perceived stress.

- The secondary outcome measures were the level of resilience and psychological well-being, which were assessed using the Thai version of the Connor-Davidson resilience scale[21] and the general health questionnaire 28[22], respectively. The 25-item CD-RISC demonstrated good validity, with negative correlations to depression, anxiety, and stress, and reliable internal consistency (Cronbach's alpha = 0.89) and test-retest reliability (ICC = 0.87). The scale has subscales measuring personal competence, support resources, and self-Efficacy, where higher scores indicate greater resilience. The Thai GHQ-28 exhibited high sensitivity (84%) and specificity (76%) at a cutoff score of 5/6, and good internal consistency (Cronbach's alpha = 0.91). The GHQ-28 assesses somatic symptoms, anxiety & insomnia, social dysfunction, and severe depression, with higher scores indicating greater mental health problems.

1.3 The post-lesson worksheets for each 4 psychoeducation lessons.

2. Online CBT-based psychoeducation for stress management

Online CBT-based psychoeducation for stress management was developed by the researcher and underwent three rounds of content review and validation by three experts in CBT, all from the Department of Psychiatry, Faculty of Medicine, Khon Kaen University. The process included:

1. First review: The experts assessed the outline, scope of lessons, and narration to develop video content lasting 5-10 minutes per episode, totaling 4 episodes. The content was presented using line-drawn cartoon animations with narrated subtitles, with the storyboard and narration created by the researcher.

2. Second review: The experts reviewed the draft content and narration before the video production process.

3. Final review: The completed video content and narration were evaluated for accuracy and appropriateness, with adjustments made to finalize the program for pilot testing.

A pilot test of the complete program was conducted with five fifth-year medical students from the Faculty of Medicine at Khon Kaen University which is not the same group as registering in the online CBT-based psychoeducation. The students watched online CBT-based psychoeducation videos and provided feedback via a Google Form on five aspects: Relevance of content to the study topic, Appropriateness of language, Ease of understanding of the content, Clarity of visuals and accompanying video and Suitability of content length. The evaluation revealed that all four video sessions were rated as highly appropriate across all criteria. The finalized version of online CBT-based psychoeducation is now ready for use in the actual research study.

Session 1: Understanding 'Stress' Through the Lens of Thought	**Session 2**: Changing the Approach Using Cognitive and Behavioral Principles	**Session 3:** Stress Management Techniques and Personal Development Planning	**Session 4:** Overall Summary
- Definition of stress - Causes and factors contributing to stress - Characteristics of stress and response to stress - Symptoms and impacts resulting from stress (physical, emotional, cognitive, behavioral) - Current stress level assessment using a stress scale - Understanding responses to situations and external factors through schema and core beliefs related to CBT - Summary of session 1 - Worksheet 1: Stress situation	- Recognizing common cognitive distortions among medical students - Common patterns of distorted thinking - Techniques to change thought patterns (e.g., challenging negative thinking) - Managing behaviors related to distorted thinking commonly found among students, such as adjusting eating habits or procrastination - Summary of session 2 - Worksheet 2: Identify unhelpful patterns of thinking	- Stress cycle and the negative impacts of stress - Stress management techniques: Relaxation skills, Daily time management skills, Developing effective time management skills and Creating personal development plans with goal-setting strategies, emphasizing SMART goals - Preparing for future stress management - Summary of session 3 - Worksheet 3: Stress management	- Complete review of all sessions - Worksheet 4: Self therapy session

Data Collection Process

After obtaining ethics approval, fifth-year medical students at Khon Kaen University were recruited via online announcements. Participants were screened based on inclusion and exclusion criteria, and electronic informed consent was obtained through Google Forms. Baseline data on prior learning experiences and knowledge were collected before randomization into either the intervention or control group. The intervention group received a four-session online CBT-based psychoeducation via the KKUx platform, with one self-paced lesson per week. Lesson reminders were sent through a Line official group.

Each lesson included a worksheet for practicing stress management skills, with participants encouraged to apply techniques daily for 10–15 minutes. The program was self-guided with instructors

available to answer questions during the course via a Line official group and engagement was tracked progress and video access through KKUx login records.

