Original article   Open Access

Stress Level Assessment of Medical School Program and correlations between Learning Styles and Teaching Methodologies

Fernanda Fortuci Resende Botelho[1], Ingrid Bergamo[2], Mariana Carvalho de Oliveira[3], Fulvio Bergamo Trevizan[4], Felipe Colombelli Pacca[5], Patricia Fucuta[6], Carolina Colombelli Pacca[7], Patricia Maluf Cury[8]

Corresponding author: Prof Patricia Maluf Cury pmcury@hotmail.com

Institution: 1. Faceres Medical School, 2. Faculdade de Medicina de São José do Rio Preto, 3. Universidade do Oeste Paulista, 4. Faculdade de Medicina de São José do Rio Preto, 5. Faceres Medical School, 6. Faceres Medical School, 7. Faceres Medical School, 8. Faceres Medical School

Categories: Education Management, Students/Trainees, Teaching and Learning

Abstract

Stress is a psychological change that is becoming ever more frequent among medical school students than that of the general population, and these stress levels may affect academic performance. When the individual learning style does not fit into the method used by the student's university, the clash may become another stress factor. We evaluated preferred learning styles (Honey-Alonso Learning Styles Questionnaire) and stress levels (Lipp Inventory of Stress Symptoms for Adults) among medical students from two universities in the state of São Paulo that apply different teaching methods. The results showed that and the majority of the students were found to exhibit the reflexive learning style at both schools (60.4% at UNOESTE and 32.7% in FACERES) and high stress levels overall among the students (68.2% at UNOESTE and 74.0% at FACERES) in the resistance phase (81%), and there was a predominance of psychological symptoms of stress over physical symptoms at both universities (75.86% of students at UNOESTE and 86.48% at FACERES). Female students were found to exhibit higher stress levels than their male counterparts (72% and 55%, respectively). However, we didn´t find any statistical association between stress level and learning style. This is the first study to compare stress levels, learning styles, and teaching methodologies at two different medical schools.

Introduction

As fields of human knowledge have grown through research in recent years, there have been changes in the process of creating and transmitting information, changes which have affected learning and teaching strategies (Lewis et al., 2009). Innovative programs have been developed in the search for more humanized curricula. The curriculum reform that occurred at McMaster Medical School in Hamilton, for example, led to a surge in new learning methods such as problem-based learning, or PBL (Hart 1977).

The traditional teaching model on which medical schools are based has long been used and is based on the Flexner Report from 1910. This method is composed of theoretical courses throughout the program and practical work in medicine starting in the third year of study. This traditional model reflects a hierarchical professor-student relationship in which the professor maintains the power of knowledge and the students are mere listeners, passive participants who must study the content provided in the program and by the professor (Abreu, 2009). As more institutions began to transition from the traditional method to PBL, the mixed method was developed. Today, this mixed method is used by a few medical schools in an attempt to capture elements of both methods: practical work is often introduced earlier in the program, but the students maintain their traditional theoretical classes with professors.

Learning and memory can be affected by stress. Although an optimal level of stress can enhance learning ability (Kaplan, 2007), too much stress can cause physical and mental health problems (Päivi M. Niemi & Vainiomäki, 1999), reduce students' self-esteem, and affect students' academic achievement (Saipanish, 2003).

Stress is a psychological change that is becoming ever more frequent among medical school students. Overall, medical students' psychological distress is consistently higher than that of the general population, and these stress levels may affect academic performance. They may also contribute to the development of mental disorders, anxiety, and substance abuse (which, in turn, may lead to dropout), as well as to depression and even thoughts of suicide (Nandi, Hazra, Sarkar, Mondal, & Ghosal, 2012).

In the case of Brazilian medical schools (which are considered undergraduate programs and in which students enroll after receiving a high school diploma), there are far more applicants than there are spaces. This gap generates substantial competition at both public and private universities. Students are already faced with high levels of stress before they enroll. Furthermore, research has found that, after being accepted, many students exhibit difficulty adapting to PBL teaching methods PBL (Lewis et al., 2009; Peruzzo, 2008).

In addition to the fact that new teaching methods can serve as stress factors for students, studies have shown that students' learning styles may influence their learning processes. In a study that was consistent with the literature, Alonso and Gallego (based on Keefe) defined learning styles as indicators of how students develop in their learning environments. These studies have considered individuals' ways of learning, interacting, and responding to different methods of education (Catalina M. Alonso, 1997; Silva, 2012).

