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Effectiveness of Behavioral Activation Therapy for the treatment of depression in medical students of two Mexican universities: a pilot study

Efectividad del Tratamiento de Activación Conductual para el tratamiento de la depresión en estudiantes de medicina de dos universidades mexicanas: un estudio piloto

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Abstract

Introduction: Depression is a common mental disorder among medical students, with prevalence rates reaching up to 39.3 %. Students may also have associated clinical symptoms such as anxiety, sleep problems, and suicide risk. Therefore, it is necessary to create programs to meet the mental health needs of medical students. **Objective.** Determine the effectiveness of Behavioral Activation Treatment for Depression (BATD) in reducing depressive and associated symptoms in medical students. **Method.** This study included 17 patients who received 10 BATD sessions, and compared levels of depression, anxiety, sleep quality and suicide risk before and after treatment. **Results.** Statistically significant differences were found at post intervention in depression ($p < .001$), stress ($p < .001$), anxiety ($p < .001$), sleep quality ($p < .001$) and suicide risk ($p = .007$), most of the participants did not show clinically significant symptoms of depression or other mental disorder after the BATD treatment. **Discussion and conclusion.** The 10 sessions of BATD demonstrated effectiveness in reducing symptoms of depression, anxiety, sleep quality issues, and suicidal risk among medical students, suggesting it may be a promising treatment for depression in vulnerable populations.

Keywords: behavioral activation, depression, suicide risk, sleep quality, medicine students.

Resumen:

Introducción: La depresión es un trastorno mental frecuente entre los estudiantes de medicina de hasta 39.3% quienes también experimentan síntomas como ansiedad, problemas de sueño y riesgo sucida. Por lo tanto, es necesario crear programas para atender las necesidades de salud mental en estudiantes de medicina. **Objetivo.** Deteminar la eficacia del Tratamiento de Activación Conductual para la Depresión (BATD) para reducir depresión y síntomas asociados en estudiantes de medicina. **Método.** Se incluyeron 17 pacientes que recibieron 10 sesiones de BATD, y se compararon las medias de depresión, ansiedad, calidad de sueño y riesgo suicida antes y después de la intervención. **Resultados.** Se encontraron diferencias significativas al finalizar la intervención en las mediciones de depresión ($p < 0.001$), estrés ($p < 0.001$), ansiedad ($p < 0.001$), calidad de sueño ($p < 0.001$), y riesgo suicida ($p = 0.007$), la mayoría de los participantes no mostraron síntomas clínicamente significativos después del tratamiento de BATD. **Discusión y conclusión.** La terapia BATD de 10 sesiones mostró efectividad para disminuir los síntomas de depresión, ansiedad, calidad de sueño y riesgo suicida en estudiantes de medicina, por lo que puede ser un tratamiento prometedor para la depresión en poblaciones vulnerables.

Palabras claves: activación conductual, depresión, ideación suicida, calidad de sueño, estudiantes de medicina.

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Introduction

Depression is the most common mental illness around the world (World Health Organization, 2017), is defined by the DSM-5 (2013) as a mood disorder, the basic symptoms of depression are depressed mood and loss of interest or pleasure, as well as sleep problems, a slowing down of thought, feeling of worthlessness, changes in appetite, lack of energy among others symptoms (American Psychiatric Association, 2013). Currently, depression is a significant health problem, this mental illness is increasing constantly worldwide among adult population, from 1990 to 2017, the incident cases has increased in 49% (Liu et al., 2019) affecting nearly 264 million people around the world and represents the third leading cause of years lived with disability (James et al., 2018), and has been widely related to suicide (Barzilay & Apter, 2014). Depression and anxiety commonly present high comorbidity (Tiller, 2012) and both affects sleep quality, in specific the insomnia and lack of sleep quality has a relationship with suicide risk (Oh et al., 2019).

University students demostrate a higher prevalence of mental issues, such depression compared to the general population (30.6 vs 9%) (Ibrahim et al., 2013). These issues are particularly common among medical students, with depression symptoms (27 %) and suicidal thoughts (11.1 %) (Rotenstein et al., 2016); anxiety (33.68 %) (Quek et al., 2019). In addition, medical students are susceptible to suffer other disorders such, low sleep quality, problematic alcohol use and stress (Pacheco et al., 2017); burnout (Dyrbye et al., 2014). The students suffering mental illness can lead to have a poor academic performance, loss of interest in patients, substance abuse such as alcohol and an increased risk of suicide (Dyrbye et al., 2005; Jadoon et al., 2010). These disorders are strongly linked to the intense stress of medical training, which involves rigorous demands and interactions with patients and senior medical staff in hospital settings (Romo-Nava et al., 2019) and by academic workload (Razaei et al., 2018). These findings consistently highlight the significant vulnerability of medical students to mental health challenges, emphasizing the urgent need for strategies aimed at improving their mental health.

