

An Analytical Approach to Estimate Prevalence of Depression from a Non-Probability Sample of College Students in Karachi Using Beck Depression Inventory

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Abstract

Objective: To estimate and compare prevalence of depression among college students in Karachi. Analytical approach was aimed to minimize biases produced by profession, gender and age of samples on prevalence rate.

Methods: A cross-sectional study design was employed. Two hundred and sixty students were chosen during January 2018 to March 2019 through purposive non-probability sampling technique from different professional colleges in Karachi. Beck Depression Inventory, a self-report questionnaire comprising of 21 items was used as study tool. After taking informed consent, each sample was inquired about profession, age, gender, and personal and family history of psychiatric illness. Diagnosed cases of any psychiatric illness were excluded. Samples were stratified on the basis of profession, gender and age. A minimum sample size of 70 students was extracted from the total sample through quasi randomization. Statistical software SPSS version 16 was used for data entry, sample randomization and analyses.

Results: Overall prevalence rate was 26.15%. Profession based stratification of samples showed prevalence rates of 21.81% and 29.33% in business and medical college students, respectively. Substrata of medical colleges i.e. public and private medical college students showed prevalence rates of 38.66% and 20%, respectively. Gender based stratification showed prevalence rate of 33.33% in female and 17.24% in male students. Age based stratification showed prevalence rate of 15.49% in teens (17-19 years) and 21.69% in post-teen group (20-25 years). Independent sample t-tests showed statistically significant difference between the strata of profession, gender and age and substrata of public and private medical colleges. Prevalence rate of 25.71% was estimated in quasi randomized samples.

Conclusion: Randomization, stratification and large sample sizes are employed to minimize biases in prevalence studies. Present study showed the importance of sample stratification based on age, gender and profession in estimating prevalence of depression. Results also showed validity of minimum sample size if calculated appropriately.

Keywords: Depression, mental health, students

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Introduction

Among the mental health problems, depression has been ranked as one of the leading causes of morbidity particularly in young students. Several studies have pointed out that college and university students are more vulnerable to develop psychiatric problems like anxiety, depression, burnout, sleep problems, suicidal ideation and mood problems^{1,2,3}. Prevalence of psychiatric issues particularly depression reported for undergraduate students ranges from 2.9% to as high as 71.2%^{1,3,4,5,6}. Prevalence

or severity of depression usually show an increase as the students pass onto senior classes where training becomes more demanding^{1,7}. However some contrary reports suggested much better coping skills possessed by senior medical students and higher risk of depression for junior medical students^{5,8}.

Gender based prevalence studies showed females to be more vulnerable to develop depressive symptoms than male students⁹. These findings emphasize the need of students mentoring, training and counselling in early years of university curriculum¹⁰.

Many research studies were conducted to investigate the prevalence, association and causation of depression across different professions, communities and culture. However, external validity of the research is limited due to the cultural differences of the samples of students used in these studies. Prevalence of depression and other psychiatric symptoms among Pakistani students has also been investigated^{11,12,13}. Some studies were reported for Asian and Indian medical students^{14,15,16,17}. Factors reported in these studies vary but stressful study schedule, hectic clinical hours, cynicism, worrying for making career and burnouts are commonly reported¹⁸. Very few studies considered differences due to gender, age, profession and type of colleges in which students were studying.

In the present study, an appropriate sample size of university students was estimated¹⁹. For the assessment of depression Beck Depression Inventory (BDI) was used. BDI is a self report inventory developed by Aaron T. Beck. It is one of the most frequently used psychometric scales. BDI has been used to study depressive symptoms in general population as well as in college and university students^{20,21,22}.

Total score of BDI across all the items indicate the severity of depression. For example a score of 21 or more is suggestive of depression in general population.

For patients with diagnosed mental health problems a score of 9 indicates minimal, 10 to 16 indicates mild, 17 to 29 indicates moderate and a score of more than 29 indicates severe depression.

Patients and Methods

Beck Depression Inventory (BDI) was used to estimate the prevalence of symptoms of depression among students of professional colleges. BDI consists of 21 items, each with four options scoring from 0 to 3. Each symptom of depression is assessed by an item of BDI. Total score of BDI across all the items indicates the severity of depression.