For analysis, participants were categorized into "do worksheet" or "do not do worksheet" groups, based on worksheet submissions (four out of four lessons). Outcomes were assessed via Google Forms at baseline, post-intervention, and 12 weeks later. Control group participants were allowed to join the program after the study.

Sample size

$$n_1 = [(z_1 - \alpha/2 + z_1 - \beta)^2 * (\sigma_1^2 + \sigma_2^2 / r)] / \Delta^2$$

Where:

- n_1 = Sample size for group 1
- r = n_2 / n_1 (ratio of sample sizes between group 2 and group 1)
- Δ = $\mu_1 - \mu_2$ (difference between the means of group 1 and group 2)
- $z_1 - \alpha/2$ = Z-value corresponding to the significance level (two-tailed)
- $z_1 - \beta$ = Z-value corresponding to the power of the test
- σ_1^2 = Variance of group 1
- σ_2^2 = Variance of group 2

The researchers based their calculations on a previous study by Raul Calderon Jr. et al., which found that the PSS-4 score had a mean of 7.5 and a standard deviation of 2. Since this study used the longer PSS-10 assessment form, the mean and standard deviation were estimated to be 2.5 times higher. The mean PSS-10 score in the group that did not receive the psychoeducation intervention was estimated to be 19, with a standard deviation of approximately 5 points. The researchers expected the intervention to reduce the mean PSS-10 score by around 5 points. After substituting these values into the formula, the calculated sample size was 16 participants. Accounting for a 20% potential dropout rate, the final sample size was determined to be 19 participants in the intervention group and 4 in the control group, for a total of 23 participants.

Statistical analysis

The data were analyzed using SPSS Statistics 26. Descriptive statistics, including mean, standard deviation, median, and interquartile range, were used to summarize the continuous data. The researchers employed independent t-tests or Mann-Whitney U tests to analyze the differences between the group that received the four-session online CBT-based psychoeducation intervention and the control group, depending on the distribution of the data. Furthermore, the researchers used Analysis of Variance and Bonferroni tests, or Friedman and Wilcoxon signed-rank tests, to examine the differences within the psychoeducation group before and after watching the videos at the first and third months, again based on the distribution of the data.

Study results

1. Baseline characteristics of the population study

After extensively determined inclusion and exclusion criteria, 21 samples (age 22-24 years old) were included in this study. The subjects were divided into 2 groups at the ratio of 4:1 between the psychoeducation based on cognitive behavioral therapy online and the control group. The samples were 52.38% female, GPA of 3.46±0.35, 9.5% had common psychiatric disorder, 76.2% drink alcohol, and smoking 4.76%. The factors of feelings of stress or anxiety in the last four weeks were also evaluated. Concerning the 2019 coronavirus pandemic, the comments on the advantages and disadvantages/ limitations for online learning in the last four weeks consist of satisfaction score on the effectiveness of internet signals, learning readiness, and the satisfaction level over the past four weeks were shown in table 1.

2. Results of the Study on efficacy of online CBT-based psychoeducation for stress management

2.1 Comparison of the results of receiving online CBT-based psychoeducation between the intervention group and the control group

The levels of perceived stress, severity of mental health problems, and resilience were assessed using the T-PSS-10, Thai-GHQ-28, and 25-item CD-RISC Thai version. These assessments were conducted in phases:

before receiving online CBT-based psychoeducation (T0) and after completing online CBT-based psychoeducation for 4 weeks (T1) between the intervention group and the control group. The findings indicated that the total score of T-PSS-10 in the intervention group increased by 1 point (95% CI -1.27, 3.27, p-value = 0.036) with no significant difference between the intervention and control groups. However, there was a significant decrease in the level of severity of mental health problems, with a reduction in the total Thai-GHQ-28 score (95% CI -5, -1, p-value=0.003) and in the social dysfunction subscale (95% CI -1.5, 0, p-value=0.030) after receiving online CBT-based psychoeducation. Furthermore, the resilience scores increased significantly, with a score on the 25-item CD-RISC for both total score (95% CI 1.26, 9.91, p-value=0.015) and personal competence/tolerance of negative affect (95% CI 0.68, 4.73, p-value=0.012) in the education group as shown in table 2.

