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Association of severity of depressive symptoms with sleep quality, social support and stress among Pakistani medical and dental students: A cross-sectional study

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Abstract

Objectives: This study has been designed to elucidate the prevalence of stress, depression and poor sleep among medical students in a Pakistani medical school. There is a paucity of data on social support among medical students in Pakistan; an important predictor of depressive symptoms. Therefore, this study was also aimed to demonstrate the direct and indirect impact of social support in alleviating depressive symptoms in the study sample.

Methods: This observational cross-sectional study was conducted in Lahore, Pakistan, where a total of 400 students at a medical school were approached between 1st January to 31st March 2018 to participate in the study. The study sample comprised of medical and dental students enrolled at a privately financed Pakistani medical and dental school. The participants responded to a self-administered survey comprising of five parts: a) demographics, b) Pittsburgh Sleep Quality Index (PSQI), c) Patient Health Questionnaire-9 (PHQ-9), d) Multidimensional Scale of Perceived Social Support (MSPSS) and e) Perceived Stress Scale-4 (PSS-4). All data were analysed using SPSS v. 20. Linear regression analysis was used to reveal the predictors of depression.

Results: In total, 353 medical students participated, yielding a response rate of 88.25%. Overall, poor sleep quality was experienced by 205 (58.1%) students. Mild to severe depression was reported by 83% of the respondents: mild depression by 104 (29.5%), moderate depression by 104 (29.5%), moderately severe depression by 54 (15.3%) and severe depression by 31 (8.8%) respondents. Subjective sleep quality, sleep latency, daytime dysfunction and stress levels were significantly associated with depression symptoms. Social support was not significantly associated with depressive symptoms in the regression model (Beta = -0.08, P < 0.09); however, it acted as a significant mediator, reducing the strength of the relationship between depressive symptoms and sleep quality and stress.

Conclusions: According to our study, a large proportion of healthcare (medical and dental) students were found to be suffering from mild to moderate depression and experienced poor sleep quality. It is concluded that social support is an important variable in predicting depressive symptomatology by ameliorating the effects of poor sleep quality and high stress levels.

Keywords

Sleep, Pittsburgh Sleep Quality Index, stress, depression, social support, patient health questionnaire, medical students, Pakistan

INTRODUCTION

Admission to medical colleges is associated with a feeling of accomplishment and satisfaction amongst most physicians-in-training. However, the demanding educational and training environment in preclinical and clinical years has been shown to be emotionally taxing in many published studies (Kiessling et al., 2004; Popa-Velea et al., 2017a). Owing to this emotional exhaustion, a continuous down-spiralling of psychological and physical health has been reported among these students; overburdened by monotonous schedules, extensive curricula, a highly competitive environment and excessive self-demands and professional expectations (Popa-Velea et al., 2017b; Tempski et al., 2012).

This challenging environment leads to serious consequences including burn-out syndrome (Dyrbye et al., 2008; Popa-Velea et al., 2017a), alexithymia, psychological distress (Popa-

Velea et al., 2017a), sleep disorders, cynicism and depressive symptoms (Lemma et al., 2012; Thomas et al., 2007). Serious comorbidities like alcohol and substance abuse (Ball and Bax, 2002) and suicidal and self-harming behaviours can also ensue (Dyrbye et al., 2011, 2008). In their longitudinal investigation (Rosal et al., 1997), Rosal and Ockene revealed that the rise in depression scores among American medical students persists over time and is chronic and persistent rather than episodic. These future healthcare providers may succumb to increased psychological distress, which can lead to a decline in empathy and resilience and poor doctor-patient relationships (Hojat et al., 2002; Howe et al., 2012; Thomas et al., 2007). Moreover, continuous exposure to human suffering and tragic events such as patient deaths and ethical conflicts further add to these issues (Murphy et al., 2009; Tempski et al., 2012). Recent studies have also revealed that training for healthcare professionals fails to inculcate qualities like resilience and self-efficacy among them (Howe et al., 2012). The aforementioned issues are shown to be significantly associated with medical errors, communication issues, cynicism and patient dissatisfaction (Hafferty and Franks, 1994; Popa-Velea et al., 2017a; West et al., 2006).