Students studying at different professional colleges in Karachi were taken as study participants. Non-probability purposive sampling technique was employed due to the feasibility and availability of students. Sample size was calculated as given in Naing et al¹⁹. Sample size for an average prevalence rate of 25%, as reported in Pakistani studies, with 0.1 precision of estimation and 95% confidence interval was performed and it came out to be 70. For the present study, we sampled 260 students from different professional colleges.

The inclusion criterion for the study were students studying in professional colleges of Karachi. Both genders were included and age range was kept at 17-25 years. All cases that previously diagnosed for psychiatric illness or mental health problems by psychiatrists were excluded from the study.

Preliminary data about subjects/samples demographics e.g. age, gender, profession, type of college was collected after informed consent.

Data was collected during January 2018 to March 2019 from different professional colleges of Karachi. Study was conducted at Karachi Institute of Medical Sciences Karachi. Before giving the BDI the participants were briefed about the study and were given consent form in written so they could decide to participate in the study freely and independently. Permission from Institutional Review Board was taken and submitted.

Results

All the data, both demographic and scores of BDI items, was entered in Microsoft excel sheets and software SPSS version 16. Statistical analyses i.e. independent sample t tests and graphic illustra-

tion of data were performed using Minitab and SPSS version 16.

Table 1. shows the demographic data like profession, age, gender, and type of professional college. It can be seen that there is a significant difference in teen to post-teen, male to female and public to private ratios across the two strata of professional colleges i.e. business colleges and medical colleges.

Table 1. Demographic data of college students of Karachi included in the present study

Strata of samples based on profession	Sample size	Teen to Post teen Ratio(%)	Male to Female Ratio(%)	Public to Private Ratio(%)
Business colleges	110	46:54	58:42	05:95
Medical colleges	150	13:87	35:65	50:50

Table 2. shows that prevalence rates of depression based on Beck Depression Inventory scores across the whole sample with no stratification and each of the two strata based on profession/ gender/ age. Cut off level of BDI score for general population was 21 i.e. if the BDI score across all the 21 items summed up to be 21 or greater, the individual was said to be depressed. Independent sample t tests were performed using SPSS to find out the significant difference between the two strata based on profession, gender and age. Results of t tests showed that the BDI scores across the two strata based on profession, gender and age are significantly different from each other (Table 2).

Table 2. Prevalence rate of Depression among the study samples of the present study. Prevalence rates were also shown for samples stratified on the basis of profession, age, gender and type of colleges.

Stratification based on	Study participants	Sample size (number of individuals)	Prevalence Rates (%)	Independent sample t test (p value)
No	All	260	26.15	
Profession	Business colleges	110	21.81	< 0.05 (significant)
	Medical colleges	150	29.33	
Gender	Male	116	17.24	< 0.05 (significant)
	Female	144	33.33	
Age	Teen	71	15.49	< 0.05 (significant)
	Post-teen	189	21.69	

For justification of minimum sample size as described by Naing et al¹⁹ a total of 70 individuals were extracted from the whole sample through quasi randomization as described by Arifin²³. Prevalence rate across the quasi randomized sample was compared with the prevalence rate across the whole sample. A small difference of 0.433% was found between the two prevalence rates (Fig 1).

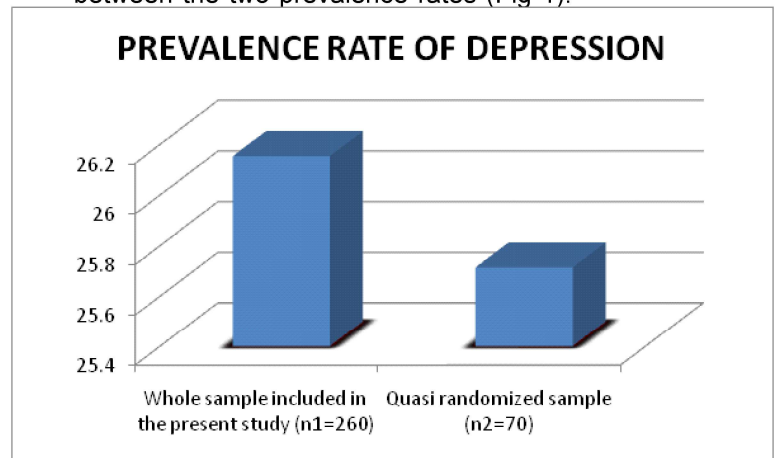


Fig. 1 Prevalence rates of the whole sample included in the present study (n=260) and quasi randomized sample (n=70).

