ORIGINAL ARTICLE

Latent class of depressive symptoms of and its determinants: A cross-sectional study among Iranian University students

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Background: According to the report of the World Health Organization, mental disorders are one of the 10 most important causes of disability in the world. This study was conducted with the aim of determining the number and frequency of latent classes of depression and its determinants in Isfahan university of medical students. **Materials and Methods:** A total of 1408 medical students from Isfahan University of Medical Sciences, Iran, were enrolled in the study in 2017. The symptoms and severity of depression were assessed using the standard Hospital Anxiety and Depression scale questionnaire. Latent class analysis was applied to seven symptoms of depression, all of which had four levels. Latent class subgroups were compared using the Chi-square test and analysis of variance test. The regression model was used to check the relationship between identified classes and related factors. Analyzes were done using SPSS-21 and Mplus7 software. **Results:** In this study, three latent classes were identified, that is, the group of healthy people, the group of borderline people, and the group of people suspected of depression. The prevalence of identified latent classes among medical students is 0.52, 0.32, and 0.16%, respectively. The regression results showed that compared to the healthy group, the factors affecting depression in the borderline and suspicious group were increasing age, female gender, interest in the field of study, physical activity, history of depression, and history of anxiety. **Conclusion:** The three classes that were identified based on the students' answers to the depression symptoms questions differed only based on severity. The history of depression and anxiety were the strongest predictors of latent classes of depression.

Key words: Depression, latent class analysis, university students

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INTRODUCTION

Depression is a common mental disorder in the world and its prevalence is estimated to be 3.76% worldwide and 5.48% in Iran.[1] Depression is the main cause of disability and contributes to the global burden of diseases, especially when it is frequent and moderate to severe, it can be a serious health problem.[2]

Mental health is lower among collegiate students worldwide and they have high levels of mental disorders, including depression.[3] Previous research reported that students' depression at the Universities of Medical Sciences was much higher than students of other universities. In a study on behavioral health trends in the United States, the National Institute of Mental Health reported that the prevalence of major depression was 7.2%–9.3% among young individuals and nonmedical students, compared with 27.2% among students of medical universities[4,5] because medical students might face other challenges such as high workload, a large number of evaluations, and clinical environmental pressures.[6]

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According to a recent meta-analysis, the prevalence of depression is about 52.12% among Iranian students.[7] Several medical universities in Iran have also conducted studies on the prevalence of depression and its determinants with some contradictory results. According to these studies, about 25.4% to more than 80% of students experience varying degrees of depression.[8,9]

Uncertainty about the classification of depression is an obstacle to the successful diagnosis and treatment of depression as there are more than 1400 possible combinations of symptoms for diagnosing major depressive disorder alone.[10] Symptoms of depression are nonspecific and there is considerable diversity in risk factors, severity, and duration of this disease. This heterogeneity appears to affect treatment responses, and despite decades of research and the vast use of antidepressants, success in this field is still unsatisfactory.[11]

Sometimes studies with different depression subgroups and contradictory results have been introduced, whereas their applications and clinical benefits are unclear. These subgroups were conventionally determined based on differences in etiologies, symptoms, onset, gender, and treatment response were explained using variable and person-centered analytical methods.[12] Latent variable methods, especially latent class analysis (LCA), have been widely used for such purposes in recent years.[13]

LCA, as an advanced statistical technique, can be used to classify individuals with similar characteristics who are in heterogeneous classes. LCA has been widely used in previous studies and has shown its superiority in classifying people with depression.[14,15] A systematic review of depression subgroups in adults concluded that there was no conclusive evidence to indicate the number and type of subgroups of depression given the high diversity in the diagnosed subgroups. Another major observation based on LCA was that both severity and nature of symptoms played important roles in the differentiation of depressive subgroups.[16]

There are few studies for diagnosing subgroups of depression in terms of symptoms in medical students and as far as our search showed, no such study has been done on Iranian students. However, students from different academic disciplines of medical sciences are involved in maintaining the physical and mental health of individuals in society and are more vulnerable due to their special status. Accordingly, correct and early classification and diagnosis of depression subgroups among students can provide an opportunity for early prevention of its progression and aggravation, which in turn, they can ensure the students' and public mental health. The goal of this study was to determine the latent subgroups of depression using the LCA and related factors among students of Isfahan University of Medical Sciences.