In recent years, social support has garnered a lot of attention in the public mental health investigations in the general population (Silva et al., 2014). It has been found to be a significant predictor of a number of psychiatric ailments including stress and depression. However, data regarding social support among Pakistani healthcare students is lacking. A recent Iranian study emphasized the poor social support networks among students, reporting low social support among 60% of medical students (Zamani-Alavijeh et al., 2017). This poor social support translates into a large proportion of students with poor help-seeking skills, thus, concealing their emotional behavioural difficulties (Walter et al., 2013; Ahmed Waqas et al., 2014).

Social support is also associated with numerous physical and psychosocial health benefits. It enhances empathy in medical students, which might be an indicator of its stress buffering effects (Park et al., 2015). Poor interpersonal support is associated with increased prevalence of major depressive disorder, generalized anxiety, social phobia, sleep problems and several physical health problems (Jeong et al., 2010b; Moak and Agrawal, 2010). Therefore, social support acts as a mediator, buffering the harmful effects of stressful events on depression. A number of studies have been conducted on the prevalence of psychiatric symptomatology among healthcare students in Pakistan (Ahmad et al., 2015; Haddad et al., 2017, 2016; A Waqas et al., 2014; Waqas et al., 2016, 2015b, 2015a, 2015c). However, none of these have focused on elucidating social support patterns and its buffering effects on depressive symptomatology, thus, warranting this study. Therefore, this study tests following hypotheses (Heun, 2018):

H_1: Stress levels and sleep quality are associated with depressive symptoms among medical students.

H_2: Social support is a significant mediator, suppressing the relationship of depressive symptoms with stress levels and sleep quality among medical students.

METHODS

Study setting and participants

This observational cross-sectional study was conducted in Lahore, Pakistan, where a convenient sample of a total of 400 students at CMH Lahore Medical College & Institute of Dentistry in Lahore was approached face to face during their class hours, from 1st January to 31st March 2018 to participate in this study. Students belonging to all years of study and degree courses (Medicine & Dentistry) were included in the study, with no exclusion criteria based on age, gender or background of participants. Convenience sampling method was employed to recruit the study participants. Due to limitation of resources, we could not ensure random sampling procedures adding bias to the study.

The study sample comprised of medical and dental students enrolled at a privately financed Pakistani medical and dental school. The students are taught a traditional track curricula based on non-problem-based learning and teacher-centred pedagogic environment. The medium of teaching is in English language. Only those participants who volunteered to participate in the study were recruited, after providing written informed consent. And no financial incentive was paid to the students for taking part in the study.

Survey

Minimum sample size required for the study was calculated as 292 based on the following assumptions: confidence level (95%), margin of error (5%), population size (1200) and response distribution of 50% (Kane, 2019). For regression analysis, a minimum of 194 participants were required for an anticipated effect size of 0.15 (f^2), alpha error of 0.05 and statistical power of 95 and 14 predictors. The participants responded to a self-administered paper based survey comprising of five parts: a) demographics b) Pittsburgh Sleep Quality Index (PSQI), c) Patient Health Questionnaire-9 (PHQ-9), d) Multidimensional Scale of Perceived Social Support (MSPSS) and e) Perceived

Stress Scale-4 (PSS-4). Time for completion of the survey was estimated at 20 minutes and all scales were administered in the English language.

PHQ-9 is a nine-item psychometrically validated scale used to measure severity of depressive symptoms among respondents (Kroenke et al., 2001). The nine items on this scale document different symptoms of depression that are rated on a Likert scale ranging from 'not at all' to 'nearly every day'. It is further used to categorize depressive symptom severity into mild depression (5–9), moderate depression (10–14), moderately severe depression (15–19) and severe depression (20–27). PSS-4 comprises of four items that assess experience of stress on a Likert scale ranging from 'never' to 'very often' (Cohen et al., 1983). The negatively worded items are reverse scored before a total score is calculated. A maximum score of 16 is yielded after summing together all the items, with higher scores collating with higher stress levels (Shah et al., 2010).

