Heliyon 6 (2020) e04178

Contents lists available at ScienceDirect

Heliyon

journal homepage: www.cell.com/heliyon

Research article

Depression in Mexican medical students: A path model analysis

Susana Castaños-Cervantes *, Alejandro Domínguez-González

Research Department, La Salle University, Benjamín Franklin 45, Col. Condesa, Alcaldia Cuauhtemoc, 06140, Mexico City, Mexico

ARTICLE INFO

Keywords:
Psychology
Depression
Medical student
Anxiety
Emotion regulation
Coping Skill

ABSTRACT

Background: Depression is a mental health disorder present in medical students that foster cumulative disadvantages throughout life and that may compromise patient care. Yet, in Mexico there is a dearth of research concerning prediction models for depression in this population.

Methods: The aim of this cross-sectional study was to develop and test a path model analysis of depression in 103 freshmen Mexican medical students ages 18–23 years old selected non-randomly. Anxiety, emotion dysregulation, and coping skills were used as factors influencing depression. Mexican self-report scales were used as assessment measures.

Results: Main results showed that anxiety and emotion dysregulation had a significant direct influence on depression. Emotion dysregulation had a significant direct effect on coping skills and anxiety, while anxiety had a significant direct effect on problem drinking and alcohol problems. Fit indexes obtained indicate an excellent adjustment to data. R square indicates that 53.7% of the variance in depression can be explained by this model.

Limitations: The results are exploratory rather than confirmatory. The sample size was not large enough and the research focused on only Mexican freshmen medical students. Other factors associated to depression in medical students were not considered.

Conclusions: The current research provides unique findings in terms of a model of depression in Mexican medical students through which it is possible to design and implement interventions that decrease depression, thus positively affecting their well-being, their future careers as medical doctors and their abilities to serve the society adequately, especially in the context of Latin American cities.

1. Introduction

Depression is a common illness that leads to substantial impairments in an individual's daily functionality. It affects more than 300 million people worldwide (World Health Organization [WHO], 2018). In a meta-analysis conducted by Lim et al. (2018) it was identified that the aggregate point prevalence, one-year, and lifetime prevalence of depression were of 12.9%, 7.2%, and 10.8%, respectively from 1994 to 2014, and that the heterogeneity in prevalence was high. In Mexico, depression is one of the most prevalent mental disorders and the first cause of disability (Secretaría de Salud de la Ciudad de México, 2019).

Mexican medical students have to complete between 4-5 years plus two years of internship and social service practical training to obtain a medical degree. Upon the completion of these requirements and after having been certified by the educational institution, the Secretary of Education issues a medical license to authorize medical school graduates to practice general medicine. Afterwards, Mexican doctors complete an additional 4–7 years of specialization. These requirements to become a fully licensed medical professional are similar in many other countries. Consequently, worldwide, medical schools can result in high levels of stress that increase the probability of presenting anxiety and depression (Hill et al., 2018), which are the most prevalent comorbid mental health problems present in medical undergraduates (Kebede et al., 2019) as compared to their age-matched nonmedical colleagues (Yussoff, 2011). Globally, the prevalence of depression amongst medical scholars has been of 28% (Puthran et al., 2016). It has been of 26% in Central and North America and of 27.7% in South America (Tam et al., 2019). In Mexico, prevalence of depression in medical undergraduates commonly is of 20.2% with 16.2% presenting major depressive disorder (Romo et al., 2019).

Depression and anxiety are linked with various psychosocial factors such as emotion regulation, coping skills, and alcohol problems.

Several studies carried out with diverse populations (Uhl et al., 2019) including college students (Chiu et al., 2019) have highlighted the role of emotion regulation as a risk or protective factor against anxiety and depression. Maladaptive emotion regulation strategies (*e.g.*, denial,

* Corresponding author.
E-mail address: susana.castanos@lasalle.mx (S. Castaños-Cervantes).

https://doi.org/10.1016/j.heliyon.2020.e04178
Received 23 March 2020; Received in revised form 6 May 2020; Accepted 5 June 2020
2405-8440/© 2020 The Authors. Published by Elsevier Ltd. This is an open access article under the CC BY-NC-ND license (http://creativecommons.org/licenses/by-nc-nd/4.0/).

avoidance, suppression, and rumination) are related to an increase in symptoms of depression and anxiety (Everaert and Joormann, 2019), and adaptive emotion regulation strategies (*e.g.,* cognitive reappraisal, problem solving, and acceptance) to the presence of less anxiety and/or depression (Naumann et al., 2016).

Concerning coping skills, previous research has demonstrated that in medical students, adaptive coping skills (*e.g.,* reflection, problem-solving, task-focus, self-control, positive reappraisal) were found to be health-promoting coping styles predicting a low level of depression and anxiety, while dysfunctional coping styles (*e.g.,* suppressive and reactive coping) increased the degree of depression and anxiety (Akhtar et al., 2019).

Furthermore, maladaptive coping styles are associated with emotion dysregulation, while functional coping strategies correlate with positive emotion regulation skills (Bamonti et al., 2019).

In addition, coping and emotion regulation profiles predict distinct patterns of substance use (Wong et al., 2013). Likewise, anxiety and depression favor the maintenance and relapse of alcohol use disorders (Ribadier and Varescon, 2019). In medical students, as a means of coping with anxiety, depression, and stress, research has indicated the use of psychoactive substances such as alcohol and nicotine cigarettes (Coker et al., 2018), which are counterproductive and may aggravate experienced psychological distress (van Zyl et al., 2017).

