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A DEAL-based intervention for the reduction of depression, denial, self-blame and academic stress: A randomized controlled trial

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الملخص

أهداف البحث: تقييم فعالية طريقة "ديل" التداخلية على أعراض الاكتئاب لطلاب كلية الطب، واستراتيجيات التأقلم والضغوط المدركة.

طرق البحث: أجريت تجربة عشوائية متوازية على طلاب كلية طب حكومية في ماليزيا. وضمت ١٧١ طالبا للدراسة بعد أخذ موافقتهم للمشاركة في الدراسة. وأكمل منهم ١٥٣ طالبا الدراسة بنجاح. ونظمت ورشة عمل تعليمية لطلاب كلية الطب لمدة ٤ ساعات صممت بالاعتماد على طريقة "ديل". وتم قياس الاكتئاب، واستراتيجيات التأقلم والضغوط المدركة بناء على مقياس "بيك" للاكتئاب، واستبانة "كوب" وضغوط الطلاب الموجزة على التوالي.

النتائج: تم اختيار ١٧١ طالبا من كلية الطب بصورة عشوائية (مجموعة التحكم = ٨٣ طالبا ومجموعة التدخل = ٨٨ طالبا). واستبعد ١٨ طالبا بسبب انسحابهم المبكر من الدراسة قبل ٣٢ أسبوعا، وبقي في الدراسة ١٥٣ طالبا (التحكم = ٨٠ والتدخل = ٧٣) للتحليل الإحصائي. أظهرت النتائج انخفاضا ملحوظا في أعراض الاكتئاب والنكران، واللوم الذاتي والإجهاد الأكاديمي في مجموعة التدخل مقارنة بمجموعة التحكم.

الاستنتاجات: إن نتائج الدراسة تدعم التأثير الإيجابي للتدخل المعتمد على طريقة "ديل" على صحة طلاب الطب النفسية. ويمكن اعتبار طريقة "ديل" التدخلية طريقة واعدة للاعتماد من قبل كليات الطب لأنه يمكن تطبيقها في وقت قصير، وتدريب ومدربين أقل، وبتكلفة مالية قليلة.

الكلمات المفتاحية: الإجهاد الأكاديمي; طريقة ديل; استراتيجيات التأقلم; الاكتئاب; التعليم الطبي

Abstract

Objective: This study aimed to evaluate effectiveness of a DEAL-based based intervention on medical students' depression symptoms, coping strategies and perceived stressors.

Methods: A parallel randomized controlled trial was conducted on a government medical school in Malaysia. A total of 171 medical students consented to participate in the study. A 4-h educational workshop that was designed based on the DEAL model was conducted on the medical students. Depression, coping strategies and perceived stressors were measured by Beck's Depression Inventory, Brief COPE and Medical Student Stressor Questionnaire respectively. The mixed model ANCOVA was applied to determine the effect of intervention. Partial eta squared ($\eta^2_{partial}$) was used to estimate effect size.

Results: 171 medical students were randomized into study groups by draw lots (control = 83 and intervention = 88). 18 medical students withdrew from the study before 32nd week, leaving 153 medical students (control = 80 and intervention = 73) for analysis. The intervention group significantly experienced lower depression symptoms ($p = 0.017$, $\eta^2_{partial} = 0.037$), less frequent of denial ($p = 0.002$, $\eta^2_{partial} = 0.063$), less frequent of self-blame ($p = 0.002$, $\eta^2_{partial} = 0.064$) and lower perceived academic stress ($p = 0.009$, $\eta^2_{partial} = 0.044$) than the control group.

Conclusion: The results support the positive impacts of the DEAL-based intervention on the medical students' mental health. It is a promising intervention to be adopted by medical schools due to it consumes minimal

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amount of time, money, training and man power as well as simple to be implemented.

Keywords: Academic stress; Coping strategies; DEAL model; Depression; Medical education

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Introduction

The medical curriculum has been designed to produce academically competent, skillful and professional doctors for the main purpose to serve people. Having said that, this purpose may be inhibited by several facets of medical training that may lead to unwanted consequences on medical students' mental health. Studies have reported that the mental health of students declines and stays poor during their medical training.[1–5] The sources of stress affecting medical students' mental health are related to the medical training[6–8] and the top three sources are examination, large amount of content to be learnt and lack of time to review what they have been learnt.[4,6,7]A recent paper has shown that medical students who suffered from high to severe stress academically were 16 times more likely to develop psychological distress than those who suffered mild to moderate stress.[6]It is worth mentioning that studies reported approximately 5%–37.5% of medical students across stages of medical training were reported to suffer from depression,[9–14] and about 14% of medical students had suicidal thoughts and 6% out of 14% planned to commit suicide during medical training.[15] The prevalence of depression reported by those studies seems to be higher than the general population which was 2.1%–3.1% as reported in a previous survey.[16] It should be noted that poor mental health might lead to many unfortunate consequences either at the individual level such as poor academic achievement and inadequate personal development or at the professional level such as feeling cynical, inadequate and unsatisfied with one's career, developing poor relationships with the faculty, and providing poor patient care.[8,10,17] This information shows that the mental health of medical students has reached an alarming point that urgently calls for 'medication'. Several studies have echoed teaching self-care and stress management skills to tomorrow's doctors as it is essential to prevent the fatal consequences of unfavorable medical training atmosphere on mental health.[18–20]

