A peer-reviewed version of this preprint was published in PeerJ on 12 March 2015.

Association of academic stressors with sleep disturbances in medical students: is psychological stress a mediator?

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Introduction: Medicine is one of the most stressful fields of education because of its highly demanding professional and academic requirements. Psychological stress, anxiety, depression and sleep disturbances are highly prevalent in medical students. **Methods:** This cross-sectional study was undertaken at CMH Lahore Medical College and Institute of Dentistry in Lahore, Pakistan, and was approved by the CMH LMC Research Ethics Committee. Students enrolled in all yearly courses for the MBBS degree were included. The questionnaire consisted of four sections: 1) demographics 2) a table listing 34 potential stressors, 3) the 14-item Perceived Stress Scale (PSS-14), and 4) the Pittsburgh Quality of Sleep Index (PSQI). Data were analyzed in SPSS v. 20. Logistic regression was run to identify associations between group of stressors, gender, year of study, student's background, stress and quality of sleep. **Results:** Total response rate was 93.9% (263/280 respondents returned the questionnaire). The mean PSS-14 score was 30.04 (6.97). Logistic regression analysis showed that cases of high-level stress were associated with year of study and academic-related stressors only. Univariate analysis identified 157 cases with high stress levels (59.7%). The mean PSQI score was 8.09 (3.12). According to PSQI score, 203/263 respondents (77.02%) were poor sleepers. Logistic regression showed that mean PSS-14 score was a significant predictor of PSQI score (OR 1.99, P<0.05). **Conclusion:** We found a very high prevalence of academic stress and poor sleep quality among medical students. Many medical students reported using sedatives more than once a week. Academic stressors contributed significantly to stress and sleep disorders in medical students.

1   **Association of academic stressors with sleep disturbances in medical students: is**

2   **psychological stress a mediator?**

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Introduction

20

21 Medicine is one of the most stressful fields of education because of its highly demanding

22 professional and academic requirements. Extensive medical curricula, frequent examinations and

23 fear of failure are sources of constant stress and anxiety for medical students (1), who may cut

24 short their leisure activities and hours of sleep in order to achieve their desired goals. Several

25 studies have reported a high incidence of stress disorders among medical students. According to

26 a systematic review published in 2006, US and Canadian medical students suffer from a higher

27 incidence of psychological distress, anxiety, depression and suicidal ideation than the general

28 population (2). Sherina et al. reported that 41% of Malaysian medical students suffered from

29 psychological stress, which correlated directly with depressive symptoms (3). Several other

30 studies have reported the prevalence of psychological morbidity in medical students of different

31 nationalities. This prevalence was reported to be 20.9% in Nepal (4), 63.8% in Saudi Arabia (5)

32 and 90% in Pakistan (6). It should be noted, however, that these studies used psychometric

33 instruments which are not completely transposable to the DSM diagnostic criteria for psychiatric

34 illnesses. Nevertheless, psychological stress among medical students may have deleterious

35 consequences by leading to poor academic performance (7), sleep disorders (8), alcohol and

36 substance abuse (9), decreased empathy, poor attitude towards the chronically ill and cynicism

37 (10).

38   Several studies have also reported poor sleep quality in medical students. Aftab et al.

39 found that the prevalence of disturbed sleep patterns among Pakistani medical students was

40 higher than in their non-medical counterparts (11). Psychological stress is a triggering factor for

41 insomnia and has a bidirectional association with poor sleep quality (12). Thus, it represents a

42 vicious cycle that is associated with adverse mental health consequences in medical students.

43 Poor sleep quality is also associated with dysregulation of the human metabolome (13), high

44 failure rates and poor academic performance (14).

45   Most of the medical schools in Punjab, Pakistan offer a 5-year-long MBBS degree

46 program divided into 2 preclinical years followed by 3 clinical years. These schools use

47 conventional non-problem-based learning (PBL) teaching methods, which consist of teacher-

48 centered didactic techniques, long lectures, tutorials and practical tasks. Students are frequently

49 assessed with written, oral or practical examinations throughout the year, and each year ends

50 with a final exam held by the University of Health Sciences in Lahore. A passing grade on this

51 exam is necessary to qualify for the next academic year. According to Shah et al., Pakistani

52 medical students who reported academic stressors were 3.45 times more likely to be suffering

53 from psychological stress than their counterparts (1).