Therefore, anxiety and depression tend to increase with emotion dysregulation, and maladaptive coping styles. Problem drinking and alcohol problems are more common when individuals suffer from anxiety and/or depression, as a means of maladaptive coping, and when a person lacks the ability to regulate emotions. In medical students, all of these psychosocial factors lead to problems later in professional life, including lower academic performance, reduced self-esteem, substance and alcohol abuse, attempted suicide and suicide (Mackenzie et al., 2011), and disability and poor quality of life (Yusoff et al., 2013).

If medical students' depression is not given early attention by management of medical schools and policy makers, their future careers as medical doctors and their abilities to serve society adequately (Benbassat et al., 2011) will be compromised.

This cross-sectional preliminary study was carried out to develop and test a path model of depression in a group of Mexican medical students to explore psychosocial factors in shaping depression and plausible pathways that may explain its effects. Relationships between depression, anxiety, coping skills, problem drinking and alcohol problems and emotion dysregulation, were explored. These factors were chosen due to empirical evidence obtained in prior research with medical students as previously mentioned, and because of the influence they have in determining their well-being, mental health, academic achievement, and professional practice. Other environmental, curricular, learning and health-related factors were not included since previous studies have examined these factors in medical undergraduates. For example, research with Mexican medical students and depression have focused on resilience, sleep quality, and morningness (Tafoya et al., 2019), emotion abuse outside school, suicide attempt, and perceived academic stress (Romo et al., 2016), a family history of depression (Romo et al., 2019); and stress and a low socioeconomic level (López et al., 2013). On the other hand, Latin American studies have focused on sleep quality, daytime sleepiness, educational environment, academic efficacy, burnout, body mass index, leisure-time physical activity, alcohol problems, stress, and anxiety, among other factors (Barahona et al., 2018; Pacheco et al., 2017; Solis and Lotufo, 2019).

Therefore, this research adds to the body of growing literature on depression in medical students, particularly in the context of Latin American cities.

The path model tested is based in the following hypothesized model (Figure 1).

The first hypothesis was that dysfunctional emotion regulation and anxiety would be significant positive predictors of depression. The second hypothesis was that functional coping skills would be a significant negative predictor of depression, while dysfunctional coping skills would be a significant positive predictor of depression. The third hypothesis was that anxiety would be a significant positive predictor of depression in women. Lastly, it was predicted that anxiety and depression would be positively associated with problem drinking and alcohol problems.

This preliminary research serves to encourage the design and implementation of effective research-based programs and policies that can positively affect the psychological health of medical students particularly in Mexico. The Unified Model of Depression (Beck and Bredemeier, 2016) served as the theoretical framework to analyze and explain depression in medical students from an integrated perspective in which depression is seen as an adaptation to conserve energy after the perceived loss of an investment in a vital resource such as a relationship, group identity, or personal asset.

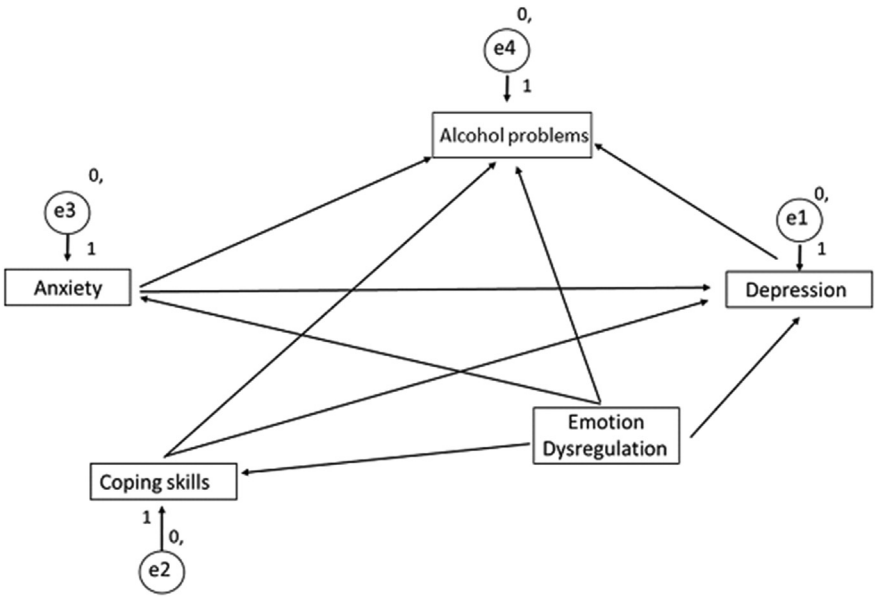

Figure 1. Hypothesized version of the Path Model Analysis of Depression in medical students with anxiety, alcohol problems, emotion dysregulation, and coping skills as psyshosocial correlates. It was hypothesized that anxiety is positively associated with depression and problem drinking and alcohol problems. Coping skills is negativity associated with anxiety, depression, and problem drinking and alcohol problems. Lastly emotion dysregulation is positively associated with anxiety, depression, and problem drinking and alcohol problems, and negatively associated with coping skills.

2. Methods

2.1. Participants

Participants included 103 freshmen (36 men and 67 women) ages 18–23 years old (*M*[*SD*] = 19.69[0.92]) pertaining to upper-middle classes and to households in which the head of the family has a professional degree and occupation. The study population included all of the first year medical students enrolled in the Faculty of Medicine of La Salle University Mexico. Thus, they were selected purposively. Participants who 1) did not reside within the selected university during the data collection period, 2) were not students from the first year of medical school (freshman); and 3) did not consent to participate in the study, were excluded. None refused to collaborate in this study.

2.2. Measures

Alphas reported in the following self-report measures were obtained from the current sample.

Beck's Depression Inventory: Adapted to Mexican population by Jurado et al. (1998). Self-report questionnaire of 21 items that assess symptoms of depression (α = 0.87). The cut point to establish the presence of severe depression is 10 in Mexican population.