Samples from medical colleges were sub-stratified into private and public medical colleges. Each of the sub-strata included 75 students. Independent sample t test showed a significant difference between the two sub-strata of the medical colleges. Fig. 2 shows the interval plot for the two sub strata of medical colleges with mean and 95% confidence interval. Mean BDI score of private and public medical colleges was 14 and 20 respectively and there was no overlapping of their 95% confidence intervals.

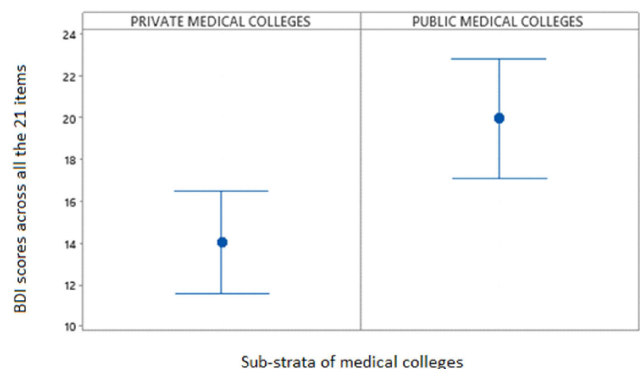


Fig. 2 Interval plots of BDI scores across the two sub-strata of medical colleges i.e. private and public medical colleges showing mean and 95% confidence interval.

Discussion

Prevalence studies are subjected to many biases that make the inference invalid and non-reproducible. Such studies are usually conducted on non-probability samples due to convenience and feasibility. For non-probability study design the accuracy of the estimates depends upon the characteristics of the samples included in the study²⁴. Greater the resemblance of characteristics of sample population with the target population more accurate will be the estimate. However, it is unlikely for a non-probability sample to resemble the target population, therefore, researcher should focus on those characteristics of the sample that are likely to influence the inference. Literature on prevalence of depression has shown the effect of gender, age and profession on prevalence rate. Therefore in the present study, stratification based on these characteristics was done to give the reader a more realistic picture of the depression prevalence in college students.

Another factor that can lead to unreliable estimate is the sample size. It is generally believed that larger the sample more accurate will be the estimate. This is statistically true because a larger sample approaches population characteristics more efficiently. However, shortage of time and resources make it difficult to employ a larger sample size. Researchers have suggested a minimum sample size required for prevalence studies¹⁹. Estimation of minimum sample size requires an expected prevalence rate of the disease/morbidity under study. Expected prevalence rate can be estimated from available literature and research studies. In the present study a minimum sample size of 70 individuals was estimated from expected prevalence rate of 25%. This minimum sample size which was quasi randomized from the whole sample gave an estimate of prevalence rate which was very close to the whole sample prevalence rate. Therefore, it can be inferred that a minimum sample size can work if computed appropriately; however, it does not undermine the importance of large sample size for accurate estimation of prevalence rate.

Depression is one of the most prevalent mental health problems. Several studies have pointed out the growing prevalence of depression in students particularly among those belonging to the medical profession. Although some studies also pointed out demographic variation in the prevalence rate of depression across different populations, however, global consensus is in agreement that college students showed enhanced vulnerability towards depression. Higher prevalence of depression in students of professional colleges may be attributed to their busy schedule, hectic life style, demanding profession and high competition-oriented environment.

Gender is another factor that can change the outcome. In the present study, female students showed a higher prevalence of depression than their male counterparts. Beside the genetic basis of gender difference in depression prevalence, cultural differences also play an important role. In Pakistani society, females are considered more vulnerable and dependent. In general, they are provided with less resources and opportunities and face a glass ceiling effect. This social environment can develop a feeling of helplessness in female, hence depression is likely to occur.

According to Erik Erikson's psychosocial stages of development, there are two stages where isolation and despair can develop into depression²⁵. First is the post-teen stage (20-40 years) and second is the old age (mid 60s). In the present study, post-teen samples showed a higher prevalence of depression. Nevertheless, it might be due to their greater proportion in the study sample. However, increasing social responsibilities and achievement orientation may play a contributory role in causing depression.

Beck Depression Inventory (BDI) measures affective, cognitive, and somatic symptoms of depression. Each item of the Inventory is scaled from 0 to 3 with increasing severity of the symptom, 0 being the absence of the symptom and 3 being the presence of symptom in its most severe form. A self-report is considered more reliable than

the one reported by a third-party observation as individual is more aware of his or her feelings, emotions and cognition than others.