METHODS

Participants

In this cross-sectional study, participants were students who were studying at Isfahan University of Medical Sciences in the academic years 2017–2018. In this research, multistage sampling was used. Faculties were considered strata. Then, in the next step, the field and degree in different educational levels (including undergraduate courses and basic medical students) and the year of entering the university were considered layers. Finally, according to the number of students involved in that entry and with emphasis on maintaining gender balance in the samples that were to be selected, a number of people from the last layer were examined as the final sample. Participants were excluded from the study if they did not show a tendency.

The sample size was estimated to be 1184 individuals, using Cochran's formula and considering a 99% confidence level, 0.03% error level, and 0.20% prevalence based on the difference in prevalence in different studies, and it was estimated to be 1360 considering dropout rate and the probability of exclusion, but 1408 students were selected for the study.

Data collection method

The Hospital Anxiety and Depression Scale (HADS) was used to collect data. The questionnaire had 14 items; seven items measured the factors associated with depression. The items were multiple-choice and on a Likert scale (occasionally, often, sometimes, and never). Each option received a score of 0–3 and the total score was in the range of 0–21. A score of 0–7 revealed healthy individuals (without depression), 8–10: intermediate and abnormal, and 11–21: suspected of depressive disorder.

The questionnaire was completed by the participants through the self-administered method. In a study by Montazeri *et al*., the questionnaire's internal consistency was 0.70 using Cronbach's alpha. They also reported external reliability with an intra-class correlation coefficient (ICC) index of 0.48–0.86.[17] Demographic variables, including age, gender, residence status, semester, the field of study, and interest in the field of study were also taken into account. Other variables such as regular physical activity (number of days per week), a history of individuals' or family depression, parents' jobs, and parents' education levels were also measured. All relevant items were listed in a separate section at the beginning of HADS that was completed by the participants through the self-administered method.

Statistical analysis

The LCA model was fitted to seven symptoms of depression, all of which had four levels (never, sometimes, occasionally, and often). The model was fitted from 1 to 6 classes in the sample. A total of 16,384 response patterns could be available depending on the number and levels of variables related to the HADS. Akaike information criterion (AIC) and bayesian information criterion (BIC) were employed to select the suitable models. The Chi-square and analysis of variance (ANOVA) were used to determine the possible relationship between qualitative and quantitative variables with depression latent classes.

The latent class regression was also used to assess the possible relationship between predictive variables and risk depression. The variables which showed a significant relationship in the initial analysis (Chi-square and ANOVA-test) were included in the regression model including age, number of siblings, physical activity, gender, marital status, academic semester, interest in the field of study, history of depression, family history of depression, and anxiety history.

Data analysis was performed using SPSS Inc., Chicago, IL, USA, V16. Mplus7 was used to construct the response patterns of the LCA data to better understand the research data. $P < 0.05$ were considered statistically significant.

RESULTS

The total number of samples was 1408, among whom 62.9% (n = 855) were female. The mean and standard deviation of the participants' age was 22.50 ± 5.1 with an age range of 18–58 years.

Table 1 presents the results of fitting LCA models with 1–6 classes. Given that the fitted models had a $P = 0.05$, the BIC and AIC values of each model were considered to choose the optimal model. The values of these two indices in the model with three latent classes were minimal and the model had a better fit than other models.