Difficulties in Emotion Regulation Scale: Adapted to Mexican population by Marín et al. (2012). Self-report instrument of 24 items rated on a 4-point Likert scale from 1(Almost never) to 4 (Almost always) that assess the emotion dysregulation strategies of denial, suppression, avoidance, and rumination (α = 0.85).

Ways of Coping Questionnaire: Adapted to Mexican population by Alfaro (2001). Self-report instrument of 31 items rated on a 4-point Likert scale from 1 (Never) to 4 (Always) that assess the coping styles of positive re-appraisal, self-control, professional and social support (α = 0.93).

Zung's Self-Rating Anxiety Scale: Adapted to Mexican population by Hernández et al. (2008). Self-report instrument of 20 items that assess symptoms of anxiety (α = 0.77).

Cage's Questions for Alcohol Use: Adapted to Mexican population by Cremonte et al. (2010). It is a four item instrument that assesses problem drinking and alcohol problems (Test reliability estimate by Kuder-Richardson-20 index = 0.72). The cut point to establish the presence of problem drinking and alcohol problems is six in Mexican population.

2.3. Procedure

This cross-sectional preliminary study was reviewed and approved by the Institutional Review Board of La Salle University Mexico and of the Faculty of Medicine of La Salle University Mexico (approval numbers EDU-14-18 and SAL-21-19), who granted the permission to conduct this study and gave access to the population. This review serves as the Mexican equivalent to an American IRB Review. Informed consent was obtained after the aims of the study were discussed with the directors of the collaborating institution and the freshmen medical students. All participants in this study collaborated on a voluntary basis. Participants received information about the study's general objectives, use of data, and confidentiality agreement.

Self-report measures were given to participants after permission to use them was obtained from the Mexican researchers who developed the Mexican version of such scales. The research took place in collaborating institution's on-site auditorium to assure that participants answered the self-report questionnaires under the same conditions. While no time limit was established, participants took approximately 15–30 min to answer the complete set of self-report instruments. Researchers took care to answer participants' questions without biasing participation choice. Participants were empowered to refuse to answer any question or to discontinue study participation at any time.

2.4. Statistical analyses

Statistical analyses were conducted using SPSS version 25. These included: descriptive, and correlation analyses employing Pearson correlation.

To evaluate study hypotheses, path analysis was used. Path analysis is able to assess the fit of the full model as well as examine specific mediation models. The AMOS 21.0 statistical program was used to analyze the path model, obtain goodness-of-fit indices and maximum-likelihood estimates of model parameters. This method allows for simultaneous examination of multiple direct and indirect predicted paths and provides global indices of the fit between the theoretical model and the data. The following variables were included in the model: anxiety, emotion dysregulation, coping strategies, problem drinking and alcohol problems, and depression. In order to evaluate the model fit, Chi-square ($\chi 2$) and the root mean square error of approximation (RMSEA) were used as absolute fit indices; the comparative fit index (CFI), the relative fit index (RFI), the Tucker-Lewis index (TLI) and the normed fit index (NFI) were used as incremental fit indices in this study. A value of 0.95 or above for these indexes, of 0.06 or below for RMSEA, a χ^2 not significant ($p > 0.05$) and an adjusted $\chi 2$ by its degrees of freedom of 3 or below were regarded as a relative good model-data fit in general (Hu and Bentler, 1999; Kline, 2004).

To test differences according to gender, stepwise multiple linear regression analyses were carried out using the same explanatory models as in the path analysis. Standardized regression coefficients (β), which indicate the relative magnitude of prediction of each independent variable, and standard errors were computed from the results of the linear regression analyses.

For all of the analyses, p values reported were two tailed and statistical significance was set at $p < 0.05$.

3. Results

Results revealed that 96% of the participants presented lower levels of problem drinking and alcohol problems, anxiety, and of depression with except of four medical students (two males and two females) who exhibited severe depression as compared to previous meta-analysis studies with medical undergraduates, where the prevalence of problem drinking and alcohol problems was of 32.9% (Pacheco et al., 2017), of anxiety was of 33.8% (Quek et al., 2019), and of depression was between 27%-28% (Tam et al., 2019). Gender differences were non-significant as well as in coping and emotion dysregulation skills.

Regarding the path model analysis carried out, the final model had a good fit with a chi-square = 4.028 (df = 5, p = 0.545; adjusted $\chi 2$ by its df = 0.8056), RMSEA (90% CI) = 0.000 (LO = 0.000, HI = 0.123), p = 0.674, NFI = 0.973, RFI = 0.946, IFI = 1.007, TLI = 1.014, and a CFI = 1.000.

Figure 2 indicates that anxiety and dysfunctional emotion regulation strategies had a significant direct effect on depression (β = -0.273, p = 0.000 for anxiety, β = 0.548, p = 0.000 for dysfunctional emotion regulation). Anxiety had a significant direct effect on problem drinking and alcohol problems (β = 0.324, p = 0.000). Dysfunctional emotion regulation had a significant direct effect on anxiety (β = 0.542, p = 0.000) and coping skills (β = -0.409, p = 0.000), and an indirect effect on depression (β = 0.148, p = 0.000) and on problem drinking and alcohol problems (β = -0.176, p = 0.000) with anxiety as the mediating variable. R-square indicates that 53.7% of the variance in depression can be explained by this model.

Findings of the Pearson correlation (Table 1) indicated for both genders that there was a significant positive association between depression, anxiety and emotion dysregulation. Moreover, anxiety negatively correlated with coping skills, and positively with dysfunctional emotion regulation.

In addition, with regard to female participants, coping skills were negatively associated with depression and with emotion dysregulation.