Dealing with stressors depends on how persons cope with it. Carver and colleagues have proposed 15 dimensions of coping in 1989: five dimensions assess conceptually distinct aspects of problem-focused coping (active coping, planning, suppression of competing activities, restraint coping, seeking of instrumental social support); five additional dimensions assess aspects of what might be viewed as emotion focused coping (seeking of emotional social support, positive reinterpretation, acceptance, denial, turning to religion); the last set of five dimensions assesses coping responses that perhaps are less useful, which is also known as dysfunctional or avoidant coping strategies (focus on and venting of emotions (venting), behavioral disengagement, mental disengagement (self-distraction), humor, substance use).[21,22] Several studies have reported the relationship between mental health and coping strategies among students. There are several instances of how 1) distressed students were reported to use denial and behavioral disengagement as coping strategies significantly more frequent than their non-distressed colleagues, while the non-distressed students used positive reframing significantly more frequent than the distressed students[23]; 2) self-blame was associated with psychological distress[24]; 3) distressed medical students have a greater tendency to use self-distraction, venting of emotion, denial, humor, behavioral disengagement and self-blaming as coping strategies compared to their non-distressed colleagues[25]; and 4) distressed young students (i.e. adolescents) tended to use negative coping strategies such as self distraction, denial, behavioral disengagement, and self blame, while non-distressed students tended to use positive coping strategies such as planning.[26]These coping strategies if used effectively and appropriately to specific stressful encounters may buffer unwanted consequences on mental health.[27]

Studies have revealed interventions conducted on medical students have important favorable results on several important aspects of health.[18–20] The reported favorable results range from positive student feedback and health biomarkers.[18,19] In spite of these encouraging results, several shortcomings should be addressed in future research which are related to duration of follow up, research method (i.e., sample size, distribution of study subjects across medical training phases, sampling method andrandomization method) and the theoretical basis of stress management that was developed.[18,19] In addition to this, there is no evidence available to support the effectiveness of brief interventions (i.e. required less than two days) on the medical students.[18] So far, only three papers have reported on the effectiveness of brief interventions and none of them were based on randomized controlled trial studies.[28–30] Furthermore, most interventions required a substantial amount of time and resources, which makes it difficult for medical schools to implement such programs.[18,31] Therefore, there is a need for an effective brief intervention that consumes minimal amount of time and resources and that could be easily integrated in the academic schedule. With this study, we aim to overcome the shortcomings by selecting study subjects across different phases of medical training using random sampling for selecting study subjects, calculating proper sample size and designing a brief intervention based on a theoretical model which is the DEAL model.[32–34]

The DEAL model consists of four components which are **D**etection of stressors, **E**valuation of stressors, **A**ction towards stressors and **L**earning from stressors through self-reflection.[32–35] Based on the DEAL model, four guiding principles are set to 1) teach students to detect problems early and have a positive perception toward the problems, 2) teach students to appraise problems positively and appropriately, 3) teach students to cope with problems positively and 4) teach students to learn from problems for

future self-improvement.[32–35] As individuals undergo the DEAL-based intervention, they will acquire greater insight into personal stress management ability via self-awareness, experience and conscious effort, thus allowing stressors to be handled in better ways. In the end, students are becoming more accountable to constantly develop their skills to deal with the stressors efficiently.

This study is designed to address 3 questions; 1) which stressors are significantly perceived less stressful by the intervention and control groups?; 2) which coping strategies are frequently practiced by the intervention and control groups?; 3) is there any significant differences in depression symptoms between the intervention and control groups? We anticipated participants in the intervention group to perceive stressors less stressful, practice positive coping strategies more frequently and experience lower depression symptoms than the participants in the control group.

Materials and Methods

Trial design

We conducted a parallel randomized controlled trial. Ethical approval was obtained from the Human Research Ethics Committee University Sains Malaysia prior to the start.

Participants

We conducted this study in a Malaysian government medical school that consisted of 957 medical students (165 first year students, 171 s year students, 223 third year students, 206 fourth year students and 192 fifth year students). The medical school adopted the SPICES curriculum design which has 3 phases. Phase I focuses on learning basic science subjects in an integrated manner according to the body systems. Phase II focuses on learning about the pathologies of each system and related basic science subjects are revisited. Clinical clerking and physical examination are introduced to students Phase II. Phase III focuses on clinical apprenticeship whereby students undergo clinical rotations based on departments such as obstetrics and gynecology, surgery and medicine, and paediatrics.

Interventions

We developed a 4-h educational workshop as an intervention based on the DEAL model.[32–34] We divided it into four sections; the first section focuses on introduction to the workshop and delivering information about stress, stressors and coping strategies that are relevant to medical students (Section 1.0); the second section focuses on the practical aspects of self-evaluation related stress, stressors and coping strategies (Section 2.0); the third section focuses on group work on dealing with stressful situations based on video clips (Section 3.0); the fourth section focuses on sharing experience, feedback and conclusion about the whole activities (Section 4.0). The detailed explanations of each section can be downloaded from MedEdPORTAL at https://www.mededportal.org/publication/9241.[32] Participants completed the intervention within 240 min (4 h) over a half-day.

Outcomes

We measured three main outcomes which were depression symptoms, coping strategies and perceived stressors.