2.2 Comparison of stress levels, mental health problems, and resilience before and after online CBT-based psychoeducation within intervention group

After completing online CBT-based psychoeducation over a period of 4 weeks, 4 control group participants were purposefully chosen to undergo the same program. Participants were assessed perceived stress, severity of mental health issues, and resilience levels using T-PSS-10, Thai-GHQ-28, and the 25-item CD-RISC at 4 weeks (T1) and 12 weeks (T2). From the analysis of the T-PSS-10 scores over all three time periods, no statistically significant changes were found in the total score or in the stress and control subscales. However, there was a statistically significant decrease in the total score of the Thai-GHQ-28 between before receiving online CBT-based psychoeducation and 4 weeks after the program ended and a decrease in the depression subscale, between 4 – 12 weeks after the program ended, with p-values of 0.003 and 0.046, respectively. Additionally, when comparing resilience levels using the 25-item CD-RISC Thai version between timepoint before online CBT-based psychoeducation and 4 weeks after the program ended, a significant increase was observed in the total score and in the competence/tolerance of negative affect subscale, with p-values of 0.039 and 0.009, respectively. The results are presented in Table 3.

2.3 Results of online CBT-based psychoeducation worksheets

The analysis encompassed all 21 participants who underwent online CBT-based psychoeducation. Within this group, 11 individuals completed the exercises through worksheets, while 10 did not. Comparing the perceived stress scale and resilience Scale scores at baseline, 4 weeks post-intervention, and 12 weeks post-intervention, no statistically significant differences emerged between the group that completed the exercises and the group that did not as shown in table 4. Additional feedback responses from participants after completing online CBT-based psychoeducation at 4 weeks are presented in Table 5.

Table 1 Baseline characteristics

Characteristics	Total (n=21) (mean±SD)	Intervention group (n=17) (mean±SD)	Control group (n=4) (mean±SD)	p-value
Gender				0.311
Male	10 ± 47.62	7 ± 41.18	3 ± 75.00	
Female	11 ± 52.38	10 ± 58.82	1 ± 25.00	
Status				0.028
Single	16 ± 76.19	15 ± 88.24	1 ± 25.00	
In a relationship	5 ± 23.81	2 ± 11.76	3 ± 75.00	
GPA				
Median (IQR)	3.47 (3.36 – 3.67)	3.51 (3.39 – 3.67)	3.39 (3.10 – 3.65)	0.394
Mean ±SD	3.46 ± 0.35	3.48 ± 0.34	3.38 ± 0.42	
Psychiatric disease	2 ± 9.52	2 ± 11.76	0 ± 0.00)	>0.999
Drinking alcohol	8 ± 38.10	6 ± 35.29)	2 ± 50.00	>0.999
Cigarette smoking	1 ± 4.76)	1 ± 5.88)	0 ± 0.00	>0.999
Online learning issues				
- Concerning about COVID-19 outbreak	2.48 ± 1.66	2.41 ± 1.62	2.75 ± 2.06	
- readiness to online learning	7.86 ± 1.06	8 ± 1	7.25 ± 1.26	
- satisfaction in online learning	7.24 ± 1.55	7.53 ± 1.12	6 ± 2.58	
- satisfaction in network performance	7.86 ± 1.06	7.82 ± 1.19	8 ± 0	

Table 2 Comparison of Thai Perceived Stress Scale, 25-item CD-RISC (Thai version) and General Health Questionnaire 28 (Thai version) within intervention group (17 participants) and control group (4 participants) at the baseline (T0) and post-intervention (T1)

Outcome	Group	T0 mean±SD	T1 mean±SD	mean difference (95% CI)	p-value
T- PPS-10					
- Total	Intervention	18.47 ± 6.74	19.47 ± 3.92	1 (-1.27, 3.27)	0.364
	Control	19.25 ± 3.10	19.25 ± 4.03	0.00 (-4.68, 4.68)	>0.999
- Stress	Intervention	9.88 ± 5.24	9.24 ± 3.95	-0.65 (-1.98, 0.69)	0.320
	Control	8.75 ± 3.77	9 ± 4.40	0.25 (-3.04, 3.53)	0.824
- Control	Intervention	8.59 ± 3.66	10.24 ± 2.14	1.65 (-0.07, 3.36)	0.059
	Control	10.5 ± 1.73	10.25 ± 1.71	-0.25 (-1.77, 1.27)	0.638

Table 2 Comparison of Thai Perceived Stress Scale, 25-item CD-RISC (Thai version) and General Health Questionnaire 28 (Thai version) within intervention group (17 participants) and control group (4 participants) at the baseline (T0) and post-intervention (T1) (Cont.)