Among the effective psychological treatments for depression, the Behavioral Activation Treatment for Depression (BATD) is an intervention that counts with strong evidence of its effectiveness, the APA and WHO recognize BATD as an evidence-based, effective intervention for treating depression (American Psychological Association, 2019; World Health Organization, 2016). This treatment has been compared to cognitive therapy in a meta-analysis study that included sixteen studies obtaining a pooled effect size of 0.02 (95% CI: - 0.21 to 0.25) showing similar effects (Cuijpers et al., 2007). In another meta-analysis study that included 26

randomized controlled trials, the results concluded that BATD was superior to the controls via standardized mean difference (SMD) (SMD = - 0.74 CI: - 0.91 to - 0.56, k = 25, N = 1088) and medication groups (SMD = - 0.42, CI: - 0.83 to - 0.00, k = 4, N = 283) representing a large effect size and moderate effect size respectively in favor of BATD (Ekers et al., 2014). It's important to emphasize in this treatment for depression since it is efficient, uncomplicated and it doesn't require experience or complex intervention strategies (Cuijpers et al., 2007).

Behavioral Activation Treatment for Depression (BATD)

BATD is a structured treatment that helps patients to engage in modify their behavior to increase contact with positive reinforcement in their lives, emphasizing in activities that generate feelings of mastery and pleasure in order to improve their mood. Behavioral activation is contextualist, it encourages the person to have more interactions with their environment and, as a result, obtain more sources of reinforcement (Hopko et al., 2003; Martell et al., 2010). The foundations of behavioral activation have their origin in the works of Ferster (1973) and Lewinsohn (1974), it is a model that has focused on the application on empirical evidence about depression (Kanter et al., 2010).

The formulations of activities are not generalizable to all, it is important to observe which are the most susceptible to change, and what are the objective behaviors to keep track of them (Bianchi & Muñoz-Martínez, 2014; Bottonari et al., 2008). Along the BATD some strategies serve as homework and are applied to encourage the client to take an active role in his treatment, some activities are: activity and mood monitoring, activity scheduling, structure activities in small tasks and keep focus on activation behaviors. The homework has to be reviewed and discussed during the next BATD session, in each session the therapist encourages the client to engage in new activities that serve as reinforcement (Lejuez et al., 2011; Lejuez et al., 2001; Martell et al., 2010).

In the review by Bianchi & Henao (2015), it is pointed out that behavioral activation has few publications in Latin America, despite being a promising therapy; until then, only two publications related to behavioral activation were found in Mexico. In recent years, behavioral activation has shown effectiveness in reducing symptoms of depression in vulnerable groups such as women with breast cancer (Becerra Gálvez et al., 2020), women victims of violence (Ramírez-Cruz et al., 2023), and also shows promise as an option to quit smoking (Sánchez et al., 2020).

In the Latin American population, it has been shown that behavioral activation needs more empirical support compared to other therapies such as

cognitive behavioral therapy (Collado et al., 2016), it is necessary to demonstrate that behavioral activation is applicable in Latin America, consolidating empirical evidence of its effectiveness (Bianchi & Henao, 2015). Despite the research that supports the BATD there is no evidence that this treatment has been implemented properly in Mexico, especially, with medical students, a population with clinical symptoms of depression (Galvan-Molina et al., 2017; Guerrero Lopéz et al., 2013; Romo Nava et al., 2013), which have the highly important task of preserve the health and life of the general Mexican population. Addressing their mental health challenges is crucial, not only for their well-being but also for the quality of care they provide. To address this gap, two objectives were established:1) analyze the relationship between symptoms of depression, anxiety, sleep quality and suicide risk) and 2) evaluate the effects of BATD on the same symptoms (depression, anxiety, sleep quality and suicide risk) in medical students, before and after treatment.

Methods

Design of the study

This research was a pilot study, with a quantitative approach, explanatory scope, and pre-experimental design.