Learning styles should be considered on an individual basis, since each student has his or her own learning style. When this individual style does not fit into the method used by the student's university, the clash may become another stress factor (Amaral; & Barros, 2007). In light of this information, the objective of this study was to identify any possible relationships between stress levels, individual learning styles, and the teaching

methods to which students are exposed.

Methods

1. Ethical Considerations

The study was approved by the Research Ethics Committee of the School of Medicine of São José do Rio Preto (FAMERP), in the state of São Paulo on September 28, 2015, under case number 48524815.0.0000.5415. All students who agreed to participate in the study were first informed of the research objectives and then signed a free and informed consent form as per Brazilian Board of Health (CNS) Resolution No. 196/96. Participants were assured that refusal to participate would not affect their course grades. They were informed that the information collected would be used exclusively in research for academic purposes, and the confidentiality of the information was guaranteed.

2. Study Design and Participants

The study design was cross-sectional and descriptive. The students who participated in the study were enrolled in one of two medical schools at universities in the state of São Paulo: Ceres University (FACERES) and the University of the West of São Paulo (UNOESTE), institutions with medical schools that employ different methodologies (PBL and the Traditional method, respectively). Students from the first semester of the program were used as the subjects of this study. The inclusion criteria included being a first-year medical student and less than 30 years of age. The exclusion criteria included having completed a prior degree program and being enrolled in the first semester for a second time.

The research was divided into two sections. The first goal was to identify the students' learning styles and the second was to identify each student's stress level after the first exam.

3. Questionnaires

In order to identify learning styles, the Honey-Alonso Learning Styles Questionnaire (Catalina M. Alonso, 1997) was applied. The questionnaire is comprised of 80 brief and dichotomous items structured into four 20-item groups, each of which corresponds to the four learning styles: active, reflexive, theoretical, and pragmatic. In this tool, all items are distributed randomly to form a single set. Due to the characteristics of the questionnaire, a single person can have a marked preference for more than one learning style (for example, a single person can be found to have simultaneous preferences for the theoretical and pragmatic styles). Exhibiting a high preference for a given style does not prevent students from having the potential for a dominance of other styles.

Students' stress levels were also determined using the Lipp Inventory of Stress Symptoms for Adults (ISSL) originally provided in Portuguese by Lipp (2000); therefore, language validation was not necessary. An additional questionnaire was applied to identify the participants' sociodemographic characteristics. The ISSL can evaluate whether the individual in question has any symptoms of stress, as well as the phase in which this individual finds him or herself (alert, resistance, near exhaustion, or exhaustion); the questionnaire also distinguishes between physical and psychological symptoms (LIPP, 2000).

4. Statistical Analysis

The descriptive analysis included absolute and relative frequencies for categorical variables and mean, median, standard deviation, and variation for continuous variables. The groups were compared using the Mann-Whitney U test when continuous data was not normally distributed and the chi-square test for categorical data. A descriptive level < 0.05 was considered significant. The statistical analysis was performed using the IBM-SPSS Statistics software, version 24 (IBM Corporation, NY, USA).

Results

A total of 135 medical students participated in this study, 50 of whom were from FACERES (the Active PBL method) and 85 of whom were from UNOESTE (the Traditional method). The sample was comprised of a higher number of female students (66%) than male students (43%), and the students' mean age was 19.63 years (SD ± 1.754). Based on the Honey-Alonso Learning Styles Questionnaire, the participants were distributed into one of the four learning styles (active, reflexive, theoretical, or pragmatic), and some of them mixed two or more learning styles. Most of the students at UNOESTE (60.4%) were found to prefer the reflexive learning style (60.4%), while the most preferred learning style among the FACERES students was reflexive (33%), followed by active (25%). Most of the students (67%) reported feeling stress (Table 1).

Table 1. Demographic data, stress levels, and learning styles among students learning based on PBL and the Traditional method.

		FACERES	UNOESTE	*p*-Value
Age in years	19 (17 - 28)	20 (17-28)	19 (16-26)	0.51
Gender				
Male	51 (43%)	19 (36.5%)	32 (33%)	0.66
Female	98 (66%)	33 (63.5%)	65 (67%)	
Learning style				
Active	26 (17%)	13 (25%)	13 (13.5%)	
Reflexive	75 (51%)	17 (33%)	58 (60.4%)	
Theoretical	16 (11%)	7 (13,5%)	9 (9.4%)	0.03
Pragmatic	13 (9%)	6 (11.5%)	7 (7.3%)	
Mixed	18 (12%)	9 (17%)	9 (9.4%)	
Stress status				
Yes	99 (67%)	37 (71%)	62 (64%)	0.37
No	50 (33%)	15 (29%)	35 (36%)	

Categorical variables are described as a number (percentage); continuous variables are described as a median (range).