Outcome	Group	T0 mean±SD	T1 mean±SD	mean difference (95% CI)	p-value
Thai GHQ-28					
- Total	Intervention Median (IQR)	2 (1-5)	0 (0-1)	-2 (-5, -1)	0.003*
	Control Median (IQR)	3.25 (4.57)	1.5 (3)	-1.75 (-12.17, 8.67)	0.630
- Somatic symptoms	Intervention Median (IQR)	0 (0-1)	0 (0–0)	-0.5 (-1, 0)	0.073
	Control Median (IQR)	1 (0.5–1.5)	0 (0–1)	-1 (NA)	0.578
- Anxiety and insomnia	Intervention Median (IQR)	0 (0-1)	0 (0-0)	0 (-0.5, 0)	0.171
	Control	2.25 ± 2.87	1 ± 2	-1.25 (-8.05, 5.55)	0.600
- Depression	Intervention Median (IQR)	0 (0-0)	0 (0-0)	0 (-0.5, 0)	0.084
	Control	0.25 ± 0.5	0 ± 0	-0.25 (-1.05, 0.55)	0.391
- Social dysfunction	Intervention Median (IQR)	0 (0 - 2)	0 (0 - 0)	-0.5 (-1.5, 0)	0.030*
	Control	2.75 ± 2.22	0 ± 0	-2.75 (-6.28, 0.78)	0.089
25-item CD-RISC					
- Total	Intervention	66.65 ± 13.10)	72.24 ± 10.50)	5.59 (1.26, 9.91)	0.015*
	Control Median (IQR)	72.5 (68–77.5)	70.5 (45.5-80)	1.75 (NA)	0.715
- Competence/ tolerance of negative affect	Intervention	29.41 ± 6.18	32.12 ± 4.91	2.71 (0.68, 4.73)	0.012*
	Control Median (IQR)	32 (29.5-34)	32.5 (21–37.5)	3 (NA)	0.713
- Support resources	Intervention	6.12 ± 1.45	6.35 ± 1.22	0.24 (-0.19, 0.66)	0.260
	Control	7 ± 0.82)	4.5 ± 3.11)	-2.5 (-7.45, 2.45)	0.206
- Self-efficacy	Intervention	10.35 ± 2.96	11.41 ± 2.37	1.06 (-0.13, 2.24)	0.076
	Control Median (IQR)	13 (11.5-14)	12 (6.5–13.5)	-1 (NA)	0.092
- Others	Intervention	20.76 ± 4.01	22.35 ± 3.74	1.59 (-0.32, 3.50)	0.097
	Control Median (IQR)	20.5 (19–23.5)	20 (14.5–23.5)	0.25(NA)	0.853

Notes:

- T-PPS-10 = Thai Perceived Stress Scale; Thai GHQ-28 = General Health Questionnaire 28 Thai version; 25-item CD-RISC = 25-item Connor-Davidson Resilience Scale
- Normal distribution data analyzed by Pair t-test and presented by Mean (SD)
- Non normal distribution data analyzed by Wilcoxon signed-rank test and presented by by Median (IQR)
- Wilcoxon signed-rank test was applied for analysis.
- * = p-value<0.05

Table 3 Comparison of Thai Perceived Stress Scale, 25-item CD-RISC (Thai version) and General Health Questionnaire 28 (Thai version) within intervention group (21 participants included control group) at the baseline (T0), post-intervention (T1) and 12-week (T2) follow-up.