Sample description

A non-randomized sample of 290 participants was obtained to carry out the first objective (correlation of symptoms associated with depression), medical students from two public colleges of Mexico; Autonomous University of Baja California (UABC) and the Autonomous University of Ciudad Juarez (UACJ). A Mental health advertising campaign was carried out in both universities. Participants were recruited from a survey carried out in both colleges in online format including mental health measurements and taken into account the depressive symptoms to enroll in the treatment, the participants were contacted by email or telephone and invited to a face-to-face DSM-5 based clinical interview (by experienced clinical psychologists). The inclusion criteria were: medical students who are enrolled in one of the two colleges, who were at least 18 years at the moment of the survey, participants with depressive symptoms measured by the CES-D (> 16) and confirmed in the interview conducted by a clinical psychologist, participants who agreed and signed the informed consent to participate in the study. The exclusion criteria were: any participant who were currently using drugs,

receiving psychological or pharmacological treatment, or a recent suicide attempt (within 3 months). The procedures for obtaining the sample and the methods applied were previously approved by the bioethics committee of the Autonomous University of Baja California (approved in May 2019, with the number 714/2019-1), as well as registered within Clinical.Trails.gov: NCT04069182.

Of the 290 medical students assessed with the self-report test, a total of 21 participants participated in the study to receive this intervention, however 4 participants did not conclude the treatment. Therefore, the final sample was composed by 17 participants (second objective: analysis pre post treatment), with a mean age of 20.94 (*SD* = 1.43). The majority of the participants were at the moment of the intervention in the 3rd semester of the career (*n* = 4) and 8th semester (*n* = 5) respectively. Sociodemographic data of sex, age, university and grade are listed in **Table 1.**

Table 1. *Sociodemographic data*

Descriptive	*n*	(%)
Sex		
Female	12	(29.4)
Male	5	(70.6)
Age	17	Mean = 29.91 SD: 1.43
University		
UACJ	8	(47.1)
UABC	9	(52.9)
Current semester (grade)		
First	1	(5.9)
Second	1	(5.9)
Third	4	(23.5)
Forth	1	(5.9)
Fifth	0	0
Sixth	1	(5.9)
Seventh	1	(5.9)
Eighth	5	(29.4)
Ninth	1	(5.9)
Tenth	2	(11.8)

UABC = Universidad Autónoma de Baja California.
UACJ = Universidad Autónoma Ciudad Juárez

Measurements

Depression Scale of the Center for Epidemiological Studies (CES-D). This instrument served as the primary outcome; it assesses the number of depression symptoms within 2 weeks. It consists of 20 items and contains 4-point score

responses (0 to 3) as the following: rarely or none of the time (less than 1 day); some or a little of the time (1-2 days); occasionally or a moderate amount of time (3-4 days) and most or all of the time (5-7 days). The total possible range of scores is from 0 to 60 where > 16 is the cut-off point, and higher scores indicate higher depression symptoms (Carleton et al., 2013). The CES-D has been validated and widely used in epidemiological studies, and has shown good reliability in a sample of Mexican university students (Cronbach´s α = 0,83) (González-Forteza et al., 2011).

Depression Anxiety and Stress Scale (DASS-21). This instrument evaluates the subscales of depression, anxiety and stress within the past week. Each subscale contains seven items with responses rated on a 4-point scale (0-3); 0 Did not apply to me at all; 1 Applied to me to a considerable degree, or some of the time; 2 Applied to me to a considerable degree or a good part of time; 3 Applied to me very much or most of the time (Lovibond & Lovibond, 1995). Each subscale has a cut-off scores for each severity condition (normal, moderate, severe), the cut-off score for moderate levels of depression is 7-10, 5-7 for moderate anxiety and 10-12 for moderate stress, the cut-off for severe levels of depression is 11-13, 8-9 for anxiety 13-16 for stress; for extremely severe levels of depression the cut-off is 14, 10 for anxiety and 17 or more for stress indicating that any score above is considerate as severe or extremely severe. This scale has been evaluated in two studies in Hispanic population obtaining high reliability (Cronbach´s α = 0.96 and 0.93) (Daza, et al., 2002; Ruiz, et al., 2017). For the purposes of this study, only depression and anxiety subscales where assessed.