54   Sir William Osler was a strong opponent of conventional teaching methods and

55 examinations, which he believed was a system of education designed for simpler times. By the

56 early 20th century, the ever-growing complexity of medical sciences along with the expansion of

57 the medical curriculum had already proven to be a burden on teachers as well as medical students

58 (15). At present, 100 years after Osler's call for educational reform in the teaching of medicine,

59 medical curricula around the world should be brought into consonance with recommendations

60 from experts in education and mental health.

61   This study was designed with two aims: 1) to determine the prevalence of psychological

62 stress and sleeping difficulties among medical students, and 2) to explore how academic stressors

63 mediate between psychological stress and poor sleeping habits among medical students.

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65

66 **Methodology**

67 <u>**Study design**</u>

68 This cross-sectional study was done at CMH Lahore Medical College (LMC) and Institute of

69 Dentistry, Lahore (Pakistan) after approval by the CMH LMC Research Ethics Committee.

70 Students from all yearly courses of the MBBS degree program were included in this study, which

71 took place from August, 2014 to September, 2014. The sample size required for this survey was

72 calculated as 251 participants for an assumed response distribution of 50%, a 95% confidence

73 level and a 5% margin of error. Students were randomly selected with a stratified sampling

74 technique. First the students were divided into groups based on their year of study. Then random

75 numbers were generated using computer software. A total of 280 self-administered

76 questionnaires were distributed to potential respondents to ensure an adequate percentage

77 response rate. Written informed consent was obtained from all participants. They were informed

78 about the aims of this study and assured anonymity and that only group-level findings would be

79 reported.

80

81 <u>**Questionnaire**</u>

82 The questionnaire consisted of four sections: 1) demographics 2) a table listing 34 potential

83 stressors, 3) the 14-item Perceived Stress Scale (PSS-14), and 4) the Pittsburgh Quality of Sleep

84 Index (PSQI). The demographics section recorded data for participants' age, gender, year of

85 study, residence and background. The table of potential stressors was adapted from a study in

86 Nepal by Sreeramareddy et al. (4) and used to obtain data on the frequency and severity of each

87 potential stressor. Frequency was reported as never, rarely, sometimes, often or always, and

88 severity was rated with a Likert-type response scale of increasing severity from 1 to 10.

89   The PSS-14, developed by Sheldon Cohen (16), is one of the most widely used

90   psychological instruments to measure perceived stress. It comprises 7 positively-stated and 7

91   negatively-stated items, and is scored by reverse coding the negatively-stated items and then

92   summing the scores for all 14 items. The scores range from 0 to 56 with higher scores indicating

93   higher levels of stress.

94   The fourth section of the questionnaire consisted of the PSQI, a self-rating questionnaire

95   that assesses sleep quality and disturbances during the preceding month. This instrument

96   comprises 19 individual items and yields an overall score ranging from 0 to 21. Participants who

97   score higher than 5 are considered poor sleepers. It also yields scores on seven other

98   components: subjective sleep quality, sleep latency, sleep duration, habitual sleep efficiency,

99   sleep disturbance, use of sleeping medication and daytime dysfunction (17).

100

101   **Data analysis**

102   Al data were analyzed in SPSS v. 20 software. Frequencies were calculated for demographic

103   variables. Mean PSS-14 scores were calculated and divided into quartiles, then further recoded

104   as a dichotomous variable by combining the upper two quartiles and lower two quartiles (cut-off

105   value = 28). These values were recoded as 1 = high stress levels and 0 = low stress levels, as in

106   an earlier study from Pakistan (1). The frequencies of stressors were grouped into dichotomies as

107   follows: Never/rarely/sometimes = 0 and often/always = 1. These stressors were also grouped

108   into three domains: psychosocial stressors, academic stressors and health-related stressors. Mean

109   severity of stressors was calculated. Logistic regression was used to identify the determinants of

110   perceived stress. The PSS-14 score was used as a dependent variable and age, year of study,

111   gender, residence, background, psychosocial stressors, health-related stressors and academic

112 stressors were used as dependent variables. Logistic regression was used to identify associations

113 between PSS-14 scores and PSQI scores (dichotomous variable). The mediating effects of

114 academic stressors were analyzed with simple linear regression. First, academic stressor scores

115 were entered as a predictor of PSQI score in model 1. Then, in model 2, PSS-14 scores were

116 added as a predictor to analyze their controlling effects.