Results of the present study showed a score of 14.94 for private and score of 19.96 for public medical college students. It is worth mentioning here that public medical college students are selected through very strict criteria of open merit. It is highly likely that only those students are selected who are achievement oriented and very much determined to choose medicine as a career. Moreover, public medical colleges also offer a more competitive environment where students have to struggle through busy schedule and no formal counselling or mentoring system is available in public medical colleges.

On the other hand, private medical students suffer from a huge financial burden due to high tuition fee and hostel charges which make up around 1 to 1.5 million rupees per year. This factor along with busy schedule at medical colleges may cause stress among them. However, a formal or informal counselling system is usually available in private medical colleges that may help to lessen the stress on the medical students.

Literature review shows that prevalence rate varies among medical students residing in Pakistan. For example, a study conducted on Pakistani students in Karachi²⁶ reported prevalence rate of 49% to 66% in a private medical university which is quite higher than the prevalence rate observed in the present study. However, they used Aga Khan University Anxiety and Depression Scale (AKUADS) to estimate severity of depression. Prevalence of depression was reported as 43.89% and 70% in public medical colleges of Multan and Karachi respectively, using AKUADS^{27,28}.

Different prevalence rate were also reported for college students of different geographical areas. For example Kumar, Jain and Hegde (2012) reported an overall prevalence rate of 71.25% in medical students of Karnataka, India²⁹. They used BDI with a sample size of 400. This study did not mention the

category of medical institution as private or public. However, two more studies from India reported prevalence rate of 49.1% and 64% among students of private medical colleges^{30,31}.

Comparison of prevalence rates reported in different studies showed that variation is high even among students residing in the same city. Use of different instruments and sample sizes and stratification strategy may be the causative factors for this variation. However, variation does not eliminate the significance and gravity of this problem as World Health Organization (WHO) has declared it to be the second most prevalent morbidity around the world by 2020.

Depression among college students poses a serious problem all over the world. Young people fall victim of a very devastating illness that deprive them of their enthusiasm for their profession and this may be a key factor to increased drop outs from professional colleges. It is very important to investigate this mental health problem prevalent among college students as social and economic development depend on the expertise, competence and skills of young generations. Early and proper diagnosis and supportive measures can be made operational through a systematic mentoring and counselling systems that should work right from the admission of the students at professional colleges.

Factors that limit the generalization of the result of the present study are smaller sample size, less number of sampling units, and non-random sampling technique. Moreover, it is difficult to know if a past stressful event occurred prior to submission of BDI self-report that contributed to inflate the score thus threatening the internal validity of the study. Although samples were taken from normal and healthy population with no history of psychiatric illness, one may hide or may shy away to declare himself or herself as psychiatric patient or having some mental illness owing to the cultural norms of making such illness a social stigma. A larger sample size may overcome the above mentioned problems.

Conclusion

It can be concluded that among other contributory and associated factors for depression in college students, profession chosen by the students, gender, age, and the type of college or university to which the students belong, must be taken into consideration for research studies as the present study showed a significant difference in the prevalence of depression among college students of different demographic and professional attributes.