Pittsburgh Sleep Quality Index (PSQI). It is composed of 19 self-applied items and 5 items evaluated by the couple or roommate (if this person is available), but only the self-applied items are included in the score. This instrument evaluates sleep pattern quality, it differentiates the "poor" and "good" sleep by measuring seven subcategories: subject sleep quality, sleep latency, sleep duration, habitual sleep efficiency, sleep disturbance, use of sleep medication, daytime dysfunction, where the range score of answers is from 0 to 3, where 0 is no difficulty in this area and 3 indicates a severe difficulty. The global sum of this scale can be a value between 0 to 21. If the total score of 0 this indicates the absence of sleeping difficulties, and 21 a severe difficulty (Buysse et al.,1989). The evaluation in Mexican population has shown solid reliability criteria (Cronbach´s α = 0.78), making it a scale capable of assessing sleep quality (Jiménez-Genchi et al., 2008).

The Plutchik Suicide Risk Scale. In this scale the history of suicide attempts, hopelessness, ideations and suicide plans are taken into account. This Self-applied instrument contains 15 items that evaluate previous suicide attempts, intensity of

current suicidal ideation, feelings of depression, hopelessness and other factors related to the attempts (Plutchik & Van Praag, 1994). Each item is dichotomous with yes or no answers. A cut-off point of 6 has been reported to indicate a substantial suicide risk This instrument has been validated in the young Mexican population with adequate reliability (Cronbach´s alphas = .74) (Santana-Campas & Telles, 2018).

Procedure

Once the sample was obtained, through the online survey and the interview, The BATD was implemented by 5 clinical psychologists who received 20 hours of training plus weekly supervision to apply BATD, the therapy was conducted in each city and it consisted in 10 structured sessions proposed by Maero & Quintero (2016) (summary of sessions included in Table 2. The participants were at pre and post treatment to determine the effectiveness of BADT. The intervention was conducted from August to December 2019.

Table 2. *Behavioral activation sessions proposed by Maero and Quintero (2016)*

Session	Content
1	Psychoeducation on depression and its treatment, introduction of daily monitoring, and task assignment.
2	Task review, evaluation of model comprehension, presentation of the vital areas, values and activities form, and task assignment.
3	Task review, introduction of activity selection form and hierarchy, and task assignment.
4	Task review, introduction to activity planning, and task assignment.
5	Task review, introduction of agreements, and task assignment.
6 to 9	Task review, review of material covered throughout sessions, and task assignment.
10	Daily monitoring with activity planning. Treatment completion.
Behavioral activation sessions planned for 10 sessions.	

The BATD training program was conducted by a Ph.D. in clinical psychology specializing in care, intervention, and training related to the mental health of children and adolescents. The training sessions lasted one month, with two weekly sessions of two hours each. The format was conducted via videoconference, and supervision sessions were held once the treatment began to ensure adherence to the BATD model and provide support in resolving any doubts or difficulties in cases where it was necessary.

Statistical analyses

To achieve the objectives of this study, descriptive analyses of the sample were conducted to provide an overview of baseline characteristics. Pearson's Correlations were performed to examine associations between the symptoms at baseline, establishing the foundational relationships within the data (objective 1). To define the whether Student's t or Wilcoxon ranges would be used, which are the ideal analyzes to compare related pre- and post-treatment samples a normality analysis was performed (objective 2), since the assumption of normality for conducting parametric analyses was inconclusive for all variables, paired Student´s t-test were performed with a significance level of α = 0.05, considering the robustness of the test, which allows its application despite small sample sizes with a non-normal distribution. In addition to statistical significance, the effect size was analyzed using Cohen's *d* coefficient, a critical statistic for measuring the practical impact of treatment interventions (Lakens, 2013). Effects sizes were interpreted as follows: values of *d* less than .20 indicate no effect, between .21 and .49 indicate a small effect, between .50 and .70 a moderate effect, and values grater than .80 correspond to a large effect (Cohen, 1990). The inclusion of effect size is essential for contextualizing the magnitude of the treatment's impact, complementing *p* values, and providing deeper insights into the clinical relevance of BATD.All analyses were conducted using the IBM Statistical Package for the Social Sciences v.23 (IBM corporation, 2015).

Ethical considerations

All procedures in this study were carried out according to the Declaration of Helsinki and has been reviewed by the bioethics department of the Faculty of Medicine and Psychology of the Autonomous University of Baja California. An informed consent to participate in the study was presented and explained, in which the rights of the participants were mentioned, including the guarantee of confidentiality and anonymity. This form also explained that if, during the interview or treatment, it was deemed that participant's life or someone else´s life was at risk, or if a serious mental health issue was detected, the faculty of medicine would be notified, and the participant would be referred to the university's psychological care department.