117

118 **Results**

119 **<u>Demographic characteristics</u>**

120 Total response rate was 93.9% (263 of 280 respondents returned the questionnaire). Mean age of

121 respondents was 21.07 years (1.78). The gender distribution of the respondents was 148 women

122 (56.3 %) vs. 115 men (43.7%). Most participants were of Pakistani background (220, 83.7%) and

123 the remaining 43 respondents (16.3%) were of other nationalities. Most of the participants

124 resided off the medical school campus (161, 61.2%) and the remaining 102 (38.2%) resided in

125 student residence facilities. The distribution according to year of study was 1st year 58 (22.05%),

126 2nd year 67 (25.475%), 3rd year 48 (18.25%), 4th year 45 (17.11%) and 5th year 45 participants

127 (17.11%).

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129 **<u>Perceived stress</u>**

130 Mean PSS-14 score was 30.04 (6.97). According to logistic regression analysis, cases of high-

131 level stress were associated with year of study and academic stressors only (Table 1). Univariate

132 analysis identified a total of 157 cases with high stress levels (59.7%). Most respondents with

133 high levels of stress were 2nd-year students (48, 71.6%) and 5th-year students (32, 71.1%),

134 followed by 1st-year (29, 50%), 3rd-year (24, 50%) and 4th-year students (24, 53.3%).

135

Stressors

The frequency and severity are shown for academic stressors in Table 2, psychosocial stressors

in Table 3, and health-related stressors in Table 44. The frequency of different stressors was

reported as often/always by 147 (55.9 %) respondents for academic stressors, 45 (17.1%) for

psychosocial stressors, and 48 (18.3%) for health-related stressors.

141

Quality of sleep

Mean PSQI score was 8.09 (3.12). According to these scores, 203/263 respondents (77.02%)

were poor sleepers. Logistic regression showed that mean PSS-14 score was a significant

predictor of PSQI score (OR 1.99, P<0.05). During the month preceding the survey, 73 (27.8%)

respondents got less than 5 hours of sleep per day, 233 (88.6%) reported nighttime disturbances,

97 (36.9%) poor sleep latency, 128 (48.7%) daytime dysfunctioning, 94 (35.7%) poor sleep

quality and 31 (11.8%) poor sleep efficiency. A few respondents 13 (4.9%) reported using

sedatives more than once a week.

The chi-squared test revealed a significant association between stress and poor quality of

sleep (chi-squared = 5.48, P<0.05). The prevalence of poor quality of sleep among stressed

students was 82% (129/157), whereas among non-stressed students, only 69.8% were poor

sleepers. Linear regression was used to analyze the controlling effects of PSS-14 scores on the

association between academic stressors and PSQI scores. For this purpose, two models were

created. First, the score for academic stressors was added as a predictor. This yielded a model

that explained 3.8% of the variation in PSQI scores. Then in model 2, PSS-14 scores were

introduced, which increased the effect size of the model ($R^2 = 0.125$). However, including the

158   PSS-14 scores in model 2 decreased the beta value of academic stressors, which became

159   nonsignificant (Table 5).

160

161   **Discussion**

162   Our sample consisted of medical students enrolled at a privately financed Pakistani medical

163   school which favors a strictly teacher-centered, non-PBL conventional teaching environment.

164   We aimed to explore the association, in a conventional learning environment, between academic

165   stressors, psychological stress and sleeping difficulties among medical students. Our results

166   document a high prevalence of psychological stress (59.7%) and poor sleep quality (77.02%),

167   which is in consonance with earlier studies conducted in Pakistan. Most of the respondents

168   (55.9%) indicated that they often or always experienced academic stressors, and this subgroup

169   was 2.5 times as likely to suffer from psychological stress and poor sleep quality as their non-

170   stressed counterparts. These results underscore the importance of nurturing a positive learning

171   environment for medical students.