MSPSS is a 12-item validated scale that assesses perceived emotional support from three sources: a) family, b) significant other and c) friends. This scale has previously been validated in a South Asian population (Akhtar et al., 2010). It yields scoring on these three subscales, which can also be summed together to provide an overall indicator of the perceived social support (Kazarian and McCabe, 1991). Lastly, the PSQI scale was used to assess the quality of sleep among the respondents. It has previously been validated among Pakistani medical students (Hashmi et al., 2014). It comprises of seven subscales indicating quality of sleep across different dimensions including subjective sleep quality, sleep latency, day dysfunction, use of sleeping medications, sleep disturbances, sleep efficiency and duration of sleep. Scores across all seven subscales can be summed to yield a maximum global score of 21, with higher scores correlating with poorer sleep quality. A cut-off value of five distinguishes poor sleepers from good sleepers (Buysse et al., 1991).

Ethical statement

All procedures performed in the study were in accordance with the 1964 Helsinki declaration and its later amendments. Ethical approval for this study was sought and obtained from the Ethical Review Board of CMH Lahore Medical College & Institute of Dentistry, Lahore Cantt, Pakistan. Written informed consent was obtained from all individual participants included in the study. They were ensured anonymity and that only group level findings would be reported in scholarly publications.

Table 1. Characteristics of the respondents (n = 353)

Variable		Count	Percentage (%)
Age	Mean = 20.57		
Gender	Male	154	43.6
	Female	199	56.4
Year of study	First	106	30.0
	Second	113	32.0
	Third	17	4.8
	Fourth	117	33.1
Background	Rural	78	22.1
	Urban	275	77.9
Residence	Day scholar	189	53.5
	Hostel	164	46.5

Statistical analysis

All data were calculated and analysed in SPSS v. 20. Descriptive statistics were run for categorical and numeric variables. Chi-square test of association was used to analyse the association between gender of respondents and psychiatric symptomatology (MSPSS, PHQ, PSQI and PSS scores). Linear regression analysis was used to reveal the predictors of depression. In this model, PHQ-9 scores were taken as a dependent variable, while the characteristics of respondents such as age, gender, year of education, indicators of sleep quality, stress levels and social support scores were taken as independent variables.

PROCESS software (v 3.1) by A.F. Hayes was used to analyse the mediation effects of social support on relationship of depression with stress and sleep quality. $P < 0.05$ was considered to demonstrate statistical significance. Overall, there was < 2% missing data in the study, where missing quantitative variables were imputed by their mean value and categorical variables by mode.

RESULTS

Out of a total of 400 students, 353 participants responded to the questionnaire, with a higher proportion of female (199, 56.4%) respondents than male. This yielded a total response rate of 88.25%; reasons for declining to participate in the study was not inquired from the participants. The mean age of the participants was 20.57 years (1.53), with the majority residing in urban areas (275, 77.90%) (Table 1).

According to the questionnaires, high stress levels (PSS-4 score > 9) were reported by 149 (42.2%) respondents, very poor subjective sleep quality by 24 (6.8%), very poor sleep latency by 34 (9.7%), very poor sleep duration by 42 (11.9%), very poor

habitual sleep efficiency by 52 (14.8%), severe sleep disturbances by nine (2.5%), use of sleep medication more than once a week by 44 (12.4%), severe daytime dysfunction by 38 (10.8%) and overall poor sleep quality (PSQI ≥ 6) was experienced by 205 (58.1%) respondents. Mild to severe depression was reported by 83% of the respondents: mild depression by 104 (29.5%), moderate depression by 104 (29.5%), moderately severe depression by 54 (15.3%) and severe depression by 31 (8.8%) (Table 2).