In addition to the mention that the data collected would be used exclusively for scientific purposes, participants were assured of their confidentiality. For data analysis tasks, an identifying number was used to protect the identity and information of each participant. The therapists had constant supervision, which

helped as prevention in case emergencies or complex situations arose in the treatments.

Results

Correlations

To analyze the relationship between symptoms of depression, anxiety, sleep quality and suicidal risk, a Pearson correlation was performed (objective 1). In the correlation analyses all participants assessed at the beginning of this study were included (n = 290). The correlated variables at a significance level of 0.01 (2-tailed) were the following: CES-D and DASS21-Depression (*r* = .819), CES-D and Suicide Risk (*r* = .756), DASS21-Anxiety y Suicide Risk (*r* = .584); CES-D y PSQI (*r* = .60); DASS21-Anxiety and PSQI (*r* = .523), Suicide Risk and PSQI (*r* = .60), CES-D and DASS21-D (*r* = .819), DASS-Depression and PSQI (*r* = .511), DASS21-Depression and Suicide Risk (*r* = .719), and DASS21-Depression and DASS21-Anxiety (*r* = .656). The results of the correlation test can be observed on **Table 3.**

Table 3. *Results of correlations* (n=*290*)

Measure	DASS-21 Anxiety	DASS-21 Depression	CES-D	PSRS	PSQI
DASS-21 A.	-	-	-	-	-
DASS-21 D.	.656**	-	-	-	-
CES-D	.693**	.819**	-	-	-
PSRS	.584**	.719**	.756**	-	-
PSQI	.523**	.511**	.600**	.600**	-

** Correlation is significant at the 0.01 level (2-tailed)
* Correlation is significant at the 0.05 level (2-tailed)
DASS-21= Depression Anxiety and Stress Scale. CES-D=Depression Scale of the Center for Epidemiological Studies. PSRS=The Plutchik Suicide Risk Scale. PSQI=Pittsburgh Sleep Quality Index.

Pre post treatment comparisons

To analyze the effectiveness of BATD before and after treatment on symptoms of depression, anxiety, sleep quality and suicidal risk, a Student's t test was performed (objective 2). Changes in CES-D showed significant decrease $t(16) = 8.20$, $p <. 001$. These decreases were also observed on depression and anxiety subscales of DASS-2, $t(16) = 6.47$, $p < .001$ and $t(16) = 5.49$, $p <.001$; Sleep Quality $t(16) = 3.67$, $p <.05$ and suicidal risk, $t(16) = 3.08$, $p <.002$. The effect sizes ranged from 0.74 for Suicidal Risk to 1.98 for CES-D. Graphs of the paired t-test and the Cohen´s *d* effect sizes index is shown in **figure 1**. With the Wilcoxon rank test,

significant differences were found in the same way as with Student´s t, depressive symptoms decreased (z = 3.52, p <.001), the Plutchik suicide risk scale score (z = 2.46, p < 05), the DASS evaluations in both anxious (z = 3.511, p < .001) and depressive symptoms (z = 3.47, p <.01) and sleep quality (z = 2.76, p < 0.01).