172   An interesting finding in our analysis was that both male and female students were

173   equally likely to experience stress and sleep disturbances. This result is consistent with a report

174   by Cohen and colleagues, who found no significant association between stress levels and gender

175   in a sample of college students (16). In 2004, a systematic review of anxiety and depression in

176   the general community reported a higher prevalence of depression in women (mean point

177   prevalence 45.5%) than in men (18). Similarly, according to Shah and colleagues, female

178   medical students were more likely to experience stress than male medical students (1). Our study

179   was based at a privately financed medical school, where most of the medical students belong to

180   higher socioeconomic classes and might be assumed to come from a more tolerant cultural

181   background. Therefore, these students might not be exposed to the same psychosocial stressors

182   as students from a more gender-sensitive and patriarchal environment. Medical students enrolled

183   in their 2nd and 5th (final) year of the MBBS program experienced higher levels of stress. This

184   might be due to the extensive teaching curriculum in the 2nd year, and due to the introduction of

185   clinical subjects and clerkships in the final year of the MBBS degree program.

186   Another interesting finding in our study was that 77.02% of the medical students reported

187   poor sleep quality, which was significantly associated with academic stressors. A high

188   percentage of respondents (27.8%) got less than 5 hours of sleep per night. This is in consonance

189   with a large-scale study of 2515 Ethiopian university students, 55.8% of whom reported poor

190   sleep quality. That study also reported a strong association between poor sleep quality, stress,

191   anxiety and depression (8). Drug misuse to induce sleep was reported by 4.9% of the students.

192   Zafar et al., in their survey of four universities in Karachi, Pakistan, found a high prevalence of

193   self-medication by students. More than 33 (7.6%) of their participants reported insomnia as a

194   reason for self-medication, and 44 (10%) participants admitted to the misuse of sleeping pills

195   (19). The relatively high use of sleep-inducing medication may have been related with the fact

196   that Pakistani pharmacies sell these drugs without a prescription. According to a 2005 survey, an

197   alarming proportion of Pakistani pharmacies (50/311, 16.1%) reported selling this type of

198   medication without a prescription (20). Our analysis showed that 94 (35.7%) respondents

199   complained of daytime sleepiness. People with daytime sleepiness because of insomnia have

200   lower self-esteem and are three times as likely to be involved in road accidents as their well-

201   rested counterparts (21).

202   Our results are consistent with previous studies at medical schools in Nepal (4) and

203   Pakistan (1) that reported a strong association between academic stressors and psychological

204 morbidity. Both of the schools involved in those studies had a conventional teaching

205 environment. However, the stress associated with a conventional teaching environment can be

206 reduced. The ultimate aim of medical education should be to produce competitive but

207 compassionate, reflective, self-reliant and empathetic doctors. But the stressful environment of

208 medical schools leads to "hardening of [the] heart during medical school" i.e. a decline in the

209 capacity of medical students to empathize (22). Due to academic stress together with high

210 academic and professional expectations, medical students also report suicidal ideation during

211 their school years (23). But these statistics might be underreported in Pakistan because of public

212 stigma revolving around psychiatric illnesses in medical students (24). In April, 2014, DAWN

213 News reported an incident involving a student named Shahnawaz of Islamabad, who failed his

214 3rd-year final examination and reportedly committed suicide by throwing himself in front of a

215 moving train (25).

216   To address this grave situation, effective screening for psychological stress, anxiety and

217 depression in medical students, along with psychotherapeutic and educational interventions,

218 should be introduced at Pakistani medical schools. Long-term plans should be devised to

219 introduce changes in the medical curriculum to make it less rigid and burdensome on students.

220 New teaching methods should be implemented at Pakistani medical schools to make the learning

221 environment more student-friendly and enjoyable. There is overwhelming evidence that students

222 in the Indian subcontinent perceive positively and welcome PBL methods. A study that

223 compared perceptions towards PBL experiences reported that medical students found these

224 approaches to be better at enhancing team work, interpersonal relationships, motivation and

225 personal enjoyment, and at favoring positive attitudes towards information-gathering, reasoning

226 and independent thinking (26). Students in a PBL curriculum reported better quality of life,

227 perhaps because of the spare time available for self-study and the greater freedom and autonomy

228 to manage their time (27). A randomized controlled trial concluded that mindfulness-based stress

229 reduction programs resulted in mental well-being and improved quality of life in medical and

230 psychology students (28). In their metaanalysis, Shapiro et al. provided overwhelming evidence

231 of improvement in the psychological well-being of medical students who underwent stress

232 reduction programs such as mindfulness-based stress reduction, hypnosis, desensitization,

233 progressive muscle relaxation, social support and group therapy (29). Such programs also

234 improve participants' spirituality, empathy, positive coping skills and conflict resolution skills

235 (29). Studies should be done to determine the feasibility of campus-based psychological support,

236 stress reduction and relaxation-based interventions such as mindfulness training at Pakistani

237 medical schools.