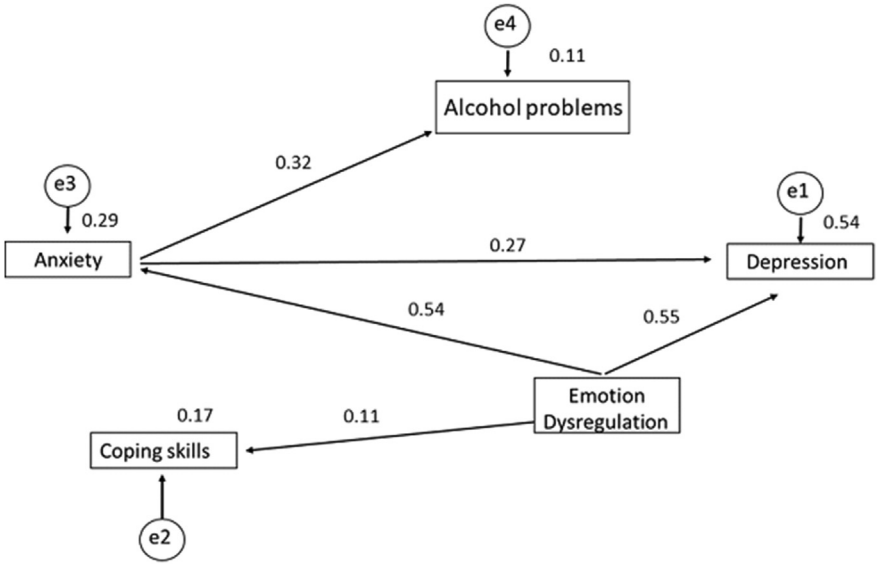

Figure 2. Final version of the path model analysis of depression in medical students. Anxiety had a direct effect on depression, problem drinking and alcohol problems. Emotion dysregulation had a direct effect on depression, anxiety and coping skills. Standardized regression weights are shown. p< 0.01.

Anxiety correlated positively with problem drinking and alcohol problems.

With respect to emotion dysregulation strategies and coping skills, in male medical students significant r values were obtained only between depression and the emotion dysregulation strategies of denial ($r = 0.574$, $p < 0.001$), suppression ($r = 0.514$, $p < 0.001$), avoidance ($r = 0.514$, $p = 0.002$) and rumination ($r = 0.712$, $p < 0.001$); and between anxiety and the coping strategy of self-control ($r = -0.540$, $p < 0.001$).

Concerning females, anxiety and depression were positively linked with emotion dysregulation strategies. Anxiety was positively associated with denial ($r = 0.711$, $p < 0.001$), suppression ($r = 0.541$, $p < 0.001$), avoidance ($r = 0.403$, $p < 0.001$) and rumination ($r = 0.564$, $p < 0.001$); as well as depression, $r = 0.513$, $p < 0.001$ for denial, $r = 0.503$, $p < 0.001$ for suppression, $r = 0.484$, $p < 0.001$ for avoidance, and $r = 0.574$, $p < 0.001$ for rumination. Finally, anxiety negatively correlated with these coping skills: positive reappraisal ($r = -0.347$, $p = 0.004$) and self-control ($r = -0.261$, $p = 0.033$). Depression also negatively correlated with positive reappraisal ($r = -0.367$, $p = 0.002$) and self-control ($r = -0.289$, $p = 0.018$).

To examine differences by gender when predicting depression, stepwise multiple regression analyses were carried out (Table 2).

Regarding male medical students, findings indicated that dysfunctional emotion regulation explained 50.9% of the variance, $F_{(1,34)} = 37.222$, $p < 0.001$.

With respect to female medical students, results showed that dysfunctional emotion regulation and anxiety explained 54% of the variance, $F_{(1,64)} = 39.723$, $p < 0.001$.

Individual predictors were examined further and revealed for both genders that all of them significantly predicted depression (Table 3).

Table 1. Correlation analyses of study variables by gender (N = 103).

Male medical students (n = 36)							
	1	2	3	4	5	*M*	*SD*
Depression		0.106	0.422*	0.723**	-0.243	3.9167	3.07409
Problem drinking and Alcohol Problems			0.316	0.261	0.046	0.2778	0.51331
Anxiety				0.358*	-0.362*	13.0000	5.11021
Dysfunctional Emotion Regulation					-0.214	11.6667	9.89949
Coping Skills						87.2500	10.31054
Tolerance (Factors with Depression)		0.932	0.872	1.000	0.954		
VIF (Factors with Depression)		1.073	1.147	1.000	1.000		
Female medical students (n = 67)							
Depression		0.115	0.637*	0.704**	-0.291	2.5373	3.00166
Problem drinking and Alcohol Problems			0.311*	0.187	-0.0144	0.1343	0.48914
Anxiety				0.643**	-0.309*	11.6716	5.07933
Dysfunctional Emotion Regulation					-0.504**	11.4776	10.20451
Coping Skills						86.5821	11.05927
Tolerance (Factors with Depression)		0.965	0.587	1.000	0.746		
VIF (Factors with Depression)		1.036	1.704	1.000	1.340		

Note. Correlations between depression and anxiety, dysfunctional emotion regulation, coping skills, and problem drinking and alcohol problems are presented separately by gender. Tolerance and VIF values are included horizontally as indication of non-existence of multicollinearity between factors. Means and standard deviations of study variables are depicted vertically.

*p < 0.05.

**p < 0.01.

Table 2. Summary of stepwise multiple regression analyses models used to predict depression by gender (N=103).