Table 2 shows the prevalence and probability of response to the symptoms of the third model. A comparison of the probability values of the response to the symptoms among the three classes indicates that the probability of response of the first class is lower for all criteria than for the other two classes. In the second class, the probability of response is higher for all symptoms than the values of the first class and less than the values of the third class. As to the third class, the probability of response was higher for all symptoms than in the other two classes, indicating that classes are not separated according to the type of symptoms and there are not only certain symptoms in a class. Ranks of classes distinguish them from each other. Therefore, the third class includes individuals who are suspected of depressive disorder (16%), the second class includes those with borderline depression (32%), and the first class includes healthy individuals (52%).

According to the results of univariate analysis shown in Table 3, increasing age ($P < 0.001$), high number of siblings ($P = 0.043$), male gender ($P = 0.009$), being single ($P = 0.014$), reducing physical activity ($P < 0.001$), being nonnative ($P < 0.001$), low semester ($P = 0.008$), interested in the field of study ($P < 0.001$), history of depression in the past ($P < 0.001$), history of depression in the family ($P < 0.001$), and previous history of anxiety ($P < 0.001$) can be related to the person's membership in class 3 (suspected of depressed). Other investigated variables (the field of study, parents' jobs, and parents' education levels) did not show a significant relationship with depression latent classes.

Table 4 shows the odds ratio of being in class two (borderline) and class three (suspected of depression) compared to class one (healthy) for independent variables including age, sex, interest in the field of study, history of depression, history of anxiety, and physical activity. Among the variables included in the regression model, history of depression shows more predictive ability. The chances of students who have a history of depression being placed in the second and third classes compared to the first class were 2.45 and 3.67 times, respectively ($P < 0.001$).

DISCUSSION

This study, which initially endeavored to determine the prevalence of latent subgroups of depression among

Table 1: The fit of the latent class analysis model with all symptoms of depression on medical students of Isfahan in 2016-2017

Number of classes	Number of parameters	Entropy	Degrees of freedom	Maximum likelihood logarithm	AIC	BIC
1	21	1	1387	−10832.88	21707.77	21818.02
2	29	0.7923	1379	−9958.31	19974.62	20126.87
3	37	0.7375	1371	−9780.08	19634.17	19828.42
4	45	0.6579	1363	−9743.87	19577.74	19813.98
5	53	0.6175	1355	−9723.27	19552.54	19830.78
6	61	0.5948	1347	−9707.03	19536.07	19856.31

AIC=Akaike information criterion; BIC=Bayesian information criterion

Table 2: Prevalence and probabilities of item response in the model fitted with all symptoms of depression on a sample of students

Symptoms for depression	Class 1 (healthy)	Class 2 (borderline)	Class 3 (suspect of depression)
Prevalence of the class	0.52	0.32	0.16
I still enjoy the things I used to enjoy			
Not at all	0.01	0.01	0.44
Only a little	0.12	0.03	0.36
Not quite so much	0.61	0.27	0.16
Definitely as much	0.26	0.69	0.04
I can laugh and see the funny side of things			
Not at all	0.00	0.02	0.12
Definitely not so much now	0.01	0.16	0.35
Not quite so much now	0.09	0.55	0.45
As much as I always could	0.90	0.27	0.05
I feel cheerful			
Most of the time	0.82	0.22	0.02
Sometimes	0.18	0.68	0.32
Not often	0.01	0.10	0.56
Not at all	0.00	0.00	0.10
I feel as if I am slowed down			
Not at all	0.81	0.36	0.03
Sometimes	0.18	0.52	0.31
Very often	0.01	0.10	0.42
Nearly all of the time	0.00	0.02	0.24
I have lost interest in my appearance			
I take just as much care as ever	0.85	0.58	0.25
I may not take quite as much care	0.12	0.29	0.34
I don't take as much care as I should	0.03	0.11	0.30
Definitely	0.00	0.02	0.11
I look forward with enjoyment to things			
Not at all	0.90	0.15	0.01
Definitely not so much now	0.09	0.49	0.27
Not quite so much now	0.01	0.32	0.59
As much as I always could	0.00	0.04	0.13
I can enjoy a good book or radio or TV program			
Very seldom	0.03	0.06	0.33
Not often	0.04	0.14	0.30
Sometimes	0.21	0.35	0.24
Often	0.73	0.45	0.13