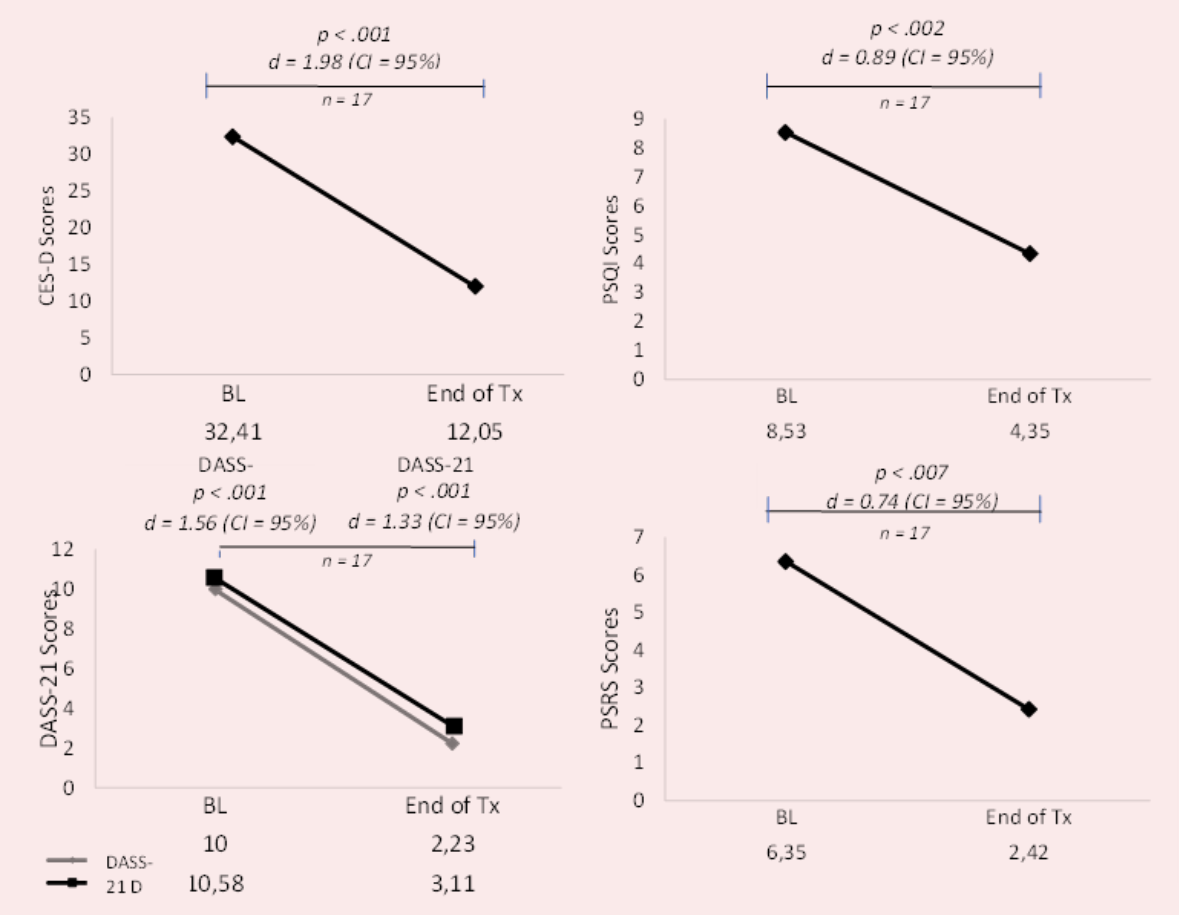

Figure 1. *Depression, anxiety, sleep quality and suicide risk measures at baseline and at the end of treatment*

Discussion

The aims of this study were 1) to analyze the relationship between symptoms of depression, anxiety, sleep quality and suicide risk, and 2) to assess the effects of BATD in a sample of medical students from two public universities in Mexico with clinical symptoms of depression. The results obtained allow us to confirm some previous approaches about depression, and in turn provide evidence of the potential of BATD to address depressive symptoms.

First, the association between the variables was significant and of moderate to large magnitudes, reflecting evidence of comorbidity of depressive symptoms (Meng & Wang, 2023; Sánchez-Hernández et al., 2023). Therefore, it is viable to address techniques focused on depression, which in turn can generate changes in other psychopathology conditions. It has previously been explored how BATD contributes to the reduction of stress and anhedonia, even though the effect sizes have been smaller than transdiagnostic behavior therapy (TBT) (Gros & Coyne, 2022).

Regarding the second objective, the results indicated that after receiving 10 BATD sessions significant statistical changes was achieved (p = <.001), in depression, anxiety and sleep quality. The size effects ranged from 0.74 (middle) to 1.98, which would be considered huge according to the classification of Sawilowsky (2009), suggesting that the treatment was effective in most of the participants and therefore fulfilling the effectiveness in this sample. At the end of treatment only 2 participants continued endorsing elevated depressive symptomatology based on the cut-off for CES-D (> 16). These decreases were observed in the DASS-21 Depression and Anxiety Subscales, where only 2 participants met the cut-off for depression, and great percentage of participants with anxiety decreased from 14 to 5 (64%) at the post treatment measures; similar changes occurred in sleep quality from 14 to 5, and suicide risk from 13 to 6.