BDI has 21 items representing manifestations of depression and are rated under 4 categories of responses (scores range from 0 to 3)[36,37] with the total scores ranging from 0 to 63. High scores indicate high depression level.[36,37] BDI have been validated across regions and the reliability coefficients (Cronbach's Alpha) have ranged from 0.76 to 0.95, with a mean of 0.86.[37] Its uses have been validated in non-psychiatric sample.[37]

MSSQ-20 is a validated instrument used to identify sources of stress.[38] It has 20 items representing possible sources of stress in medical students; Academic Related Stressor (ARS), Intrapersonal and Interpersonal Related Stressor (IRS), Teaching and Learning Related Stressor (TLRS), Social Related Stressor (SRS), Drive and Desire Related Stressor (DRS), and Group Activities Related Stressor (GARS). They are rated under 5 categories of responses ('causing no stress at all', 'causing mild stress', 'causing moderate stress', 'causing high stress', and 'causing severe stress') to indicate the severity of stress caused by each stressor. The domain scores range from 0 to 4 and high scores indicate high level of stress caused by the stressors. The reliability coefficients (Cronbach's Alpha) of the stressor groups have ranged from 0.64 to 0.92.[38–40]

The Brief COPE is a validated inventory.[22,41] It consists of 30 items describing coping methods and are rated under 4 categories of responses (I haven't been doing this at all, I've been doing this a little bit, I've been doing this a medium amount, I've been doing this a lot) to indicate how frequent they have been doing what the items describe. There are 15 domains: behavioral and mental disengagement, active coping, seeking of instrumental support, seeking of mental support, focus, positive interpretations, planning, humor, acceptance, turning to religion, restraint coping, denial, substance abuse, suppression of competing activities and self blame. The reliability coefficients (Cronbach's Alpha) of the coping domains have ranged from 0.56 to 0.89.[41] The domain scores range from 2 to 8 and high scores indicate high tendency of the individual to practice the coping strategies.

We collected data at five different intervals; the baseline measurement was performed at 2 weeks before the intervention (Time 1), and the post-intervention measurements were performed at 1 week (Time 2), 8 weeks (Time 3), 16 weeks (Time 4) and 32 weeks (Time 5). Socio-demographic profiles (refer to Table 1) were obtained by a structured form. Depression symptoms, stressors and coping strategies were measured by the English version of Beck's Depression Inventory (BDI),[36,37,42] Medical Student Stressor Questionnaire 20 items (MSSQ-20)[38–40] and Brief COPE 30 items[22,41] – all the measurement tools have been validated by previous studies in the Malaysian context.[40–42]

Sample size

The calculated sample size (power of study was set at 0.9 and significant level was set at 0.05) by Sample Power Precision Calculator (SPPC) software[43] based on a previous

Table 1: Comparisons of the mean outcome scores between the study groups at baseline.

Variables	Study group	Mean	Std. Deviation	*t*-statistics	*p*-value
ARS	Control	2.42	0.68	−1.699	0.091
	Intervention	2.61	0.71		
GARS	Control	1.83	0.74	−0.642	0.522
	Intervention	1.91	0.87		
SRS	Control	1.51	0.90	−1.775	0.078
	Intervention	1.75	0.76	−1.789	
IRS	Control	1.75	0.96	−0.002	0.999
	Intervention	1.75	1.05		
DRS	Control	1.11	1.10	0.208	0.835
	Intervention	1.08	1.10		
TLRS	Control	1.47	0.83	−0.223	0.824
	Intervention	1.50	0.90		
Self-distraction	Control	5.21	1.76	0.377	0.706
	Intervention	5.11	1.60		
Active coping	Control	6.58	1.48	2.109	0.037
	Intervention	6.11	1.22		
Denial	Control	2.94	1.20	−2.592	0.010
	Intervention	3.49	1.44		
Substance abuse	Control	2.04	0.25	−1.378	0.170
	Intervention	2.19	0.97		
Use of emotional support	Control	5.53	1.61	−0.818	0.415
	Intervention	5.75	1.84		
Use of instrumental support	Control	5.64	1.70	−1.005	0.316
	Intervention	5.92	1.75		
Behavioral disengagement	Control	2.79	1.31	−0.100	0.920
	Intervention	2.81	1.24		
Venting of emotion	Control	4.03	1.44	−0.821	0.413
	Intervention	4.22	1.48		
Positive reinterpretation	Control	6.56	1.41	−0.115	0.908
	Intervention	6.59	1.43		
Planning	Control	6.49	1.41	0.737	0.462
	Intervention	6.32	1.48		
Humor	Control	4.95	1.87	1.041	0.300
	Intervention	4.64	1.76		
Acceptance	Control	6.73	1.37	0.185	0.853
	Intervention	6.68	1.30		
Turning to religion	Control	7.15	1.43	0.655	0.513
	Intervention	7.00	1.39		
Self-blame	Control	3.77	1.38	−1.507	0.134
	Intervention	4.11	1.47		
Restraint coping	Control	5.03	1.53	−1.185	0.238
	Intervention	5.30	1.34		
Depression	Control	4.56	4.66	1.264	0.208
	Intervention	5.55	4.98		

Independent-t test was applied. Significant level was set at 0.05. Levene's test was not significant for all outcome variables.
Bold = significant outcomes; ARS = Academic related stressor, GARS = Group activity related stressor, SRS = Social related stressor, IRS = Intra- and inter-personal related stressor, DRS = Drive and desire related stressor, TLRS = Teaching and learning related stressor.

study[29] was 50 subjects per study group after 30% dropout rate taken into account.