students, using LCA, indicated that three latent subgroups were identified, that is, the group of healthy individuals, the group of borderline individuals and the group of people suspected of depression. The common class was a healthy class (prevalence of 52%) followed by the borderline depression class (prevalence of 32%), and suspected depressive disorder class (prevalence of 16%). Female gender, increasing age, interest in the field of study, a history of depression, a history of anxiety, and physical activity were the strong features that distinguished the three classes.

In this study, depression had a significant relationship with age. In a similar study, the prevalence of depression had an inverse relationship with increasing age (41% of individuals aged 16–20 years, and 18.0% of people over 25 years of age).[18] A study in Sweden also reported a decrease in the prevalence of depression with age.[19] To better understand, the possible impact of age on the reduction of the prevalence of depression among students, there is a need for a longitudinal study that examines students as soon as they enter the university until graduation. This type of study fosters an opportunity to facilitate the comparison of causal relationships by examining changes over time in the same group of participants. Of course, in our study, the age of the students is in a certain range, and it is not possible to have a deep discussion about age in this small range, and it is necessary to carry out this investigation in other studies with a larger age distribution.

In this study, the odds ratios of depression were lower in students who were interested in their fields of study. This finding was consistent with the results of a study on medical students by Kalani *et al*.[20] and Mohammadbeygi *et al*.[21] In

Table 3: Demographic characteristics of the participants across identified classes

Characteristics	Depression classes			*P*
	Class 1 (healthy), *n* (%)	Class 2 (borderline), *n* (%)	Class 3 (suspect of depression), *n* (%)	
Age, mean±SD	22.43±5.05	21.79±3.95	23.90±6.98	<0.001
Number of siblings, mean±SD	2.03±1.61	1.91±1.45	2.24±1.80	0.043
Physical activity, mean±SD	2.25±1.57	2.52±1.59	1.80±1.37	0.001
Gender				
Male	270 (37.1)	156 (34.2)	104 (46.2)	0.009
Female	457 (62.9)	300 (65.8)	121 (53.8)	
Marital status				
Single	629 (86.5)	399 (87.5)	179 (79.6)	0.014
Married	98 (13.5)	57 (12.5)	46 (20.4)	
Status of residence				
Nonnative	325 (44.7)	180 (39.5)	99 (44)	0.196
Native	402 (55.3)	276 (60.5)	126 (56)	
Dormitory satisfaction				
Yes	169 (56.9)	116 (67.4)	35 (35.7)	<0.001
No	128 (43.1)	56 (32.6)	63 (64.3)	
Academic semester				
One	114 (15.7)	76 (16.7)	42 (18.7)	0.008
Two	174 (23.9)	121 (26.5)	54 (24)	
Three	73 (10)	49 (10.7)	31 (13.8)	
Four	129 (17.7)	84 (18.4)	47 (20.9)	
Five	53 (7.3)	10 (2.2)	7 (3.1)	
Six	184 (25.3)	116 (25.4)	44 (19.6)	
Interest in the field of study				
Yes	600 (82.5)	416 (91.2)	172 (76.4)	<0.001
No	127 (17.5)	40 (8.8)	53 (23.6)	
Depression history				
Yes	85 (11.7)	27 (5.9)	67 (29.8)	<0.001
No	642 (88.3)	429 (94.1)	158 (70.2)	
Family depression history				
Yes	85 (11.7)	44 (9.6)	52 (23.1)	<0.001
No	642 (88.3)	412 (90.4)	173 (76.9)	
Anxiety history				
Yes	432 (59.4)	199 (43.6)	160 (71.1)	<0.001
No	295 (40.6)	257 (56.4)	65 (28.9)	

SD=Standard deviation

Table 4: Odds ratio and confidence interval for the relationship of factors associated with depression