The results of the ISSL scores (Table 2) show that most of the medical students studied herein felt levels of stress that fit into the resistance phase. However, some students were found to fit into the near exhaustion phase, which indicates a more severe stage of stress. Approximately 30% of the students were not found to exhibit signs of stress.

Table 2. Stress levels of medical students identified by ISSL scores.

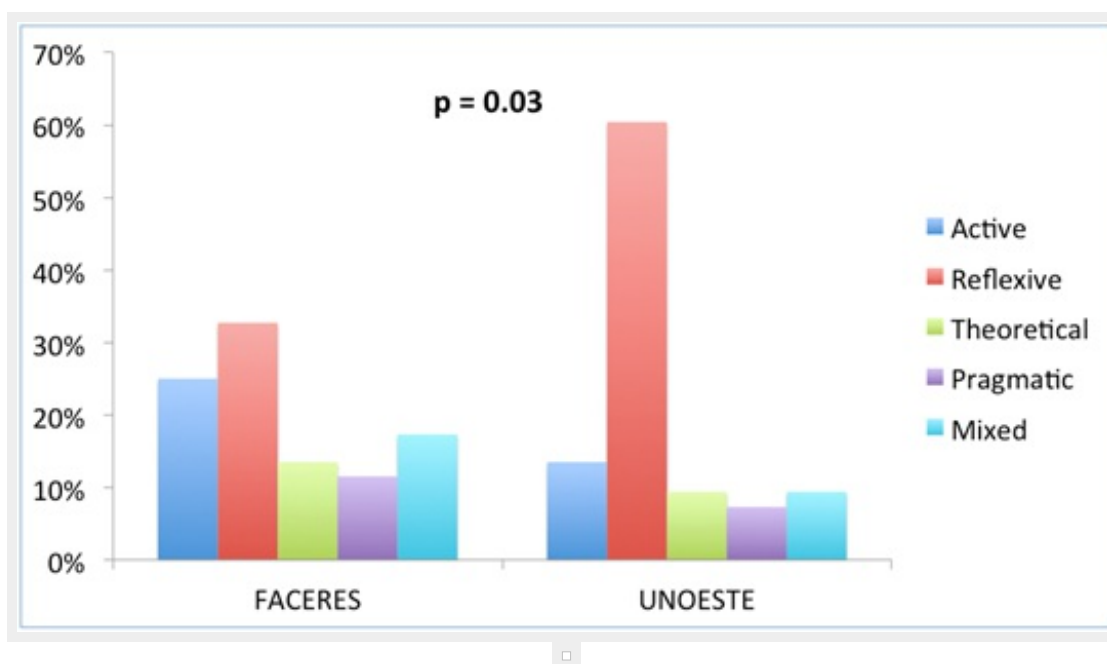|	STRESS		PHASE OF STRESS				PREDOMINANT SYMPTOMS	
	Yes	No	Alert	Resistance	Near Exhaustion	Exhaustion	Psychological	Physical
FACERES (Active PBL)	71.10%	28.86%	2.70%	81.08%	13.51%	2.70%	86.48%	24.32%
UNOESTE (Traditional)	68.24%	31.76%	3.45%	81.03%	12.07%	3.45%	75.86%	29.31%

Figure 1. Stress levels and learning styles among medical school students from two Brazilian universities

In the results, no significant differences were found between learning styles when they were considered in terms of the students' stress phases. When stress level and gender were considered together (Table 3), there were significantly higher scores among the stressed female students (72%) than among the stressed male students (55%).

Table 3. Comparative analysis considering stress levels relative to learning style

	Stress Status		p-Value
	No	Yes	
Age in years	19 (17-28)	19 (17-27)	0.4
Gender			
Male	23 (45%)	28 (55%)	0.03
Female	27 (28%)	71 (72%)	
Medical school			
FACERES (Active)	15 (29%)	37 (71%)	0.37
UNOESTE (Traditional)	35 (36%)	62 (64%)	
Learning Style			
Active	10 (38,5%)	16 (61,5%)	
Reflexive	22 (29%)	53 (71%)	
Theoretical	6 (37.5%)	10 (62.5%)	0.73
Pragmatic	6 (46%)	7 (54%)	
Mixed	6 (33%)	12 (67%)	

Categorical variables are described as a number (percentage); continuous variables are described as a median (range).