Randomization

We performed the stratified random method to invite the study subjects through postal invitations therefore recalculating the sample size to address the estimated 80% non-response rate to the invitation[44,45] that resulted in a total of 250 subjects per group across years of study (i.e. in total, 500 subjects were involved in this study). We invited 100 medical students from each year of study through stratified random sampling method. We stratified them by sex (40% male and 60% female) and race (60% Malay and 40% non-Malay) according to the prevalence of psychological distress reported by a previous study.[46] We obtained the student name lists (first to fifth year) from the academic office, and gave each student a unique code to ensure anonymity. We performed random selection by Statistical Package for Social Sciences (SPSS) version 18.[47] The selected students were invited to attend a 3 h briefing session on the study protocol and the students who agreed to participate signed an informed consent form. We preformed stratified randomization method to allocate the consenting students into intervention and control groups by draw lots. The intervention group underwent a

4-h stress management module; while the control group was put on the waiting list to undergo the intervention after the study was completed. The flow diagram of the trial was summarized in Figure 1.

Blinding

To ensure the researchers were blinded during analysis, data were collected and entered into a data sheet by a research assistant and study subjects were assigned with a unique code throughout the study.

Statistical methods

We analyzed the collected data by SPSS version 18, checked for errors and missing values, and cleaned the errors. We set alpha (α) at 0.05 and confidence interval of 95% for statistical analysis. We applied descriptive statistical analysis to calculate frequency, percentage, mean and standard deviation. We checked the assumptions before running statistical tests. We performed chi-square test to test the differences of frequency between two categories of independent variable. We performed independent-t test to test the differences of mean score between two categories of independent variables. We performed the mixed method analysis of covariance (ANCOVA) (i.e. repeated measure ANCOVA) to test the differences of mean depression, coping strategy and stressor scores between the study groups that were measured repeatedly at four intervals post-intervention.[48] The baseline scores were considered as covariates in this analysis. We performed the multivariate statistics for analysis due to the fact that it does not require sphericity assumption.[48] Partial eta squared was used to estimate effect size. Using the commonly used guidelines proposed by Cohen (1988, pp.284–7): 0.01 = small effect, 0.06 = moderate effect, 0.14 = large effect.[49]

Result

Participant flow

Figure 1 illustrates participant flow from enrollment until analysis.

Baseline data

Table 1 summarizes the baseline measurements of all measured outcomes. At baseline, the intervention and control groups were equal except for active coping and denial. Even though there is no significant difference between the study groups, the baseline scores were controlled during the statistical analysis.

Numbers analyzed

There were 153 medical students (intervention = 73 and control = 80) included in the analysis. The demographic profiles between the study groups showed no significant differences (p-value more than 0.05) based on Pearson chi-square

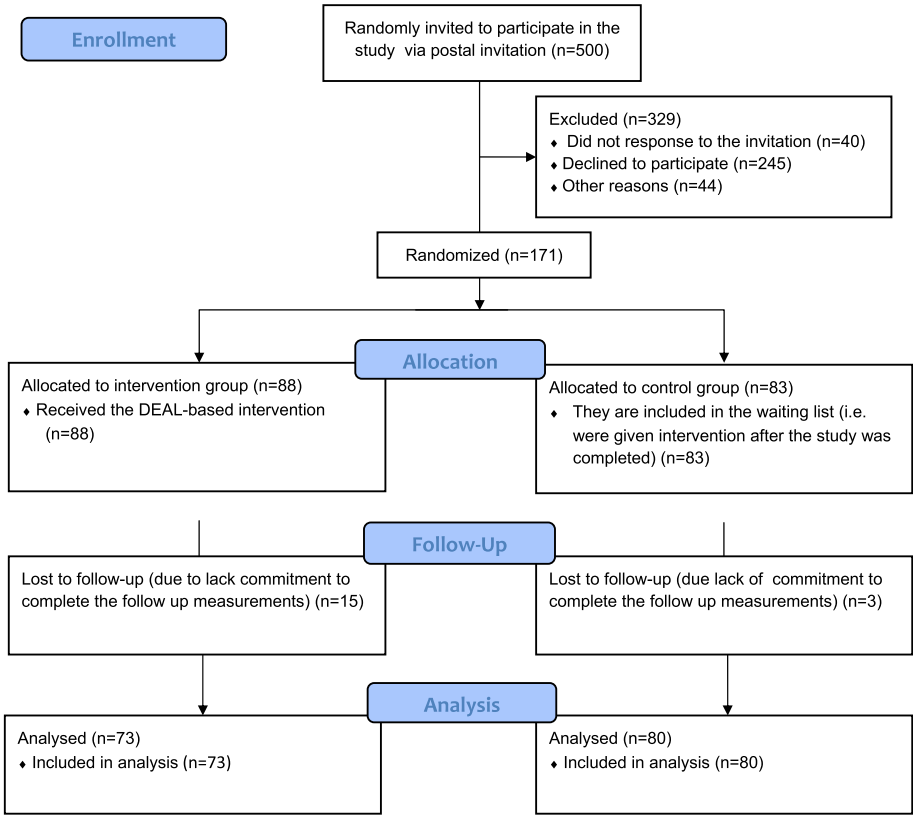

Figure 1: The flow diagram of the trial.

test (Table 2). These results suggest that randomization successfully distributed study subjects into two homogenous groups.