Independent variable	Class 2** (Class 1*as a reference)		Class 3*** (Class 1 as a reference)	
	OR (95% CI)	*P*	OR (95% CI)	*P*
Age	1.09 (1.04-1.14)	<0.001	1.13 (1.03-1.26)	<0.001
Gender female	1.14 (0.89-1.45)	0.307	2.16 (1.62-2.88)	<0.001
Interest in the field of study	0.38 (0.23-0.65)	<0.001	0.47 (0.28-0.79)	<0.001
Depression history	2.45 (1.49-4.06)	<0.001	3.67 (2.22-6.07)	<0.001
History of anxiety	2.11 (1.28-3.49)	<0.001	2.53 (1.53-4.19)	<0.001
Physical activity by day	0.83 (0.74-0.92)	<0.001	0.79 (0.71-0.88)	<0.001

*Class 1=Healthy group; **Class 2=Borderline group; ***Class 3=Suspect of depression group. OR=Odds ratio; CI=Confidence interval

another study, 72% of students, who were interested in their fields of study, did not show symptoms of depression.[22] Because satisfaction with their fields of study acts as a strong motive to enhance motivation and reduce the prevalence of depression. As to activity, positive emotions about the future and its brilliant end play a key role in dynamism and prevention of failure and humiliation.

The three classes identified can be compared to the four classes found in a study of 10,529 students older than 18 years (in California). They showed that 83.2% of students were in nondepressed class, 11.6% in mild depression class, 1.9% in severe depression class, and 3.2% in desperate class. Older age had an inverse relationship with being in the mild or severe depression class compared to the nondepressed

class.[23] While in this study, age was not a different feature between the classes. This study revealed that 0.52% of the sample was in the healthy class and the other two classes had different patterns. Two other classes were borderline severity and suspected depressive disorder, which included students with higher probability for depression severity. One class included students with borderline depression severity (0.32%), whereas the other class included students with suspected depression severity (16%).

Compared to men in this study, women had a higher chance of being in the suspected depressive disorder classes. Other studies have revealed that depression in young girls (14–25 years old) is twice that of men, and this ratio decreases with age.[24] However, after 65 years, there is a decrease in depression rates for men and women with a similar tendency, which could be because the transition to older age and the resulting change in role and position may have social consequences. For example, women with older age, which is the end of raising children and the beginning of retirement, tend to join social groups unrelated to work, but men have less desire to communicate at older ages.[25]

In this study, only the factor of physical activity from the set of healthy lifestyle principles was evaluated, which showed that individuals who had less physical activity were more likely to belong to Groups 2 and 3 than Group 1. However, due to the high sample size and the low probability of having depressive symptoms in Groups 2 and 3, the data of this group are needed to clarify whether these individuals suffer from psychological trauma or an unstructured or unhealthy lifestyle. More studies should be conducted.

Suggestions and limitations

A strength of this study was that LCA was used on a large population of students to classify depression and its related factors; hence, it was possible to detect factors related to students' depression and design appropriate interventions to reduce their problems and provide a basis for increasing their ability.

A major limitation of this study was that the causes and symptoms of depression were examined in a specific group and it was very difficult to generalize it to the whole population except in cases with predominant similarities. The collected data of this study was based on self-administered questionnaires, and thus some symptoms or answers to questions might be affected by the participants' fields of study. Due to the cross-sectional nature of the study, the relationship between parameters and depressive symptoms in students might be affected by other factors that were not taken into consideration in this study. Another limitation of this study was that medical students might not choose some options in their responses despite the similarity with their circumstances due to their knowledge of depression they feared being in a group of depressed individuals.

CONCLUSION

The students in this study were divided into three classes in terms of depression. The difference between these classes was based on the severity of the symptoms that were asked about them, and there was no difference in terms of the type of symptoms. History of depression and anxiety were the strongest predictors of latent classes of depression.

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Conflicts of interest

There are no conflicts of interest.

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