Outcome	Comparison of Time Point	Time			mean difference (95%CI)	p-value
		T0 mean±SD	T1 mean±SD	T2 mean±SD		
Thai Perceived Stress Scale (total)	T0 vs T1	16.71 ± 5.86	14.43 ± 5.08		-2.29 (-6.65, 2.08)	0.607
	T0 vs T2	16.71 ± 5.86		14.43 ± 6.23	-2.29 (-6.65, 2.08)	0.607
	T1 vs T2		14.43 ± 5.08	14.43 ± 6.23	0 (-4.37, 4.37)	>0.999
Thai Perceived Stress Scale (stress)	T0 vs T1	9.67 ± 4.93	8.76 ± 3.77		-0.90 (-4.30, 2.49)	>0.999
	T0 vs T2	9.67 ± 4.93		8.10 ± 4.61	-1.57 (-4.97, 1.82)	0.776
	T1 vs T2		8.76 ± 3.77	8.10 ± 4.61	-0.67 (-4.06, 2.73)	>0.999
Thai Perceived Stress Scale (control) Median (IQR)	T0 vs T1	6 (4 - 9)	6 (4 - 7)		-1 (-3, 0)	0.083
	T0 vs T2	6 (4 - 9)		6 (5 - 7)	-0.5 (-2.5, 1)	0.373
	T1 vs T2		6 (4 - 7)	6 (5 - 7)	0.5 (-1, 2)	0.506
General Health Questionnaire 28 (total) Median (IQR)	T0 vs T1	1 (0 - 5)	0 (0 - 1)		-1.5 (-3.5, -0.5)	0.003*
	T0 vs T2	1 (0 - 5)		0 (0 – 5)	-0.5 (-3, 0.5)	0.171
	T1 vs T2		0 (0 - 1)	0 (0 – 5)	0.5 (0, 2)	0.222
General Health Questionnaire 28 (somatic symptoms) Median (IQR)	T0 vs T1	0 (0 - 1)	0 (0 - 0)		-0.5 (-1, 0)	0.077
	T0 vs T2	0 (0 - 1)		0 (0 - 1)	0 (0, 0)	0.672
	T1 vs T2		0 (0 - 0)	0 (0 - 1)	0 (0, 0.5)	0.099
General Health Questionnaire 28 (anxiety and insomnia) Median (IQR)	T0 vs T1	0 (0 - 1)	0 (0 - 0)		0 (-0.5, 0)	0.095
	T0 vs T2	0 (0 - 1)		0 (0 - 1)	0 (-0.5, 0.5)	0.756
	T1 vs T2		0 (0 - 0)	0 (0 - 1)	0 (0, 0.5)	0.344
General Health Questionnaire 28 (social dysfunction) Median (IQR)	T0 vs T1	0 (0 - 1)	0 (0 - 0)		-0.5 (-1, 0)	0.077
	T0 vs T2	0 (0 - 1)		0 (0 - 1)	0 (-1, 0)	0.393
	T1 vs T2		0 (0 - 0)	0 (0 - 1)	0 (0, 1)	0.243
General Health Questionnaire 28 (depression) Median (IQR)	T0 vs T1	0 (0 - 0)	0 (0 - 0)		0 (-0.5, 0)	0.084
	T0 vs T2	0 (0 - 0)		0 (0 - 0)	0 (0, 0)	0.947
	T1 vs T2		0 (0 - 0)	0 (0 - 0)	0 (0, 0.5)	0.046*
25-item CD-RISC (total)	T0 vs T1	65.91 ± 16.15	73.91 ± 10.75		8 (0.32, 15.68)	0.039*
	T0 vs T2	65.91 ± 16.15		67.62 ± 14.27	1.71 (-5.96, 9.39)	>0.999
	T1 vs T2		73.91 ± 10.75	67.62 ± 14.27	-6.29 (-13.96, 1.39)	0.142

Table 3 Comparison of Thai Perceived Stress Scale, 25-item CD-RISC(Thai version) and General Health Questionnaire 28 (Thai version) within intervention group (21 participants included control group) at the baseline (T0), post-intervention (T1) and 12-week (T2) follow-up. (Cont.)