These results are consistent with previous pilot studies in vulnerable groups, in adolescents, (Ritschel et al., 2011, 2016) and university settings (Gawrysiak et al., 2019), in which symptoms of depressive disorder have been reduced by 90%, even with a version of BATD of a single session (Tull et al., 2018). It also agrees with evidence of the effects of BATD on other mental health symptoms (Chu et al., 2009). The explanation of these reductions can be inferred from correlation results and the previous studies that shows comorbidity of depression with other mental health problems such anxiety and sleep disorders (Jacobson & Newman, 2017: Oh et al., 2019). Of the participants in the treatment (n =17), 8 were in the final stage of their training, which shows that this stage involves a higher workload that is associated with deteriorated mental health, which is consistent with the findings of Romo-Nava et al., (2019)

The results of this study indicate the BATD model significantly contributes to reducing symptoms of depression, anxiety, sleep problems, and suicidal risk in medical students. This can be explained through the theorical foundations of BATD, which focus in increasing behavioral activation to enhance contact with positive reinforcements in the patient's environment. This approach is rooted in the

behavioral theory of depression proposed by Fester (1973), which posits that reduced contact with sources of positive reinforcement in the environment contributes to the maintenance of depression. BATD promotes activities that enhance feelings of mastery and pleasure, which, in the context of medical students, might relate to achieving a more balanced engagement in academic and personal activities.

The positive impact of BATD observed in this study aligns with previous findings demonstrating the effectiveness of this therapy in various context and populations. For instance, studies such as those by Ekers et al. (2014) and Gawrysiak et al. (2019) have shown that BATD is not only effective in reducing depressive symptoms but also in improving comorbid conditions like anxiety and sleep quality. This highlights the potential of BATD as an integrated intervention, particularly for populations facing significant academic and emotional demands, such as medical students.

Despite the stigma about mental health in physicians and little interest in their own mental health (Center et al., 2003), the percentages of participation and completion of treatment shows the need for treatments to meet their mental health needs. There were 290 medical students who participated in pre assessments, 21 participants who started treatment, and 17 participants did complete the 10 sessions of BATD. Nevertheless, low attrition was found, four participants failed to complete the treatment, three due time constraints and one due to the absence of expected results, even though similar participation rates were observed in similar studies (Ritschel et al., 2016; Chu et al., 2009). Due to the fact that BATD was implemented within university spaces for psychological care, it may have facilitated adherence to treatment.

Medical training is widely recognized for its demanding nature,, characterized by high levels of stress, academic pressure, but also a high demand for time, which could lead to a disconnection from activities that generate pleasure or well-being, Hence, BATD can be considered a valuable alternative for this population. Future research could consider the use of time dedicated to study, academic and personal interest activities as an analysis variable to better understand the risks faced by medical students due to the demands inherent in their studies.

In light of these preliminary results, the BATD may be useful as a feasible alternative for addressing existing mental health problems in medical students and mitigate future consequences that could affect the performance in real settings or may even lead to academic dropout (Dyrbye et al. al, 2006). Additionally, this study

supports the development of evidence-based therapies within the Latin American context (Echeburúa et al, 2010).

Although this study showed a significant decrease in all outcome variables, due to the size of the sample and the design characteristics, is possible that the results are due to a variety of conditions such as regression to the mean, and the administration of repeated measures, which makes these results non-generalizable.

Limitations and future directions

The most relevant limitations are due to design since in this study no other treatment or control group were included to compare the effects of BATD, which could also be possible by performing an RTC which would provide clarity of the effectiveness of this intervention. Also, a single case designs in which assessments are applied session by session could help to understand the fundamental elements of BATD in reducing depression. Furthermore, measurements using objective devices such as smart watches that record sleep patterns could be useful to study BATD effectiveness (Shelgikar et al., 2016). In order to observe the benefits of BATD, future research should include measures of functional impairment, which would help to observe how the results of BATD are reflected in performance in important contexts and not only on symptomatology. The variable which obtained the least effect was the suicide risk score, even though the instrument includes items that are not susceptible to change with treatment, such as questions about experiences that increase suicide risk. For example, one of the questions asks, "Do you know if someone in your family has attempted suicide?" It would be useful for future research to involve other types of measurements.

Lastly, taking into account that this was a pilot study with a reduced sample of 17 participants, and a disproportion of the gender, being 5 males and 12 females, where follow-ups couldn´t be completed due the global pandemic restrictions caused by the COVID-19, the results of this study need to be considered with caution.

Conclusions

1. In conclusion, based on the positive effects of BATD, we consider that this intervention may be an option to be implemented in medical students due to the acceptability, adherence and improvements in mental health that users may experience.

2. Further studies of BATD with medical students using other designs need to be conducted to gain new insights about his effectiveness, as well as use control groups.

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