Male medical students (n = 36)									
Model	R	R Square	Adjusted R Square	Std. Error of the Estimate	Change Statistics				
					R Square Change	F Change	df1	df2	Sig. F Change
1	0.723[a]	0.523	0.509	2.15497	0.523	37.222	1	34	0.000**
Female medical students (n = 67)									
1	0.704[b]	0.496	0.488	2.14723	0.496	63.976	1	65	0.000**
2	0.744[c]	0.554	0.540	2.03606	0.058	8.292	1	64	0.005**

Note.
a. Predictors of Depression in Male Medical Students: (Constant), Dysfunctional Emotion Regulation.
b. Predictors of Depression in Female Medical Students (First Model): (Constant), Dysfunctional Emotion Regulation [$F_{(1,65)} = 63.976$, $p < 0.001$].
c. Predictors of Depression in Female Medical Students (Final Model): (Constant), Dysfunctional Emotion Regulation, Anxiety.
**$p < 0.01$.

In the case of female medical students, emotion dysregulation had the highest β value, followed by anxiety.

To summarize, emotion dysregulation seems to be a crucial factor associated to depression in this group of Mexican medical students.

4. Discussion and conclusions

This study is among the first ones in Mexico carried out to develop and test a path model of depression in a group of medical students to explore psychosocial factors such as anxiety, coping skills, problem drinking and alcohol problems, and emotion dysregulation, in shaping depression and plausible pathways that may explain its effect.

Results of this research revealed that participants presented lower levels of problem drinking and alcohol problems, anxiety and depression. These may be explained because such difficulties are more common towards the end of medical school since the load of both paraclinical and clinical subjects is higher as compared to first years (Shawaz et al., 2015). Jiménez et al. (2015) observed that first year Mexican medical students reported lower levels of depression (3.7%), anxiety (38%) and suicide risk (1.9%). Lastly, Puig et al. (2011) reported that problem drinking and alcohol problems among Mexican medical students, was low.

The path model analysis indicated that emotion dysregulation was a significant positive predictor of depression, thus supporting the first hypothesis. These findings were also confirmed with the multiple regression analyses carried out and with results obtained with Pearson's correlation. Emotion dysregulation plays a key role in the pathogenesis and maintenance of a variety of mental disorders such as anxiety and depression (Sheppes et al., 2015). Higher levels of maladaptive emotion regulation strategies and lower levels of adaptive emotion regulation strategies are associated with higher levels of depression (Van Beveren et al., 2016). Confirming this effect, meta-analytic data has suggested that disrupted self-reported emotion regulation abilities predict subsequent diagnosis of anxiety or depression (Schäfer et al., 2017). Furthermore, Campbell-Sills and Barlow (2007) found that emotion regulation was a significant factor that not only increased the risk for the development of depression, but also manifested after the recovery from depression, and increased the risk for depression relapse.

These outcomes may also be explained with the Unified Model of Depression (Beck and Bredemeier, 2016) that states that tendencies to process information negatively that lead to depression are mediated by processes such as cognition and emotion regulation.

Findings obtained with the path model analysis and with multiple regression analyses did not confirm the second hypothesis. As such, coping skills were not a significant neither negative nor positive predictor of depression. This may be explained because first year medical students are going through late adolescence in which emotion regulation is a key factor for future psychopathology. Consequently, coping skills may play a secondary role in the development of anxiety and depression. Disruptions to emotion regulation capacities in adulthood are central to theories of how anxiety and depressive disorders manifest and are maintained (Hofmann et al., 2012). University studies take place at a key stage of the emotional development of an individual during the transition between late adolescence and early adulthood (Arnett, 2000). It is well-established that stressors, such as those associated with studying medicine, are substantial risk factors for future psychopathology (Kessler et al., 2010). There is also evidence suggesting that the capacity to regulate emotional reactions to these stressors may play a mediating role (Coates and Messman-Moore, 2014). Given increased independence and novel demands during adolescence relative to childhood, adolescents may have a particular need to regulate their emotions in response to stressors. Failure to do so may confer risk for mental health problems. Accordingly, emotion regulation may be one important piece of a complex puzzle in terms of risk for anxiety and depression.

Outcomes obtained with multiple regression analyses supported the third hypothesis. These results concur with previous research with Mexican medical students in which anxiety and depression symptoms

Table 3. Coefficients of the stepwise multiple regression models used to predict depression by gender (N = 103).

Male medical students (n = 36)										
Model		Unstandardized Coefficients		Standardized Coefficients	*t*	p	95.0% Confidence Interval for β		Correlations		
		B	*Std. Error*	β			Lower Bound	Upper Bound	Zero-order	Partial	Part
1	(Constant)	1.298	0.560		2.318	0.027	0.160	2.435			
	Dysfunctional Emotion Regulation	0.224	0.037	0.723	6.101	0.000**	0.150	0.299	0.723	0.723	0.723
Female medical students (n = 67)											
2	(Constant)	-1.324	0.638		-2.076	0.042	-2.598	-0.050			
	Dysfunctional Emotion Regulation	0.148	0.032	0.503	4.612	0.000**	0.084	0.212	0.704	0.499	0.385
	Anxiety	0.185	0.064	0.314	2.880	0.005**	0.057	0.314	0.637	0.339	0.240

Note. Standardized and unstandardized coefficients of predictors of depression and its associated t values and correlations are presented separately by gender.
*$p < 0.05$, **$p < 0.01$.

were more frequent in women, and anxiety was a predictor of depression (López et al., 2013). Anxiety commonly precedes depression (Frank--Briggs and Alikor, 2010) because anxiety can substantially increase stress and interfere with daily functioning, thus, leading to depression (Kendall, 2012). The fact that anxiety was a significant predictor of depression in women and not in men may be explained due to cultural factors. Ideals of masculinity often discourage men from awareness and expression of psychic pain and admission of weaknesses and vulnerabilities (Falicov, 2003). On the contrary, women are expected to be fragile, submissive, emotional and sensible. Therefore, it is socially desirable and accepted for them to express their fears and anxieties, making them more vulnerable and in need of protection, common situation in male-oriented societies (Mellon and Moutavelis, 2007).