References

1. Naushad S, Farooqui W, Sharma S, Rani M, Singh R, Verma S. Study of proportion and determinants of depression among college students in Mangalore city. *Niger Med J* 2014;55:156-160. [DOI:10.4103/0300-1652.129657]
2. Onyishi M, Talukdar D, Sanchez R, Olaleye AO, Medavarapu S. Prevalence of clinical depression among medical students and medical professionals: A review study [Internet]. *Archives of Medicine* 2016;8:6. Available from: <https://www.archivesofmedicine.com/medicine/prevalence-of-clinical-depression-among-medical-students-and-medical-professionals-a-systematic-review-study.php?aid=17923>. Accessed on: 12 November 2020. [DOI: 10.21767/1989-5216.1000178]
3. January J, Madhombiro M, Chipamaunga S, Ray S, Chingono A, Abas M. Prevalence of depression and anxiety among undergraduate university students in low- and middle-income countries: a systematic review protocol. *Syst Rev* 2018;7:57. [DOI:10.1186/s13643-018-0723-8]
4. Coentre R, Figueire ML. Depression and suicidal behavior in medical students: a systematic review [Internet]. *Current Psychiatric Review* 2015; 11: 86-111. Available from: <https://www.eurekaselect.com/123816/article>. Accessed on: 12 November 2020. [DOI: 10.2174/1573400510666140807005141]
5. Puthran R, Zhang MW, Tam WW, Ho RC. Prevalence of depression among medical students: a meta-analysis. *Medical Education* 2016; 50: 456-68.
6. Sarokhani D, Delpisheh A, Veisani Y, Sarokhani MT, Manesh RE, Sayehmiri K. Prevalence of depression among university students: A systematic review and meta-analysis study [Internet]. *Depression Research and Treatment* 2013; 2013: 373857. Available from: <https://www.hindawi.com/journals/drt/2013/373857/>. Accessed on: 12 November 2020. [DOI: 10.1155/2013/373857]
7. Ngasa N, Sama C-B, Dzekem BS, Nforchul K N, Tindong M, Aroke D, et al. Prevalence and factors associated with depression among medical students in Cameroon: a cross sectional study [Internet]. *BMC Psychiatry* 2017; 17: 1382-3. Available from: <https://bmcp psychiatry.biomedcentral.com/articles/10.1186/s12888-017-1382-3>. Accessed on: 12 November 2020. [DOI: 10.1186/s12888-017-1382-3].
8. Quince TA, Wood DF, Parker RA. Prevalence and persistence of depression among undergraduate medical students: a longitudinal study at one UK medical school [Internet]. *BMJ Open* 2012; 2:e001519. Available from: <https://bmjopen.bmj.com/content/2/4/e001519>. Accessed on: 12 November 2020. [DOI:10.1136/bmjopen-2012-001519].
9. Kessler RC. Epidemiology of women and depression. *J. Affect Disord* 2003;74 :5-13. [DOI: 10.1016/s0165-0327(02)00426-3]
10. Bamuhair SS, Farhan AI, Althubaiti A, Agha S, Rahman S, Ibrahim NO. Sources of stress and coping strategies among undergraduate medical students enrolled in problem based learning curriculum. *J Biomed Educ* 2015; 1-8. [DOI:10.1155/2015/575139].
11. Syed A, Ali SS, Khan M. Frequency of depression, anxiety and stress among the undergraduate physiotherapy students. *Pak J Med Sci* 2018;34:468-471. [DOI:10.12669/pjms.342.12298]
12. Hashmi AM, Aftab A, Naqvi SH, Sajjad W, Mohsin M, Khawaja IS. Anxiety and depression in Pakistani medical students: a multi-center study [Internet]. *Health Med* 2014; 8: 813-20. Available from: https://www.researchgate.net/publication/319068701_Prevalence_of_depression_and_anxiety_among_undergraduate_medical_students_in_a_government_medical_college_of_Karachi. Accessed on: 12 November 2020.
13. Rehmani N, Khan QA, Fatia SS. Stress anxiety and depression in students of medical school in Karachi Pakistan. *Pak J Med Sci* 2018;34: 696-701. [DOI: 10.12669/pjms.343.14664]
14. Islam S, Akter R, Sikder T, Griffiths MD. Prevalence and Factors Associated with Depression and Anxiety Among First-Year University Students in Bangladesh: A Cross-Sectional Study [Internet]. *Int J Ment Health Addiction* 2020. Available from: <https://link.springer.com/article/10.1007/s11469-020-00242-y#citeas>. Accessed on: 12 November 2020. [DOI: 10.1007/s11469-020-00242-y]
15. Kumari R, Langer B, Jandial S, Gupta R, Raina SK, Singh P. Psycho-social health problems: prevalence and associated factors among students of professional colleges in Jammu [Internet]. *Indian Journal of Community Health*, 2019; 31: 43-9. Available from: <https://www.iapsmupuk.org/journal/index.php/IJCH/article/view/1039/888>. Accessed on: 12 November 2020.