Outcome	Comparison of Time Point	Time			mean difference (95%CI)	p-value
		T0 mean±SD	T1 mean±SD	T2 mean±SD		
25-item CD-RISC (Personal competence/tolerance of negative affect) Median (IQR)	T0 vs T1	31 (25 - 34)	32 (31 - 34)		2 (0.5, 4)	0.009*
	T0 vs T2	31 (25 - 34)		32 (26 - 33)	0 (-2.5, 3)	0.931
	T1 vs T2		32 (31 - 34)	32 (26 - 33)	-2 (-4.5, 0.5)	0.145
25-item CD-RISC (Support resources) Median (IQR)	T0 vs T1	6 (5 - 7)	6 (6 - 7)		0 (0, 0.5)	0.291
	T0 vs T2	6 (5 - 7)		6 (6 - 7)	0.5 (0, 1)	0.257
	T1 vs T2		6 (6 - 7)	6 (6 - 7)	0 (-0.5, 1)	0.554
25-item CD-RISC (Self-efficacy)	T0 vs T1	10.29 ± 3.39	11.14 ± 3.05		0.86 (-0.79, 2.51)	0.607
	T0 vs T2	10.29 ± 3.39		10.67 ± 2.89	0.38 (-1.27, 2.03)	>0.999
	T1 vs T2		11.14 ± 3.05	10.67 ± 2.89	-0.48 (-2.13, 1.18)	>0.999
25-item CD-RISC (others)	T0 vs T1	20.43 ± 4.65	21.71 ± 4.62		1.29 (-0.85, 3.42)	0.421
	T0 vs T2	20.43 ± 4.65		20.86 ± 4.23	0.43 (-1.71, 2.56)	>0.999
	T1 vs T2		21.71 ± 4.62	20.86 ± 4.23	-0.86 (-2.99, 1.28)	0.966

Notes-Statistics used in the test, in the case of the data with a normal distribution, were presented by Mean (SD), analyzed by ANOVA and compared by Bonferroni test. If the data have no normal distribution, the test statistics were presented by Median (IQR), analyzed by Wilcoxon rank-sum test (Mann-Whitney U-test)

Table 4 Comparison of Thai Perceived Stress Scale, 25-item CD-RISC (Thai version) and General Health Questionnaire 28 (Thai version) between worksheet group (11 participants) and control group (10 participants) at the baseline (T0) , post-intervention (T1) and 12-week (T2) follow-up.

Outcome	time	Do worksheet mean± SD	Did not do worksheet mean± SD	mean difference	95%CI	p-value
Thai Perceived Stress Scale (total)	T0	15.36 ± 5.77	20.83 ± 5.15	-5.47	-12.67, 1.73	0.196
	T1	14.09 ± 5.13	16.67 ± 4.68	-2.58	-9.77, 4.62	>0.999
	T2	14.91 ± 7.44	15.5 ± 3.83	-0.59	-7.79, 6.61	>0.999
Thai Perceived Stress Scale (stress)	T0	8.09 ± 4.76	13.17 ± 4.75	-5.08	-10.76, 0.61	0.095
	T1	8.18 ± 3.79	11.17 ± 3.76	-2.98	-8.67, 2.70	0.595
	T2	7.73 ± 5.48	9.67 ± 3.44	-1.94	-7.63, 3.75	>0.999
Thai Perceived Stress Scale (control)	T0	7.27 ± 4.03	7.67 ± 3.20	-0.93	-4.32, 3.53	>0.999
	T1	5.91 ± 2.39	5.5 ± 1.76	0.41	-3.51, 4.33	>0.999
	T2	7.18 ± 3.79	5.83 ± 0.98	1.35	-2.57, 5.27	>0.999

Table 4 Comparison of Thai Perceived Stress Scale, 25-item CD-RISC (Thai version) and General Health Questionnaire 28 (Thai version) between worksheet group (11 participants) and control group (10 participants) at the baseline (T0), post-intervention (T1) and 12-week (T2) follow-up. (Cont.)