The mean scores of different scales were found to be: PSS 8.11 (SD = 2.94), PSQI 6.87 (SD = 3.71), PHQ 10.45 (SD = 6.22) and MSPSS 5.05 (SD = 1.15). The subscales of MSPSS yielded mean scores: social support by significant other 4.80 (SD = 1.62), social support by family 5.42 (SD = 1.33) and social support by friends 4.94 (SD = 1.36). A significantly ($Chi^2 = 7.98$, $P < 0.01$) higher proportion of females (97, 48.7%) reported higher stress levels than males (52, 33.80%). However, no significant gender differences were found in PSQI, PHQ and MSPSS scale scores (see *Extended data file 1*).

Multiple linear regression analysis yielded a significant model (F (df) = 14.90 (351), $P < 0.001$), that explained a 35.70% variance in depressive symptomatology (Table 3). Subjective sleep quality, sleep latency, daytime dysfunction and stress levels were significantly associated with depression symptoms. Sleep duration, habitual sleep efficiency, sleep disturbances, and use of sleeping medications were not associated with severity of depressive symptoms. None of the demographic variables: age, gender, year of study, background and residence yielded a significant level of association. Social support was not significantly associated with depressive symptoms in the regression model; however, it acted as a significant mediator in reducing the strength of the relationship between depressive symptoms and sleep quality and stress (Figures 1 and 2).

DISCUSSION

The present analyses document a high prevalence of perceived psychological stress (42.2%) and mild to moderate depression (83%) among students of health sciences in Lahore, Pakistan. Around 58.1% of the respondents also reported overall poor sleep quality, highlighting a high proportion of students with problematic subjective sleep quality, poor sleep latency, poor sleep efficiency, sleep duration, use of hypnotics and daytime drowsiness. Social support was an insignificant predictor of depression; however, it exerted significant mediational effects by reducing the impact of poor sleep quality and high stress levels on depressive symptoms, thus, validating our hypothesis 2 (H_2).

Table 2. Stress and poor sleep quality among medical and dental students

Variable	Subcategory	Frequency	Percentage
Stress levels	< 8.00	204	57.8
	> 9.00	149	42.2
Subjective sleep quality	Very good	87	24.6
	Good	172	48.7
	Poor	70	19.8
	Very poor	24	6.8
Sleep latency	Very good	127	36.1
	Good	119	33.8
	Poor	72	20.5
	Very poor	34	9.7
Sleep duration	Very good	143	40.6
	Good	94	26.7
	Poor	73	20.7
	Very poor	42	11.9
Habitual sleep efficiency	Very good	207	58.8
	Good	60	17.0
	Poor	33	9.4
	Very poor	52	14.8
Sleep disturbances	Very good	26	7.4
	Good	220	62.3
	Bad	98	27.8
	Severe	9	2.5
Use of sleeping medications	Never in last month	242	68.6
	Less than once in a week	67	19.0
	Once or twice in a week	33	9.3
	More than thrice in a week	11	3.1
Daytime dysfunction	Very good	94	26.6
	Good	137	38.8
	Bad	84	23.8
	Severe	38	10.8
PSQI	< 5.00	148	41.9
	> 6.00	205	58.1
Severity of depressive symptoms	Minimal	60	17.0
	Mild	104	29.5
	Moderate	104	29.5
	Moderately severe	54	15.3
	Severe	31	8.8

Several studies provide evidence that a substantial proportion of medical students suffer from psychological symptoms such as stress, depression, anxiety and sleep disorders, corroborating our results. The prevalence of depression has been reported to be 84.8% among Indian students with high stress levels (27, 28). The prevalence of depression was found to be 62% in a study in Turkey (Bostanci et al., 2005) and 48.5% in a study in Brazil (Costa et al., 2012), whereas the prevalence of stress

Table 3. Predictors of depression among respondents

Variables	B	Standard error	Beta coefficient	*t value*	*p-value*
(Constant)	0.883	5.785		0.153	0.879
Age	0.059	0.279	0.015	0.211	0.833
Gender	0.271	0.568	0.022	0.477	0.633
Year of study	-0.435	0.358	-0.086	-1.217	0.225
Background	0.058	0.687	0.004	0.085	0.932
Residence	0.648	0.547	0.052	1.185	0.237
Subjective sleep quality	1.105	0.393	0.150	2.814	0.005
Sleep latency	1.080	0.319	0.169	3.387	0.001
Sleep duration	-0.196	0.293	-0.033	-0.671	0.503
Habitual sleep efficiency	0.276	0.274	0.049	1.007	0.314
Sleep disturbances	0.593	0.509	0.059	1.166	0.245
Use of sleeping medications	0.039	0.388	0.005	0.099	0.921
Daytime dysfunction	0.812	0.332	0.124	2.446	0.015
Stress	0.739	0.101	0.349	7.295	0.000
Social support	-0.423	0.245	-0.078	-1.723	0.086