Outcomes and estimation

The mixed model ANCOVA (Table 3) has found that the intervention had significant main effect only on ARS. The intervention has failed to demonstrate significant main effect on the rest of stressors. The detailed results of ARS follow.

ARS

The mixed model ANCOVA (Table 3) shows no significant interaction between study groups and time, Wilk's Lambda = 0.98, F (3, 148) = 0.92, p = 0.43, partial eta squared = 0.018. There was no significant main effect for time, Wilk's Lambda = 0.93, F (3, 148) = 3.86, p = 0.73, partial eta squared = 0.073. The main effect comparing the two study groups was significant, F (1, 150) = 6.96, p = 0.009, partial eta squared = 0.044, suggesting significant difference of scores between the study groups with a small effect size. This result suggests the intervention group has significantly lower perceived academic stress than the control group across the four time intervals post-intervention.

The mixed model ANCOVA (Table 4) has found that the intervention had significant main effect on two coping strategies which were denial and self-blame. The intervention failed to demonstrate significant main effect on the rest of coping strategies. The detailed results of the two coping strategies follow.

Denial

The mixed model ANCOVA (Table 4) shows no significant interaction between study groups and time, Wilk's Lambda = 0.96, F (3, 148) = 1.96, p = 0.123, partial eta squared = 0.038. There was no significant main effect for time, Wilk's Lambda = 0.97, F (3, 148) = 1.72, p = 0.165, partial eta squared = 0.034. The main effect comparing the two study groups was significant, F (1, 150) = 10.02, p = 0.002, partial eta squared = 0.063, suggesting a significant difference in scores between the study groups with a moderate effect size. This result suggests the intervention group was significantly less frequent practicing the strategy to cope with problems than the control group post-intervention.

Self-blame

The mixed model ANCOVA (Table 4) shows no significant interaction between study groups and time, Wilk's Lambda = 0.96, F (3, 148) = 1.89, p = 0.134, partial eta squared = 0.037. There was no significant main effect for time, Wilk's Lambda = 0.97, F (3, 148) = 1.38, p = 0.253, partial eta squared = 0.027. The main effect comparing the two study groups was significant, F (1, 150) = 10.28, p = 0.002, partial eta squared = 0.064, suggesting a significant difference in scores between the study groups with a moderate effect size. This result suggests the intervention group was significantly less frequent practicing the strategy to cope with problems than the control group post-intervention.

Depression

The mixed model ANCOVA (Table 5) shows significant interaction between study groups and time, Wilk's

Table 2: Profiles of participants successfully completed this study.

Variable	Study group, Frequency (%)		X^2-statistics	P-value[a]
	Intervention	Control		
Sex				
Male	25 (34.2)	29 (36.3)	0.067[b]	0.798
Female	48 (65.8)	51 (63.8)		
Race				
Malay	58 (79.5)	61 (76.3)	0.226[b]	0.634
Non-Malay	15 (20.5)	19 (23.7)		
Religion				
Muslim	58 (79.5)	61 (76.3)	0.226[b]	0.634
Non-Muslim	15 (20.5)	19 (23.7)		
Year of study				
First	32 (43.8)	41 (51.3)		
Second	13 (17.8)	12 (15.0)	0.890[b]	0.926
Third	14 (19.2)	14 (17.5)		
Fourth	5 (06.9)	5 (06.3)		
Fifth	9 (12.3)	8 (10.0)		
Entry qualification				
Matriculation	60 (82.2)	64 (80.0)	0.119[b]	0.730
Non-Matriculation	13 (17.8)	16 (20.0)		
Repeater status				
No	64 (87.7)	71 (88.7)	0.043[b]	0.836
Yes	9 (12.3)	9 (11.3)		

[a] Pearson Chi-square test.
[b] Expected count less than 5 was 10%; Intervention (N) = 73; Control (N) = 80.

Table 3: Adjusted mean perceived stressor scores within the study groups at different time intervals.

Perceived stressor	Post intervention	Intervention group	Control group
		AM (95% CI; lower, upper)	AM(95% CI; lower, upper)
ARS	1 week	2.37 (2.23, 2.52)	2.60 (2.46, 2.74)
	8 week	2.47 (2.31, 2.62)	2.70 (2.55, 2.85)
	16 week	2.46 (2.31, 2.62)	2.77 (2.62, 2.92)
	32 week	2.66 (2.50, 2.82)	2.79 (2.63, 2.94)
GARS	1 week	1.68 (1.51, 1.85)	1.95 (1.78, 2.11)
	8 week	1.74 (1.55, 1.93)	1.97 (1.79, 2.15)
	16 week	1.77 (1.58, 1.97)	1.99 (1.80, 2.17)
	32 week	1.79 (1.58, 1.99)	1.90 (1.70, 2.09)
SRS	1 week	1.50 (1.32, 1.67)	1.55 (1.38, 1.72)
	8 week	1.53 (1.35, 1.71)	1.68 (1.50, 1.85)
	16 week	1.59 (1.39, 1.78)	1.86 (1.67, 2.05)
	32 week	1.55 (1.35, 1.75)	1.58 (1.39, 1.77)
IRS	1 week	1.54 (1.32, 1.77)	1.56 (1.34, 1.77)
	8 week	1.57 (1.36, 1.78)	1.54 (1.34, 1.74)
	16 week	1.68 (1.46, 1.90)	1.68 (1.47, 1.89)
	32 week	1.78 (1.64, 1.92)	1.89 (1.76, 2.02)
DRS	1 week	0.81 (0.62, 1.00)	0.93 (0.75, 1.11)
	8 week	0.95 (0.74, 1.16)	1.11 (0.91, 1.31)
	16 week	0.96 (0.75, 1.16)	1.10 (0.90, 1.29)
	32 week	1.00 (0.76, 1.24)	0.98 (0.75, 1.20)
TLRS	1 week	1.25 (1.08, 1.42)	1.35 (1.19, 1.51)
	8 week	1.20 (1.00, 1.40)	1.49 (1.30, 1.68)
	16 week	1.24 (1.05, 1.44)	1.44 (1.25, 1.62)
	32 week	1.34 (1.13, 1.54)	1.32 (1.12, 1.52)