Outcome	time	Do worksheet mean± SD	Did not do worksheet mean± SD	mean difference	95%CI	p-value
General Health	T0	1 (0 - 2)	4.5 (0 - 6)	2	-1, 5	0.449
Questionnaire 28 (total)	T1	0 (0 - 1)	1 (1 - 2)	0	0, 2	0.157
Median (IQR)	T2	0 (0 – 5)	2 (0 – 5)	0	-1, 4	0.541
General Health	T0	0 (0 – 1)	0 (0 - 2)	0	-1, 1	0.715
Questionnaire 28	T1	0 (0 - 0)	0 (0 - 0)	0	0, 0	0.918
(somatic symptoms)	T2	0 (0 – 1)	0 (0 – 1)	0	-1, 0	0.768
Median (IQR)						
General Health	T0	0 (0 - 1)	0 (0 - 2)	0	0, 2	0.691
Questionnaire 28	T1	0 (0 - 0)	0 (0 - 1)	0	0, 1	0.304
(anxiety and insomnia)	T2	0 (0 - 2)	0 (0 - 1)	0	0, 1	0.705
Median (IQR)						
General Health	T0	0 (0 - 1)	0 (0 - 2)	0	-1, 1	0.778
Questionnaire 28	T1	0 (0 - 0)	0 (0 - 1)	0	0, 1	0.636
(social dysfunction)	T2	0 (0 - 1)	0 (0 - 2)	0	0, 1	0.706
Median (IQR)						
General Health	T0	0 (0 - 0)	0 (0 - 0)	0	0, 0	0.488
Questionnaire 28	T1	0 (0 - 0)	0 (0 - 0)	0	0, 0	0.945
(depression)	T2	0 (0 - 1)	0 (0 - 0)	0	0, 0	0.706
Median (IQR)						
25-item CD-RISC (total)	T0	68.18 ± 13.47	63.4 ± 19.10	4.78	-14.06, 23.63	>0.999
	T1	72.82 ± 12.02	75.1 ± 9.64	-2.28	-21.13, 16.56	>0.999
	T2	65 ± 15.65	70.5 ± 12.76	-5.50	-24.34, 13.34	>0.999
25-item CD-RISC	T0	32 (25 - 34)	31 (22 - 32)	-2	-10, 5	0.458
(Personal competence/	T1	32 (28 - 36)	32.5 (31 - 34)	-0.5	-8, 5	0.832
tolerance of negative	T2	28 (23 - 33)	32 (26.34)	2	-4, 9	0.435
affect)						
Median (IQR)						
25-item CD-RISC	T0	6.36 ± 1.29	5.2 ± 2.30	1.16	-1.02, 3.34	>0.999
(Support resources)	T1	6.55 ± 0.93	5.4 ± 2.32	1.15	-1.03, 3.32	>0.999
	T2	6.18 ± 1.17	6.7 ± 1.34	-0.52	-2.70, 1.66	>0.999
25-item CD-RISC	T0	10 (8 - 13)	11.5 (9 - 13)	0	-3, 3	0.943
(Self-efficacy)	T1	12 (9 - 12)	11.5 (11 - 13)	1	-2, 3	0.695
Median (IQR)	T2	10 (7 - 12)	11.5 (11 - 14)	2	-1, 5	0.166
25-item CD-RISC	T0	21 (17 - 22)	19.5 (18 - 27)	-1	-5, 5	0.524
(others)	T1	23 (20 - 24)	20.5 (20 - 24)	0	-4, 4	0.886
Median (IQR)	T2	21 (18 - 23)	21.5 (17 - 24)	1	-4, 4	0.671

Notes : - Statistics used in the test, in the case of the data with a normal distribution, were presented by Mean (SD), analyzed by ANOVA and compared by Bonferroni test. If the data have no normal distribution, the test statistics were presented by Median (IQR), analyzed by Wilcoxon rank-sum test (Mann-Whitney U-test)

Table 5 Summary of most common responses to worksheets after completing online CBT-based psychoeducation at post-intervention (T1) (n=11)

Question	Most Common Response
Main stressors/issues needing change	Stress (90%)
Key learnings from the worksheet	Identifying stress-inducing thoughts (82%)
Obstacles in completing the worksheet	Lack of time (36%)
Desired adjustments or improvements	Better change management (36%)
Learnings over the past 4 weeks	Self-awareness of thoughts (36%)
Problem management techniques used	Task planning (45%)
Changes or improvements made	Changing thinking patterns (82%)
Identified thinking pattern issues	Catastrophizing (36%)
Understanding of problem/stress management	Applying appropriate stress management strategies (64%)
Anticipated future stressors and management	Applying learned strategies (72%)
Expected changes from learning	Improved stress management (82%)
Planned stress management skills to use	Relaxation and planning techniques (82%)
Additional skills desired for development	Effective life management (63%)