The medians obtained show the reflexive learning style to be the most commonly preferred learning style among the medical students assessed herein. However, learning style could not be evaluated in terms of stress levels using the chi-square test due to the limited sample size. There were no statistically significant differences between the universities.

Discussion

This study evaluated preferred learning styles and stress levels among medical students from two universities in the state of São Paulo that apply different teaching methods. All of the learning styles presented in the Honey-Alonso Learning Styles Questionnaire (Catalina M. Alonso, 1997) were found to be exhibited by these medical students, and the majority of the students were found to exhibit the reflexive learning style at both schools (60.4% at UNOESTE and 32.7% in FACERES) (Figure 1). This majority was followed by the active learning style (13.5% at UNOESTE and 25.0% at FACERES). Stress levels were determined using the

Inventory of Stress Symptoms for Adults, or the ISSL (LIPP, 2000), and the results showed high stress levels overall among the students (68.2% at UNOESTE and 74.0% at FACERES). The students' stress levels were found to be most commonly in the resistance phase (81%), and there was a predominance of psychological symptoms of stress over physical symptoms at both universities (75.86% of students at UNOESTE and 86.48% at FACERES). Female students were found to exhibit higher stress levels than their male counterparts (72% and 55%, respectively).

Although an optimal level of stress can enhance learning ability (Päivi M. Niemi & Vainiomäki, 1999), learning and memory can be affected by excessive stress. The findings of the present study are consistent with those of many other authors who report high levels of stress among medical students at the beginning of the program (Eva et al., 2015; Tavolacci et al., 2013; Verdonk, Rantzsch, de Vries, & Houkes, 2014). The stress questionnaire applied herein found a predominance of students in the resistance phase at both universities, a phase which is characterized as the extension of the alert phase. In this phase, the body is unable to return to the normal phase automatically and selects the most effective and economic channels to defend itself until cortisol levels decline. If the stressor is prolonged or exceeds the body's ability to defend itself, the individual in question typically enters the near exhaustion phase and may proceed to the exhaustion phase (Grossman & Carol Mattson Porth, 2014; LIPP, 2000). Lyndon et al. conducted a meta-analysis that evaluated the relationship between grades and psychological distress among medical students, and their findings suggest that academic performance decreases at high stress levels. This factor may be worthy of further analysis, since it suggests that the learning environment may also contribute to anxiety over grades (Lyndon et al., 2014).

The relatively high frequency of stress symptoms reported by approximately 70% of these students may be associated with their transition into university life. This period requires time for students to adapt to the differences in their new academic life; therefore, the stress levels reported herein may not be solely associated with the teaching method or the students' learning styles. Though our results showed a higher number of stressed students learning under the PBL methodology (FACERES) than under the Traditional method (UNOESTE), this data was not statistically significant. The results suggest that it is not the teaching method but the medical school program itself that triggers stress, given the relatively high number of students in the near exhaustion phase in both universities. Furthermore, important causes of stress among new medical students included the large amount of new information, limits on time, competition, fear of failing grades, and social problems, all of which can result in anxiety and depression (Aguiar, Vieira, Vieira, Aguiar, & Nóbrega, 2009; Saeed, Bahnassy, Al-Hamdan, Almudhaibery, & Alyahya, 2016). However, it is necessary to establish a balance between learning styles to decrease the possibility that stress will develop (Silva, 2012).

The association between gender and stress levels among medical students has been addressed in many studies. Some studies have claimed that the gender differences in mean stress levels are rare and not significant (P. M. Niemi & Vainiomaki, 2006). Another study found males to be more stressed than females, a difference which the authors argue may be due to male students' increased need to have high scores and complete their programs as quickly as possible in order to start their careers (Abdel Rahman, Al Hashim, Al Hiji, & Al-Abbad, 2013). Most studies, including the present study, found that females reported much higher levels of stress than males (Abdulghani, AlKanhal, Mahmoud, Ponnamperuma, & Alfaris, 2011; Saeed et al., 2016). The inconsistency of gender association with stress among medical students may be to the result of differences in social and educational environments, as well as of subjectivity in measuring self reported stress.