The stressors were measured by the MSSQ-20.
The mixed model ANCOVA was applied.
Covariates: the baseline of each stressor score
AM = Adjusted mean (minimum and maximum scores was 0 and 4 respectively); SD = standard deviation; CI = confidence interval.
Assumptions were checked: 1) normality of residual was fulfilled, 2) homogeneity of variances was fulfilled, 3) linear relationships between numerical covariates and dependent outcomes were fulfilled.
ARS = Academic related stressor, GARS = Group activity related stressor, SRS = Social related stressor, IRS = Intra- and inter-personal related stressor, DRS = Drive and desire related stressor, TLRS = Teaching and learning related stressor.

Lambda = 0.95, F (3, 148) = 2.70, p = 0.048, partial eta squared = 0.052. There was no significant main effect for time, Wilk's Lambda = 0.97, F (3, 148) = 1.78, p = 0.154, partial eta squared = 0.035. The main effect comparing the two study groups was significant, F (1, 150) = 5.83, p = 0.017, partial eta squared = 0.037, suggesting a significant difference in scores between the study groups with a small effect size. This result suggests the intervention group significantly had lower depressive symptoms than the control group post-intervention.

Summary of results

Based on the results, the intervention group significantly experienced lower depression symptoms (small effect size), less frequent denial (moderate effect size), less frequent self-blame (moderate effect size) and lower perceived academic stress (small effect size) than the control group. The significant results are illustrated in Figure 2.

Discussion

The present study has revealed that the intervention; 1) reduced depression symptoms; 2) decreased the practice of frequent denial and self-blame which are dysfunctional coping strategies; and 3) reduced perceived academic stress. The insights gained from these findings are discussed below.

A recent meta-analysis reported that there were seven studies reporting on the effectiveness of interventions to reduce depression symptoms of medical students – four of them showed significant effect with moderate effect sizes.[20] Consistent with the meta-analysis result, the DEAL-based intervention provides evidence to support its effectiveness in reducing depression symptoms of medical students for a duration of 32 weeks post intervention with small effect size. Interestingly, this study has shown that depression symptoms of the control group escalated towards the end of the year (mean = 6.61) compared to the baseline measurement (mean = 4.56) which is consistent with literature reporting that prevalence of depression doubled at the end of the year.[3,5] Conversely, depression symptoms of the intervention group reduced at the end of year (mean = 4.37) compared to the baseline measurement (mean = 5.55) indicating a better mental health condition after the intervention. In line with the literature, special interventions provide favorable effects on mental health.[18–20] It is worth highlighting that medical students who experienced less depression symptoms may go on to attain greater personal and professional achievement.[8,10,17,50] One implication of this study is that this one-off 4-h intervention provides comparable effects to other reported interventions which took at least 4 weeks to

Table 4: Adjusted mean coping strategy scores within the study groups at different time intervals.