Discussion

The study aimed to examine the levels of stress, resilience, and mental health among fifth-year medical students at the Faculty of Medicine, Khon Kaen University, before and after their participation in online CBT-based psychoeducation. The findings suggest that online CBT-based psychoeducation may have limited impact on perceived stress among fifth-year medical students, particularly in a context where most participants began with moderate stress levels and reported generally favorable mental health. The lack of significant change in stress scores between the intervention and control groups could be attributed to several factors. The findings of this study align with those of Lattie et al.,[23] which examined an internet-based CBT program among first-year medical students. In both studies, the intervention showed limited effects on perceived stress levels. One possible explanation is that participants began with relatively low to moderate baseline stress, resulting in a floor effect and reduced potential for significant improvement. In addition, engagement with the online program varied, and some students may have experienced reduced effectiveness due to multitasking or distractions inherent to the online format. Furthermore, the small sample size in the present study, combined with moderate baseline stress levels, likely limited the statistical power to detect significant group differences. Related studies, including a pilot evaluation of an online mental health program for medical students, have similarly identified small sample sizes and elevated baseline stress as factors limiting the strength of statistical conclusions. These issues suggest that future studies should use larger samples and better designs to clearly show the effects of the program.[24]

The study found that participants also showed variation in engagement. 20 out of 21 participants completed all sessions. However, it was not possible to verify the exact duration of each session, as completion was tracked based on participants logging in with assigned codes and clicking the “Done” button at the end of each session. Moreover, when

considering the completion of homework assignments for each session, 11 out of 21 participants completed all worksheets, accounting for approximately 52.4%. Compared to similar studies, the completion rate in this study appears slightly higher. For instance, in an open trial of an internet-based CBT program among first-year medical students, only 53 out of 194 students (27.3%) enrolled, with low repeated use.[25] Additionally, compared to previous literature reporting average engagement rates between 7–42%, the engagement observed here appears notably higher.[26] Several factors may explain moderate engagement levels in digital interventions, including the lack of financial investment, limited personalized support, distractions during use, and insufficient reminder prompts. Platform usage may not fully reflect emotional engagement, and individual and cultural differences may also affect outcomes. These factors should be considered to guide future strategies for improving engagement.

The study also found that a four-week intervention period might have been insufficient for cognitive and behavioral change to fully develop among participants. This finding is consistent with a previous study, which evaluated a four-week web-based CBT program for medical and health science graduate students and observed small effect sizes and limited symptom reduction.[25] The study emphasized that short intervention durations may not allow adequate time for participants to internalize cognitive-behavioral skills, suggesting the need for longer or booster interventions. Therefore, extending the intervention period or incorporating periodic reinforcement may be necessary to achieve more substantial and sustainable improvements in stress, resilience, and mental health outcomes.

Although the program did not significantly reduce stress scores, it showed promising effects in improving participants' resilience, both in overall scores and specifically in the areas of personal competence and tolerance of negative affect at the 4-week follow-up. This enhanced resilience was accompanied by better mental health outcomes, as indicated by reductions in total mental health scores and social dysfunction scores. These improvements suggest that the intervention may have had a more meaningful impact on participants' underlying capacity to cope with adversity, rather than directly altering subjective stress perceptions.This finding aligns with a recent systematic review which examined online programs developed to promote mental health among medical students.[27] The review highlighted that internet-based cognitive behavioral therapy (iCBT) interventions and other online programs frequently focused on strengthening protective factors such as resilience, coping strategies, and self-compassion. Although effects on stress reduction were often modest, improvements in resilience and mental health outcomes, including depression, were frequently reported. Similarly, in the present study, the effects of the program did not differ significantly between the 4-week follow-up and the 12-week post-program assessment, except for a notable improvement in depression symptoms. This pattern further underscores the importance of enhancing internal psychological resources, such as resilience and emotional regulation, which may yield substantial mental health benefits for high-performing populations like medical students, even when overt stress levels remain relatively unchanged.

Tailoring future implementations to target individuals with higher baseline stress, lower resilience, or greater functional impairment may enhance program responsiveness. Further research with larger, more diverse samples and extended follow-up periods is recommended to fully evaluate the long-term effectiveness and generalizability of CBT-based psychoeducation in medical education settings.

Conclusions

The online CBT-based psychoeducation did not significantly reduce perceived stress among fifth-year medical students but improved resilience and well-being at 4-week follow-up. However, these benefits were not sustained at 12 weeks, except for

reduced depressive symptoms. The findings suggest short-term value for coping, though longer-term strategies may be needed to maintain the effects.

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