According to the Unified Model of Depression, negative automatic thoughts associated with anxiety generate emotional symptoms and behavioral responses that lead to the development of negative beliefs about the self, world, and future. In turn, these beliefs accentuate the impact of the negative life experiences or stressors by shaping individual's appraisal of their meaning. Hence, depression is triggered. As such, these beliefs not only play a key role in the initiation of the depression program, but also can serve to maintain distorted appraisals (Beck and Bredemeier, 2016).

On the other hand, results obtained with Pearson's correlation indicated for both genders that anxiety negatively correlated with coping skills. Previous research has demonstrated that in medical students, adaptive coping skills were found to be health-promoting coping styles predicting a lower level of depression and anxiety (Akhtar et al., 2019).

In addition, with regard to female participants, coping skills were negatively associated with emotion dysregulation, thus coinciding with studies that have indicated that maladaptive coping styles are associated with emotion dysregulation, while functional coping strategies correlate with positive emotion regulation skills (Bamonti et al., 2019).

The fourth hypothesis was partially confirmed because only anxiety correlated positively with problem drinking and alcohol problems in female medical students. Women and girls are more prone to internalizing disorders which, in turn, increase the risk for problem drinking and alcohol problems (Dir et al., 2017). In addition to their vulnerability to anxiety, depression, and stress, females are even more likely to engage in binge drinking in response to such disorders (Bangasser and Valentino, 2014).

Concerning depression, some authors have found that in a Latin American population, problem drinking and alcohol problems and depression were not correlated and neither depression nor anxiety increased the probability of alcohol use (dos Santos et al., 2019). Thus, cultural factors may influence the effect that problem drinking and alcohol problems have on internalizing disorders such as depression.

In conclusion, emotion dysregulation and anxiety seem to be important risk factors for developing depression in Mexican medical students. Early and effective intervention programs targeting emotion regulation and anxiety may help prevent and diminish depression, thus promoting the well-being of medical students, and contributing to enhance the quality of their future careers as medical doctors and their abilities to serve the society adequately. Emotion Regulation Therapy (Mennin and Fresco, 2014), mindfulness interventions (Ludwig et al., 2015), and cognitive behavioral interventions (Melo et al., 2012), that include emotion regulation and coping skills as key therapeutic elements, should be provided from admission for medical students as effective intervention strategies to promote their mental health and well-being.

This study has some limitations that should be considered when interpreting findings obtained. The results are exploratory rather than confirmatory. The sample size was not large enough and the relative homogeneity of the sample (*i.e.,* first year medical students of one university) hinders the generabilizity of the outcomes achieved. Likewise, other factors associated to depression in medical students were not considered such as curricular and learning environmental factors, smoking, sleeping patterns, dietary habits, environmental, curricular, and learning factors, physical activities, obesity, menstruation, and family environment. Further research should also include these factors and a sample of medical students from varying years, universities, cultures and countries, especially in the context of Latin American cities to provide a clearer understanding of depression in this group. Nonetheless, this study examined depression and some of its psychosocial correlates, like emotion regulation and coping skills, for the first time in Mexican medical students. The results of this research are especially critical when developing effective interventions addressing psychosocial risk and protective factors in medical students and pave the way for future research involving the promotion of their mental well-being.

Declarations

Author contribution statement

S. Castaños-Cervantes: Conceived and designed the experiments; Performed the experiments; Analyzed and interpreted the data; Contributed reagents, materials, analysis tools or data; Wrote the paper.

A. Dominguez-Gonzalez: Conceived and designed the experiments; Performed the experiments; Wrote the paper.

Funding statement

This research did not receive any specific grant from funding agencies in the public, commercial, or not-for-profit sectors.

Competing interest statement

The authors declare no conflict of interest.

Additional information

No additional information is available for this paper.

References

Akhtar, M., Herwig, B., Faize, F., 2019. Depression and anxiety among international medical students in Germany: the predictive role of coping styles. J. Pakistan Med. Assoc. 69 (2), 230–234.

Alfaro, M., 2001. Estrategias de afrontamiento, personalidad y apoyo familiar con relación al estatus de seropositividad en hombres homosexuales [Coping strategies, personality and family support in relation to positive serostatus in homosexual men] (Doctoral Dissertation). Faculty of Psychology, National Autonomous University of Mexico, Mexico City, Mexico.

Arnett, J.J., 2000. Emerging adulthood. A theory of development from the late teens through the twenties. Am. Psychol. 55 (5), 469–480.

Bamonti, P., Conti, E., Cavanagh, C., Gerolimatos, L., Greeg, J., Goulet, C., Pifer, M., Edelstein, B., 2019. Coping, cognitive emotion regulation, and burnout in long-term care nursing staff: a preliminary study. J. Appl. Gerontol. 38 (1), 92–111.

Bangasser, D., Valentino, R., 2014. Sex differences in stress-related psychiatric disorders: neurobiological perspectives. Front. Neuroendocrinol. 35 (3), 303–319.

Barahona, J., Aristizabal, J., Lasalvia, P., Ruiz, Á., Hidalgo, P., 2018. Sleep disturbances, academic performance, depressive symptoms and substance use among medical students in Bogota, Colombia. Sleep Sci. 11 (4), 260–268.

Beck, A., Bredemeier, K., 2016. A unified model of depression: integrating clinical, cognitive, biological, and evolutionary perspectives. Clin. Psychol. Sci. 4 (4), 596–619.