Coping strategies	Post intervention	Intervention group	Control group
		AM (95% CI; lower, upper)	AM(95% CI; lower, upper)
Self-distraction	1 week	5.13 (4.78, 5.47)	5.22 (4.90, 5.56)
	8 week	4.82 (4.46, 5.17)	5.01 (4.67, 5.35)
	16 week	4.77 (4.41, 5.13)	5.17 (4.83, 5.52)
	32 week	4.99 (4.59, 5.39)	4.98 (4.60, 5.37)
Active coping	1 week	6.25 (5.94, 6.57)	6.34 (6.04, 6.64)
	8 week	6.05 (5.70, 6.41)	5.93 (5.58, 6.27)
	16 week	6.11 (5.74, 6.49)	5.60 (5.24, 5.96)
	32 week	6.26 (5.89, 6.64)	5.56 (5.20, 5.92)
Denial	1 week	2.60 (2.36, 2.83)	2.77 (2.54, 3.00)
	8 week	2.55 (2.30, 2.81)	3.09 (2.86, 3.33)
	16 week	2.59 (2.26, 2.91)	3.23 (2.92, 3.54)
	32 week	2.59 (2.27, 2.90)	3.10 (2.80, 3.41)
Substance abuse	1 week	2.09 (1.99, 2.19)	2.03 (1.94, 2.13)
	8 week	2.07 (1.92, 2.22)	2.10 (1.95, 2.24)
	16 week	2.11 (1.93, 2.28)	2.12 (1.95, 2.28)
	32 week	2.01 (1.89, 2.13)	2.10 (1.99, 2.22)
Use of emotional support	1 week	5.49 (5.14, 5.84)	5.13 (4.80, 5.47)
	8 week	5.24 (4.86, 5.62)	5.11 (4.74, 5.47)
	16 week	5.42 (5.05, 5.80)	4.59 (4.23, 4.95)
	32 week	5.34 (4.97, 5.72)	4.96 (4.61, 5.32)
Use of instrumental support	1 week	5.50 (5.16, 5.85)	5.33 (5.00, 5.66)
	8 week	5.38 (5.02, 5.75)	5.05 (4.70, 5.40)
	16 week	5.45 (5.08, 5.82)	4.78 (4.43, 5.13)
	32 week	5.23 (4.88, 5.59)	5.09 (4.75, 5.43)
Behavioral disengagement	1 week	2.85 (2.53, 3.12)	2.80 (2.49, 3.09)
	8 week	2.75 (2.46, 3.04)	2.77 (2.49, 3.05)
	16 week	3.07 (2.74, 3.39)	2.87 (2.56, 3.18)
	32 week	2.43 (2.16, 2.71)	2.93 (2.66, 3.20)
Venting of emotion	1 week	4.25 (3.94, 4.56)	3.80 (3.50, 4.09)
	8 week	3.82 (3.47, 4.16)	3.97 (3.64, 4.30)
	16 week	3.84 (3.52, 4.16)	3.91 (3.60, 4.21)
	32 week	3.71 (3.35, 4.08)	4.06 (3.71, 4.41)
Positive reinterpretation	1 week	6.46 (6.16, 6.76)	6.26 (5.97, 6.54)
	8 week	6.27 (5.90, 6.64)	5.97 (5.62, 6.32)
	16 week	6.06 (5.71, 6.42)	5.67 (5.33, 6.01)
	32 week	6.12 (5.71, 6.53)	5.62 (5.23, 6.01)
Planning	1 week	6.04 (5.72, 6.35)	5.99 (5.69, 6.30)
	8 week	6.09 (5.75, 6.43)	5.73 (5.41, 6.05)
	16 week	5.95 (5.59, 6.32)	5.51 (5.16, 5.86)
	32 week	6.03 (5.66, 6.39)	5.73 (5.38, 6.08)
Humor	1 week	3.84 (3.46, 4.23)	4.19 (3.83, 4.56)
	8 week	3.50 (3.13, 3.88)	3.90 (3.54, 4.26)
	16 week	3.75 (3.35, 4.14)	3.82 (3.45, 4.19)
	32 week	3.47 (3.08, 3.86)	3.57 (3.20, 3.95)
Acceptance	1 week	6.59 (6.28, 6.89)	6.42 (6.13, 6.71)
	8 week	6.04 (5.67, 6.41)	6.05 (5.70, 6.41)
	16 week	6.19 (5.82, 6.55)	5.69 (5.34, 6.04)
	32 week	6.35 (6.01, 6.69)	6.04 (5.71, 6.37)
Turning to religion	1 week	7.00 (6.72, 7.29)	6.91 (6.64, 7.18)
	8 week	6.98 (6.65, 7.31)	6.68 (6.36, 6.99)
	16 week	6.78 (6.41, 7.16)	6.31 (5.95, 6.67)
	32 week	6.88 (6.54, 7.22)	6.51 (6.19, 6.83)
Self-blame	1 week	3.50 (3.21, 3.79)	3.79 (3.52, 4.07)
	8 week	3.33 (2.99, 3.68)	4.11 (3.78, 4.44)
	16 week	3.55 (3.21, 3.90)	3.93 (3.60, 4.27)
	32 week	3.33 (3.02, 3.65)	4.06 (3.76, 4.36)
Restraint coping	1 week	4.65 (4.30, 4.99)	4.57 (4.24, 4.90)
	8 week	4.85 (4.51, 5.18)	4.77 (4.44, 5.09)
	16 week	4.64 (4.28, 5.01)	4.68 (4.33, 5.03)
	32 week	4.59 (4.22, 4.95)	4.43 (4.08, 4.77)

The coping strategies were measured by the Brief COPE 30-items.
The mixed model ANCOVA was applied.
Covariates: the baseline of each coping strategy score.
AM = Adjusted mean (minimum and maximum scores was 2 and 8 respectively); SD = standard deviation; CI = confidence interval.
Assumptions were checked: 1) normality of residual was fulfilled, 2) homogeneity of variances was fulfilled, 3) linear relationships between numerical covariates and dependent outcomes were fulfilled.

Table 5: Adjusted mean depression scores within the study groups at different time intervals.

Variable	Post intervention	Intervention group	Control group
		AM (95% CI; lower, upper)	AM(95% CI; lower, upper)
Depression	1 week	4.45 (3.51, 5.38)	4.73 (3.84, 5.63)
	8 week	4.16 (3.04, 5.29)	5.85 (4.77, 6.93)
	16 week	4.34 (3.11, 5.56)	6.36 (5.19, 7.52)
	32 week	4.37 (3.14, 5.61)	6.61 (5.43, 7.80)

Depression was measured by the BDI.
The mixed model ANCOVA was applied.
Covariates: the baseline of depression score.
AM = Adjusted mean (minimum and maximum scores was 2 and 8 respectively); SD = standard deviation; CI = confidence interval.
Assumptions were checked: 1) normality of residual was fulfilled, 2) homogeneity of variances was fulfilled, 3) linear relationships between numerical covariates and dependent outcomes were fulfilled.

complete.[18,19] Therefore the results clearly suggest it may provide similar or superior benefits on medical students' mental health than any other interventions with regards to educational impacts, feasibility and acceptability.