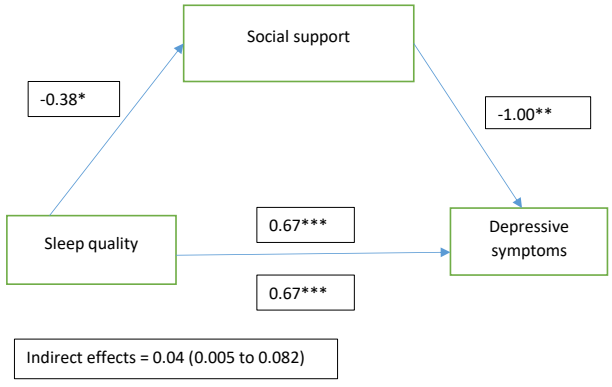

Figure 1. Buffering effects of social support on depression and sleep quality

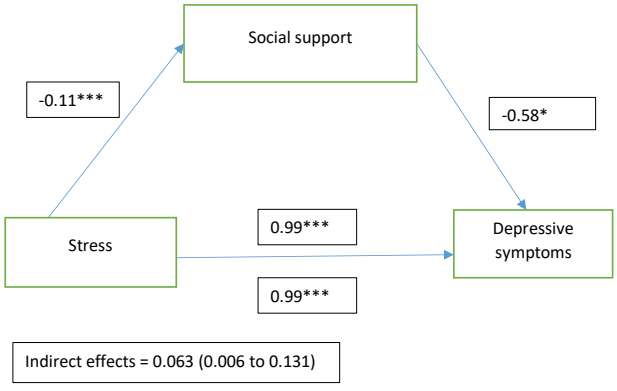

Figure 2. Buffering effects of social support on depression and stress

was found to be 20.9% in Nepal (Sreeramareddy et al., 2007), 90% in Pakistani and 63.8 % in Saudi Arabian medical schools (28, 32). An interesting study in Bangladesh also concluded that every one in seven post graduate medical residents suffered from either depression, anxiety or stress related disorder (Shibli Sadiq et al., 2019). A study by Lemma *et al.* revealed a significant association between perceived stress and depression and poor sleep quality (Lemma et al., 2012). These findings were in consonance with an earlier study in Pakistan that documented poor sleep quality among 77% of the respondents (Waqas et al., 2015b). One may posit from the aforementioned findings that the prevalence of depression and stress levels are relatively high in Pakistani and Indian medical schools, and that differences in ethno-cultural background, teaching methodologies and educational environment account for different prevalence rates of depression, stress and sleep disorders among medical students of various countries (Heun, 2018).

A study by Yamada *et al.* (Yamada et al., 2014) indicated that psychological distress and low peer social support synergistically increase the probability of poor academic self-perception among international medical students. Another study demonstrated a higher risk of depression among Korean students reporting low levels of interpersonal support (Jeong et al., 2010a). According to Tempski *et al.*,[4] meaningful relations with friends, family and teachers and reformed teaching methodologies lead to diminution of academic stressors and improved their quality of life (Yamada et alk., 2014). Social support plays a significant role in shaping stress coping strategies as well; thus, reducing stress level (Lee and Graham, 2001; Radcliffe and Lester, 2003). In addition, an availability

of adequate social support is also associated with a positive impact on academic performance due to improved coping strategies and lower stress and depression levels (Sohail, 2013). An interesting study by (Arafat et al., 2019) also emphasized on improving an alarmingly low depression literacy status among students, which is vital for promoting help seeking behaviours and early preventive measures for combating depression. The positive impact of social support on mental wellbeing was also demonstrated in a recent successful student-led stress management program that involved an organized interaction between second year and first year medical students (Redwood and Pollak, 2007).