16. Kumar G, Kattimani S, Sarkar S, Kar SS. Prevalence of depression and its relation to stress level among medical students in Puducherry India. *Ind Psychiatry J* 2017;26: 86-90. [DOI: 10.4103/ipj.ipj_45_15]
17. Sarkar S, Gupta R, Menon V. A systematic review of depression, anxiety and stress among medical students in India [Internet]. *Journal of Mental Health and Human Behaviour* 2018; 22: 88-96. Available from: <https://www.jmhbb.org/article.asp?issn=0971-8990;year=2017;volume=22;issue=2;spage=88;epage=96;aulast=Sarkar>. Accessed on: 12 November 2020.
18. Silva V, Costa P, Pereira I, Faria R, Salgueira AP, Costa MJ, et al. Depression in medical students: insights from a longitudinal study. *BMC Medical Education* 2017;17: 184. [DOI: 10.1186/s12909-017-1006-0.]
19. Naing L, Winn T, Rusli BN. Practical Issues in Calculating the Sample Size for Prevalence Studies [Internet]. *Archives of Orofacial Sciences* 2006; 1: 9-14. Available from: <https://citeserx.ist.psu.edu/viewdoc/download?doi=10.1.1.504.2129&rep=rep1&type=pdf>. Accessed on: 12 November 2020. [DOI: 10.1.1.504.2129]
20. Shant RER, Rayhan I. Depression level of undergrad students: BDI scale [Internet]. *Biom Biostat Int J* 2018;7:360-362. Available from: <https://medcraveonline.com/BBIJ/depression-level-of-undergrad-students-bdi-scale.html>. Accessed on: 12 November 2020. [DOI:10.15406/bbij.2018.07.00230]
21. Athar H, Mukhtar N, Shah S, Mukhtar F. Depression and associated factors: a cross-sectional study using Beck depression inventory. *J Ayub Med Coll Abbottabad* 2017; 29: 667-70.
22. Khaliq SA, Gul A. Validity and reliability of Urdu version of Beck's Depression Inventory among students of madaris (Islamic institutes). *Isra Medical Journal* 2018; 10: 175-176. Available from: https://www.researchgate.net/profile/Dr_Sheikh_Abdul_Khaliq/publication/326160108_VValidity_and_Reliability_of_Urdu_Version_of_Beck's_Depression_Inventory_Among_Students_of_Madaris_Islamic_Institutes/links/5b3bc1734585150d23f6557b/Validity-and-Reliability-of-Urdu-Version-of-Becks-Depression-Inventory-Among-Students-of-Madaris-Islamic-Institutes.pdf. Accessed on: 12 November 2020.
23. Arifin WN. Random sampling and allocation using SPSS [Internet]. *Education in Medicine Journal* 2012. Available from: https://www.researchgate.net/publication/233810425_Random_sampling_and_allocation_using_SPSS. Accessed on: 12 November 2020. [DOI: 10.5959/eimj.v4i1.4.]
24. Cornesse C, Blom AG, Dutwin D, Krosnick JA, Leeuw EDD, Legleye S, et al. A Review of Conceptual Approaches and Empirical Evidence on Probability and Nonprobability Sample Survey Research [Internet]. *J Surv Stat Methodol* 2020;8: 4-36. Available from: <https://academic.oup.com/jssam/article/8/1/4/5699631>. Accessed on: 12 November 2020. [DOI: 10.1093/jssam/smz041]
25. Suzanne DW. Erikson theory of psychosocial development. Chapter 4. *College student development; Applying theory to practice on the diverse campus*. [DOI: 10.1891/9780826118165.0004]
26. Inam SN, Saqib A, Alam E. Prevalence of anxiety and depression among medical students of private university. *J Pak Med Assoc* 2003;53: 44-7.
27. Khan MS, Mahmood S, Badshah A, Ali SU, Jamal Y. Prevalence of depression anxiety and their associated factors among medical students in Karachi. *J Pak Med Assoc* 2006;56: 583-86.
28. Jadoon NA, Yaqoob R, Raza A, Shehzad MA, Choudhry ZS. Anxiety and depression among medical students: a cross-sectional study. *J Pak Med Assoc* 2010; 60: 699-702.
29. Kumar GS, Jain A, Hegde S. Prevalence of depression and its associated factors using Beck Depression Inventory among students of a medical college in Karnataka. *Indian J Psychiatry* 2012; 54: 223-26. [DOI: 10.4103/0019-5545.102412]
30. Singh A, Lal A, Shekhar. Prevalence of depression among medical students of a private medical college in India [Internet]. *Online J Health Allied Sci* 2010; 9: 8-10. Available from: <http://cogprints.org/7251/1/2010-4-8.pdf>. Accessed on: 12 November 2020.
31. Vankar JR, Prabhakaran A, Sharma H. Depression and stigma in medical students at a private medical college. *Indian J Psychol Med* 2014; 36: 246-54. [DOI: 10.4103/0253-7176.135372]