It would be interesting to study these students later in their program, when they are more likely to have adapted to medical school. A future study could help to eliminate the confounding factors that were likely to have

influenced stress levels in this study, such as the fact that many of the students were living alone for the first time. (As mentioned previously, Brazilian medical schools are similar to undergraduate programs in that students enroll immediately after high school or, in some cases, after a year or two of pre-university preparatory courses).

Although an optimal level of stress can enhance learning ability (Rafidah, 2009), too much stress can cause physical and mental health problems (Päivi M. Niemi & Vainiomäki, 1999), reduce students' self-esteem (Linn & Zeppa, 1984; Silver & Glicken, 1990), and affect students' academic achievement. In this study, no association was found between stress and learning style; however, it was an innovative study that determined that further efforts are required to make the medical education environment more productive and less stressful for students.

Conclusion

Previous studies have shown that stress is a very important finding among medical students and working physicians alike. These stress levels could lead to burnout syndrome and may have negative consequences for patients, regardless of the program methodology or students' learning styles; high stress levels among both physicians and medical students should therefore be avoided. This is the first study to compare stress levels, learning styles, and teaching methodologies at two different medical schools.

Take Home Messages

- Medical students are more stressed than the general population and this stress level occurs at the beggining of the program and can affect academic performance.
- Female students were found to exhibit higher stress levels than their male counterparts.
- In this study, no association was found between stress and learning style.
- The majority of the students were found to exhibit the reflexive learning style at two different teaching methods.
- It is not the teaching method but the medical school program itself that triggers stress.

Notes On Contributors

Fernanda Fortuci Resende Botelho is a medical student at Faceres Medical School, São José do Rio Preto, São Paulo, Brazil.

Ingrid Bergamo is a psicologist and post graduate student in Faculdade de Medicina de São José do Rio Preto, São Paulo, Brazil.

Mariana Carvalho de Oliveira is a medical student at Universidade do Oeste Paulista, Presidente Prudente, SP, Brazil,

Fulvio Bergamo Trevizan is a psicologist and post graduate student in Faculdade de Medicina de São José do Rio Preto, São Paulo, Brazil.

Felipe Colombelli Pacca, MSc, is a Professor in the Division of Medical Education, Faceres Medical School,

São José do Rio Preto, São Paulo, Brazil.

Patricia Fucuta, PhD; is a Professor in the Division of Medical Education, Faceres Medical School, São José do Rio Preto, São Paulo, Brazil

Carolina Colombelli Pacca, PhD; is a Professor in the Division of Medical Education, Faceres Medical School, São José do Rio Preto, São Paulo, Brazil

Patricia Maluf Cury, PhD; is a Professor and Coordinator at Faceres Medical School, São José do Rio Preto, São Paulo, Brazil.

Acknowledgements

Bibliography/References

Abdel Rahman, A. G., Al Hashim, B. N., Al Hiji, N. K., & Al-Abbad, Z. (2013). Stress among medical Saudi students at College of Medicine, King Faisal University. J Prev Med Hyg, 54(4), 195-199.

Abdulghani, H. M., AlKanhal, A. A., Mahmoud, E. S., Ponnamperuma, G. G., & Alfaris, E. A. (2011). Stress and its effects on medical students: a cross-sectional study at a college of medicine in Saudi Arabia. J Health Popul Nutr, 29(5), 516-522.

https://doi.org/10.3329/jhpn.v29i5.8906

Aguiar, S. M., Vieira, A. P. G. F., Vieira, K. M. F., Aguiar, S. M., & Nóbrega, J. O. (2009). Prevalência de sintomas de estresse nos estudantes de medicina. Jornal Brasileiro de Psiquiatria, 58, 34-38.

https://doi.org/10.1590/S0047-20852009000100005

Amaral, S. F. d., & Barros, D. M. V. (2007). Estilos de aprendizagem no contexto educativo de uso das tecnologias digitais interativas. http://lantec.fae.unicamp.br/lantec/pt/tvdi_portugues/daniela.pdf

Catalina M. Alonso, D. J. G., Peter Honey. (1997). Los estilos de aprendizaje: procedimentos de diagnóstico y mejora. Bilbao: Mensajero.

Eva, E. O., Islam, M. Z., Mosaddek, A. S., Rahman, M. F., Rozario, R. J., Iftekhar, A. F., Haque, M. (2015). Prevalence of stress among medical students: a comparative study between public and private medical schools in Bangladesh. BMC Res Notes, 8, 327.

https://doi.org/10.1186/s13104-015-1295-5

Grossman, S., & Carol Mattson Porth, R. N. P. D. (2014). Porth's Pathophysiology: Concepts of Altered Health States: Lippincott Williams & Wilkins.