Benbassat, J., Baumal, R., Chan, S., Nirel, N., 2011. Sources of distress during medical training and clinical practice: suggestions for reducing their impact. Med. Teach. 33, 486–490.

Campbell-Sills, L., Barlow, D., 2007. Incorporating emotion regulation into conceptualizations and treatments of anxiety and mood disorders. In: Gross, J. (Ed.), Handbook of Emotion Regulation. Guilford Press, New York, NY, US, pp. 542–559.

Chiu, H.T., Yee, L.T.S., Kwan, J.L.Y., Cheung, R.Y.M., How, W.K., 2019. Interactive association between negative emotion regulation and savoring is linked to anxiety symptoms among college students. J. Am. Coll. Health 1–8.

Coates, A., Messman-Moore, T., 2014. A structural model of mechanisms predicting depressive symptoms in women following childhood psychological maltreatment. Child Abuse Negl. 38, 103–113.

Coker, A., Coker, O., Sanni, D., 2018. Sociodemographic correlates and symptoms of depression, anxiety and stress among a sample of nigerian medical students. Niger J Basic Clin. Sci. 15, 58–62.

Cremonte, M., Ledesma, R., Cherpitel, C., Borges, G., 2010. Psychometric properties of alcohol screening tests in the emergency department in Argentina, Mexico and the United States. Addict. Behav. 35 (9), 818–825.
Dir, A., Bell, R., Adams, Z., Hulvershorn, L., 2017. Gender differences in risk factors for adolescent binge drinking and implications for intervention and prevention. Front. Psychiatr. 8, 289.
dos Santos, D., Nazário, F., Freitas, R., Henriques, V., de Paiva, I., 2019. Alcohol abuse and dependence among Brazilian medical students: association to sociodemographic variables, anxiety and depression. J. Subst. Use 24 (3), 285–292.
Everaert, J., Joormann, J., 2019. Emotion regulation difficulties related to depression and anxiety: a network approach to model relations among symptoms, positive reappraisal, and repetitive negative thinking. Clin. Psychol. Sci. Article in press.
Falicov, C., 2003. Culture, society and gender in depression. J. Fam. Ther. 25, 371–387.
Frank-Briggs, A., Alikor, A., 2010. Anxiety disorder amongst secondary school children in an urban city in Nigeria. Int. J. Biomed. Sci. 6 (3), 246–251.
Hernández, M., Macías, D., Calleja, N., Cerezo, S., del Valle, C., 2008. Psychometric properties of Zung's anxiety inventory with Mexicans. Psychologia. Avances de la disciplina 2 (2), 19–46. http://www.redalyc.org/articulo.oa?id=297225162009.
Hill, M., Goicochea, S., Merlo, L.J., 2018. In their own words: stressors facing medical students in the millennial generation. Med. Educ. Online 23 (1), 1530558.
Hofmann, S., Sawyer, A., Fang, A., Asnaani, A., 2012. Emotion dysregulation model of mood and anxiety disorders. Depress. Anxiety 29, 409–416.
Hu, L., Bentler, P., 1999. Cutoff criteria for fit indexes in covariance structure analysis: conventional criteria versus new alternatives. Struct. Equ. Model. 6, 1–55.
Jiménez, J., Arenas, J., Angeles, U., 2015. Depression, anxiety and suicide risk symptoms among medical residents over an academic year. Rev. Méd. Inst. Mex. Seguro Soc. 53 (1), 20–28.
Jurado, S., Villegas, M., Méndez, L., Rodríguez, F., Loperena, V., Varela, R., 1998. La estandarización del Inventario de Depresión de Beck para los residentes de la Ciudad de México [Standardization of Beck's Depression Inventory for residents of Mexico City]. Salud Ment. 21, 26–31.
Kebede, M., Anbessie, B., Ayano, G., 2019. Prevalence and predictors of depression and anxiety among medical students in Addis Ababa, Ethiopia. Int. J. Ment. Health Syst. 13, 30.
Kendall, P., 2012. Child and adolescent therapy. The Guildford Press, USA.
Kessler, R., McLaughlin, K., Green, J., Gruber, M., Sampson, N., Zaslavsky, A., Aguilar-Gaxiola, S., Alhamzawi, A., Alonso, J., Angermeyer, M., 2010. Childhood adversities and adult psychopathology in the WHOWorld mental health surveys. Br. J. Psychiatry 197, 378–385.
Kline, R., 2004. Principles and Practice of Structural Equation Modeling. Guildford, New York.
Lim, G., Tam, W., Lu, Y., Ho, C., Zhang, M., Ho, R.C., 2018. Prevalence of depression in the community from 30 countries between 1994 and 2014. Sci. Rep. 8 (1), 2861.
López, J., Martin, G., de León, S., Morelos, J., Pérez, V., Flores, M., 2013. Factors predicting depression among medical students. Gaceta Médica de México 149 (6), 598–604.
Ludwig, A.B., Burton, W., Weingarten, J., Milan, F., Myers, D.C., Kligler, B., 2015. Depression and stress amongst undergraduate medical students. BMC Med. Educ. 15, 141.
Mackenzie, S., Wiegel, J., Mundt, M., Brown, D., Saewyc, E., Heiligenstein, E., Harahan, B., Fleming, M., 2011. Depression and suicide ideation among students accessing campus health care. Am. J. Orthopsychiatry 81 (1), 101–107.
Marín, M., Robles, R., González, C., Andrade, P., 2012. Psychometric properties of the difficulties in emotion regulation scale for mexican youth. Salud Ment. 35, 521–526.