Based on two systematic review reports[18,19] no articles reported on the impacts of special interventions on coping strategies. This study is perhaps the first attempt reporting on the impacts of a special intervention on coping strategies practiced by medical students. We found that the intervention significantly reduces the practice of dysfunctional coping strategies such as denial and self-blame. However, the other 13 coping strategies failed to achieve significant results. These are important findings showing that reducing the practices of denial and self-blame as coping strategies might lead to positive mental health condition.[23,25,26,51,52] Mosley Jr et al. (1994) found that those who practiced self-criticism as coping strategies were associated with increment of depression symptoms; Moffat et al. (2004) found that those who practiced denial as coping strategies were more likely to develop psychological distress; Johari & Hashim (2009) found that those who practiced denial and self-blame as coping strategies were more likely to develop psychological distress; Yusoff et al. (2011) reported that distressed students had more tendency to practice self-blame and denial as coping strategies than non-distressed students. All these results suggest that the brief intervention is able to reduce dysfunctional coping strategies that lead to poor mental health.

In consistence with previous studies,[18,19] we found that the intervention successfully reduced perceived academic stressors. A study reported that reducing perceived academic stressors might lead to improving psychological health of medical students.[6] The study reported that medical students who perceived academic matters causing high stress were 16 times more likely to develop psychological distress compared to medical students who perceived academic matters causing mild stress.[6] In addition to that, it has been widely reported that the major stressor for medical students during medical training is related to academic requirements regardless of curriculum designs[6–8,10,53,54] — therefore, it is only logical that reducing perceived academic stress would lead to healthy mental health. The top three stressors perceived as highly stressful by medical students were examinations, large amounts of content to be learnt, and lack of time to review what has been learnt.[6,7] These facts have shown that medical students were overloaded with a tremendous amount of information that needed to be learnt within a limited amount of time for their examinations.[4] This information overload would create feelings of academic disappointment because most medical students never perceived themselves as being

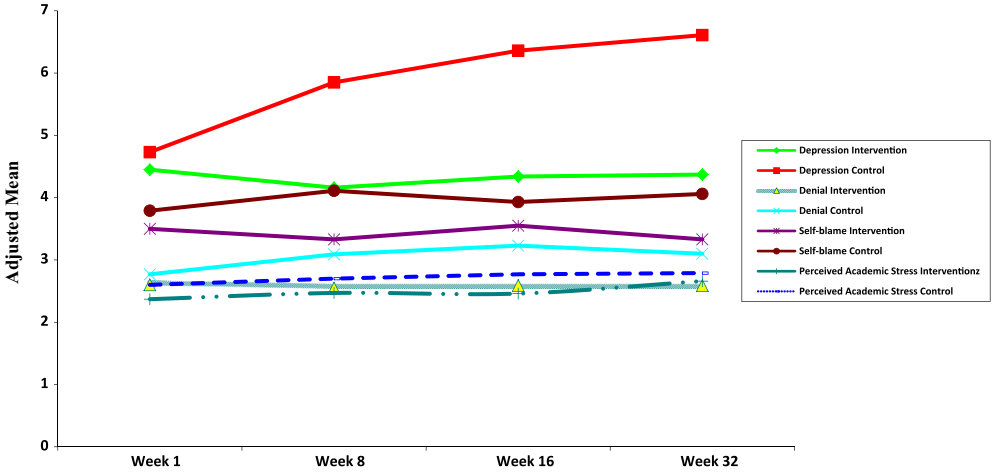

Figure 2: Comparison of adjusted mean depression, denial, self-blame and perceived academic stress scores between intervention and control groups post intervention.

able to revise enough subjects to attain their personal examination performance goals. Therefore, many medical students struggled with questions about their ability to meet the demands of the medical curriculum.[55] The mismatch between the demands and the perceived ability to meet the demands worsened stressful feelings of medical students.[56] Perhaps, these feelings of academic disappointment are most prevalent among those students with poor previous academic performance.[3–5,57] This idea stands in line with a previous study on how unfavorable stress for medical students was found to double during the final examination.[58]These facts clearly show the benefits of reducing perceived academic stress on mental health condition of medical students.

Considering these results, several recommendations are proposed; 1) this study should be replicated in other medical schools to verify its credibility, practicality and transferability to improve the credentials of its effects on medical students' mental health; 2) future research should include qualitative methods so that more data could be explored to support its validity; and 3) future research should explore whether effects of the intervention is operator-dependent. Last but not least, we recommend that this intervention be adopted by medical schools as a preventive measure to improve their medical students' mental health condition. In addition, this intervention is easy to be incorporated in the academic schedule as it requires a minimal amount of time and money and can be conducted by any medical teachers since it does not require any special training. It is also downloadable free of charge at https://www.mededportal.org/publication/9241.[32]

Conclusion

The results support the positive impacts of the DEAL-based intervention on medical students' mental health. It is a promising intervention to be adopted by higher education systems because it is simple and economical. It is not time consuming, and does not require any training or special man power.

Authors' contributions

1. Muhamad Saiful Bahri Yusoff significantly contributed in designing the study, collecting data, analysis and interpretation of data, preparing first draft and critically appraised the final draft.
2. Abd Rahman Esa All authors significantly contributed in designing the study, collecting data, analysis and interpretation of data, preparing first draft and critically appraised the final draft.

Conflict of interest

The authors have no conflict of interest to declare.

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