Hart, L. (1977). Medicine at McMaster; an innovative programme for undergraduates. S Afr Med J., 51(9), 282-284.

Kaplan, B. J. S. V. A. S. H. I. (2007). Kaplan & Sadock's synopsis of psychiatry: behavioral sciences/clinical psychiatry (10th ed ed.). Philadelphia Wolter Kluwer/Lippincott Williams & Wilkins.

Lewis, A. D., Menezes, D. A., McDermott, H. E., Hibbert, L. J., Brennan, S. L., Ross, E. E., & Jones, L. A. (2009). A comparison of course-related stressors in undergraduate problem-based learning (PBL) versus non-PBL medical programmes. BMC Med Educ, 9, 60.

https://doi.org/10.1186/1472-6920-9-60

Linn, B. S., & Zeppa, R. (1984). Stress in junior medical students: relationship to personality and performance. J Med Educ, 59(1), 7-12.

https://doi.org/10.1097/00001888-198401000-00002

LIPP, M. E. N. (2000). Inventário de sintomas de stress para adultos de Lipp (ISSL). São Paulo: Casa do Psicólogo.

Lyndon, M. P., Strom, J. M., Alyami, H. M., Yu, T. C., Wilson, N. C., Singh, P. P., Hill, A. G. (2014). The relationship between academic assessment and psychological distress among medical students: a systematic review. Perspect Med Educ, 3(6), 405-418.

https://doi.org/10.1007/s40037-014-0148-6

Nandi, M., Hazra, A., Sarkar, S., Mondal, R., & Ghosal, M. K. (2012). Stress and its risk factors in medical students: an observational study from a medical college in India. Indian J Med Sci, 66(1-2), 1-12.

https://doi.org/10.4103/0019-5359.110850

Niemi, P. M., & Vainiomaki, P. T. (2006). Medical students' distress--quality, continuity and gender differences during a six-year medical programme. Med Teach, 28(2), 136-141.

https://doi.org/10.1080/01421590600607088

Niemi, P. M., & Vainiomäki, P. T. (1999). Medical Students' Academic Distress, Coping, and Achievement Strategies During the Preclinical Years. Teaching and Learning in Medicine, 11(3), 125-134.

https://doi.org/10.1207/S15328015TL110302

Peruzzo, A. S., Cattani, B. C., Guimarães, E. R., Boechat, L. de C., Argimon, I. I. de L. & Scarparo, H. B. K. (2008). Estresse e vestibular como desencadeadores de somatizações em adolescentes e adultos jovens. Psicologia e Argumento, 26(55), 319-327.

Rafidah, K., Azizah, A., Norzaid, M. D., Chong, S. C., Salwani, M. I. & Noraini, I. (2009). The Impact of Perceived Stress and Stress Factors on Academic Performance of Pre-Diploma Science Students: A Malaysian Study. International Journal of Scientific Research in Education, 2, 13-26.

Saeed, A. A., Bahnassy, A. A., Al-Hamdan, N. A., Almudhaibery, F. S., & Alyahya, A. Z. (2016). Perceived stress and associated factors among medical students. J Family Community Med, 23(3), 166-171.

https://doi.org/10.4103/2230-8229.189132

Saipanish, R. (2003). Stress among medical students in a Thai medical school. Med Teach, 25(5), 502-506.

https://doi.org/10.1080/0142159031000136716

Silva, L. L. V. (2012). Styles and learning strategies of university students. (Master), USP, São Paulo.

Silver, H. K., & Glicken, A. D. (1990). Medical student abuse. Incidence, severity, and significance. JAMA, 263(4), 527-532.

https://doi.org/10.1001/jama.1990.03440040066030

Tavolacci, M. P., Ladner, J., Grigioni, S., Richard, L., Villet, H., & Dechelotte, P. (2013). Prevalence and association of perceived stress, substance use and behavioral addictions: a cross-sectional study among university students in France, 2009-2011. BMC Public Health, 13, 724.

https://doi.org/10.1186/1471-2458-13-724

Verdonk, P., Rantzsch, V., de Vries, R., & Houkes, I. (2014). Show what you know and deal with stress yourself: a qualitative interview study of medical interns' perceptions of stress and gender. BMC Med Educ, 14, 96.

https://doi.org/10.1186/1472-6920-14-96

Appendices

Declaration of Interest

The author has declared that there are no conflicts of interest.