Mellon, R., Moutavelis, A., 2007. Structure, developmental course and correlates of children's anxiety disorder-related behavior in a Hellenic community sample. J. Anxiety Disord. 21, 1–21.
Melo, A., Van Oudenhove, L., López, A., 2012. Depressive symptoms among Mexican medical students: high prevalence and the effect of a group psychoeducation intervention. J. Affect. Disord. 136 (3), 1098–1103.
Mennin, D., Fresco, D., 2014. Emotion regulation therapy. In: Gross, J. (Ed.), Handbook of Emotion Regulation, second ed. Guilford Press, New York, NY, pp. 469–490.
Naumann, E., Holmes, E., Tuschen-Caffier, B., Samson, A., 2016. Emotion regulation strategies in depressive and anxiety symptoms in youth: a meta-analytic review. J. Youth Adolesc. 46 (2), 261–276.
Pacheco, J., Giacomin, H., Tam, W., Ribeiro, T., Arab, C., Bezerra, I., Pinasco, G., 2017. Mental health problems among medical students in Brazil: a systematic review and meta-analysis. Revista Brasileira de Psiquiatria 39 (4), 369–378.
Puig, A., Cortaza, L., Pillon, S., 2011. Alcohol use among Mexican medical students. Revista Latino-Americana de Enfermagem 19 (SPEC. ISSUE), 714–721.
Puthran, R., Zhang, M., Tam, W., Ho, R., 2016. Prevalence of depression amongst medical students: a meta-analysis. Med. Educ. 50 (4), 456–468.
Quek, T., Tam, W., Tran, B., Zhang, M., Zhang, Z., Ho, C., Ho, R., 2019. The global prevalence of anxiety among medical students: a meta-analysis. Int. J. Environ. Res. Publ. Health 16 (15).
Ribadier, A., Varescon, I., 2019. Anxiety and depression in alcohol use disorder individuals: the role of personality and coping strategies. Subst. Use Misuse 54 (9), 1475–1484.
Romo, N., Bobadilla, R., Tafoya, S., Guízar, D., Gutiérrez, J., Carriedo, P., Heinze, G., 2019. Major depressive disorder in Mexican medical students and associated factors: a focus on current and past abuse experiences. J. Affect. Disord. 245 (15), 834–840.
Romo, F., Tafoya, S., Gutiérrez, J., Osorio, Y., Carriedo, P., Ocampo, B., Bobadilla, R., Heinze, G., 2016. The association between chronotype and perceived academic stress to depression in medical students. Chronobiol. Int. 338 (10), 1359–1368.
Schäfer, J., Naumann, E., Homes, E., Tuschen-Caffier, B., Samson, A., 2017. Emotion regulation strategies in depressive and anxiety symptoms in youth: a meta-analytic review. J. Youth Adolesc. 46, 261–276.
Secretaría de Salud de la Ciudad de México, 2019. Salud Mental [Mental Health]. Retrieved from. http://data.salud.cdmx.gob.mx/portal/index.php/programas-y-acciones/309.
Shawaz, I., Sandhya, G., Venkatarao, E., 2015. Stress, anxiety & depression among medical undergraduate students & their socio-demographic correlates. Indian J. Med. Res. 141, 354–357.
Sheppes, G., Suri, G., Gross, J.J., 2015. Emotion regulation and psychopathology. Annu. Rev. Clin. Psychol. 11, 379–405.
Solis, A., Lotufo, F., 2019. Predictors of quality of life in Brazilian medical students: a systematic review and meta-analysis. Revista Brasileira de Psiquiatria 41 (6), 556–567.
Tafoya, S., Aldrete-Cortez, V., Ortiz, S., Fouilloux, C., Flores, F., Monterrosas, A., 2019. Resilience, sleep quality and morningness as mediators of vulnerability to depression in medical students with sleep pattern alterations. Chronobiol. Int. 36 (3), 381–391.
Tam, W., Lo, K., Pacheco, J., 2019. Prevalence of depressive symptoms among medical students: overview of systematic reviews. Med. Educ. 53 (4), 345–354.
Uhl, K., Halpern, L., Tam, C., Fox, J., Ryan, J., 2019. Relations of emotion regulation, negative and positive affect to anxiety and depression in middle childhood. J. Child Fam. Stud. 28 (2), 1–12. Article in press.
Van Beveren, M., McIntosh, K., Vandevivere, E., Wante, L., Vandeweghe, L., Van Durme, K., Vandewalle, J., Verbeken, S., Braet, C., 2016. Associations between temperament, emotion regulation, and depression in youth: the role of positive temperament. J. Child Fam. Stud. 25, 1954–1968.
van Zyl, P., Joubert, G., Bowen, E., du Plooy, F., Francis, C., Jadhunandan, S., Fredericks, F., Metz, L., 2017. Depression, anxiety, stress and substance use in medical students in a 5-year curriculum. Afr. J. Health Prof. Educ. 9 (2), 67–72.
Wong, C., Silva, K., Kecojevic, A., Schrager, S., Bloom, J., Iverson, E., Lankenau, S., 2013. Coping and emotion regulation profiles as predictors of nonmedical prescription drug and illicit drug use among high-risk young adults. Drug Alcohol Depend. 132 (1-2), 165–171.
World Health Organization, 2018. Depression. Retrieved from: https://www.who.int/news-room/fact-sheets/detail/depression.
Yusoff, M., 2011. Effects of a brief stress reduction intervention on medical students' depression, anxiety and stress levels during stressful period. Asian J Psychiatry 12, 71–84.
Yusoff, M., Abdul Rahim, A., Baba, A., Ismail, S., Mat Pa, M., Esa, A., 2013. Prevalence and associated factors of stress, anxiety and depression among prospective medical students. Asian J. Psychiatry 6, 128–133.