238

239 **Conclusion**

240 Our study revealed a high prevalence of academic stress and poor sleep quality among medical

241 students in Lahore. Many medical students reported using sedatives more than once a week.

242 Academic stressors contributed significantly to perceived stress and sleep disorders. Steps should

243 be taken to implement student-centered syllabi and teaching modes in Pakistani medical schools.

244

245 **Acknowledgments**

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347 Table 1: Determinants of stress according to logistic regression analysis

Determinants	Odds ratio (OR)	95% CI for OR
Age	0.880	0.651-1.190
Gender		
Female	1	
Male	1.339	0.748-2.397
Residence		
National	1	
International	0.914	0.508-1.645
Residence		
Off-campus residence	1	
On-campus residence	1.291	0.606-2.750
Year*		
1st	0.197	0.039-.999
2nd	0.563	0.151-2.11
3rd	0.291	0.086-0.987
4th	0.347	0.126-0.957
5th	1	
Psychosocial stressors	1.231	0.571-2.652
Academic stressors**	2.470	1.424-4.284
Health-related stressors	0.818	0.389-1.721

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349 Notes: R^2 = 0.095 (Cox & Snell), 0.128 (Nagelkerke). Model chi-squared value = 26.258 (11).

350 * Denotes P< 0.05, **denotes P< 0.01.

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356 Table 2: Frequency and severity of academic stressors

Academic stressors	Often/Always response	Response percentage	Severity
Exam frequency	190	73.6%	7
Academic performance	148	57.4%	7
Academic curriculum	125	48.4%	6
Dissatisfaction with class lectures	86	33.3%	6
Unavailability of learning materials	55	21.3%	5
Becoming a doctor	106	41.1%	6
Lack of leisure time	123	47.7%	6
Competition with peers	77	29.8%	5
Performance in practica	73	28.3%	5

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380 Table 3: Frequency and severity of psychosocial stressors

Psychosocial stressors	Often/Always response	Response percentage	Severity of stressors
High parental expectations	137	53.1%	7
Loneliness	64	24.8%	5
Family problems	62	24%	5
Living away from home	66	25.6%	6
Political situation of country	42	16.3%	5
Relations with opposite sex	41	15.9%	5
Difficulty reading textbooks	51	19.8%	5
Lack of entertainment in Lahore	71	27.5%	5
Difficulty with the journey back home	45	17.4%	5
Quality of cafeteria food	100	38.8%	7
Financial strain	49	19%	5
Inability to socialize with peers	26	10.1%	7
Living conditions in student residence	49	19%	6
Member of fraternity or sorority	14	5.4%	5
Lack of personal interest in medicine	28	10.9%	5
Adjustment with roommate	37	14.3%	5
Lack of special guidance from faculty	70	27.1%	5

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387 Table 4: Frequency and severity of health-related stressors

Health-related stressors	Often/Always response	Response percentage	Severity
Power failures	139	53.9%	7
Difficulty sleeping	101	39.1%	6
Class attendance	112	43.4%	7
Nutrition	75	29.1%	6
Exercise	77	29.8%	6
Quality of cafeteria food	85	32.9%	7
Physical disability	10	3.9%	5
Substance abuse	16	6.2%	5

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415 Table 5: Multiple linear regression model for variables associated with scores indicating
416 Sleeping difficulties on the Pittsburgh Quality of Sleep Index in medical students in Lahore,
417 Pakistan, August-September, 2014. (N = 263)
418

Model	Predictors	B	Standard error	Beta
Model 1 Adjusted R^2 = 0.038	Academic stressors*	1.000	0.297	0.204
Model 2 Adjusted R^2 = 0.125	Academic stressors	0.457	0.302	0.093
	PSS-14**	0.146	0.028	0.321

419 Notes: * Denotes P=0.001, ** denotes P<0.001.
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