Our results revealed that only subjective sleep quality, sleep latency, daytime dysfunction and stress levels yielded a significant association with depression, thus, validating our hypothesis 1 (H_1). These findings are in coherence with a study by Moo-Estrella *et al.* (Moo-Estrella et al., 2005), reporting that students with depressive symptoms rated their sleep as poor and experienced increased sleep latency as compared to their non-stressed counterparts. According to Eller *et al.* (Eller et al., 2006), sleep problems indicated underlying depression and its associations with sleep indices were different for males and females.

An interesting finding in our analysis was that a significantly higher proportion of females reported higher stress levels than males, but overall poor sleep quality was found to be equal in both males and females. Our finding concerning the relatively higher level of perceived stress in females is backed up by several studies in the literature, which portray that females tend to have an increased sensitivity to perceived stress, despite having similar levels of stress and despite receiving similar level of social support (Eller et al., 2006; Nolen-Hoeksema, 2012; Popa-Velea et al., 2017a; Shah et al., 2010). However, Cohen and colleagues found no significant association between stress levels and gender in a sample of college students (Cohen et al., 1983). Moreover, some studies also suggest a significant association between different sleep indices and gender (Eller et al., 2006; Lund et al., 2010; Oluwole, 2010).

Multiple linear regression did not reveal any direct effects of social support on depression after controlling for confounding variables. However, social support was shown to have indirect effects on depression, by buffering the effects of psychological stress and poor sleep quality on depression. These results were in consonance with a meta-analysis by Cohen and Wills (Cohen and Wills, 1985), who demonstrated that social support intervenes between stressful event and its reaction. More importantly, it tends to mitigate the harmful effects of stress on depression in times of increased stress by altering stress appraisal or coping strategies. The stress buffering effects of social support are manifested not only during acute stress but also during periods of chronic stress (Fleming et al., 1982; Linn and McGranahan, 1980). As has been previously reported, medical students experience relatively high stress levels and poor sleep quality and that persistently increasing stress levels over a long period of time can give rise to chronic depression. Therefore, by taking into consideration the stress buffering effects of social support in the face of both acute and chronic stress, we believe that promotion of adequate social support measures would prevent the risk of development of depression in medical students by improving sleep quality and mitigating stress levels.

Previous evidence for the indirect effects of social support is not conclusive and many studies favour the hypothesis of a direct association between social support and depressive symptoms. However, Cohen and Wills opine that many studies that reveal direct effects of social support but fail to elucidate its buffering effects are limited in their methods by only assessing structural measures of social support (existence of social support rather than perception of availability of social support) or suboptimal methodologies and scales (Cohen and Wills, 1985). These structural measures of social support are less favoured because the perception of the availability of support is a more sensitive indicator than objective support measures. Moreover, the buffering effects of social support are said to be cognitively mediated, further strengthening the logic for use of MSPSS in our study (Cohen and Wills, 1985; Trockel et al., 2011).

CONCLUSIONS

According to our study, a large proportion of healthcare (medical and dental) students were found to be suffering from mild to moderate depression and experienced poor sleep quality. It is concluded that social support is an important variable in predicting depressive symptomatology by ameliorating the effects of poor sleep quality and high stress levels.

LIMITATIONS

This study has several limitations. Firstly, the use of convenient sampling and inclusion of only one medical school in the survey limits generalizability of these findings. The cross-sectional nature of this study limits inferences related to causality and temporality, and the use of self-administered questionnaires may introduce recall bias. Use of questionnaire can add recall bias in measurement of mental health indicators. Important

variables such as use of pharmacological or psychological treatments among the respondents were not known, which can add bias in the study.

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None.

ETHICAL APPROVAL

Ethical approval for this study was received from Ethical Review Board of CMH Lahore Medical College & Institute of Dentistry, Lahore Cantt, Pakistan.

INFORMED CONSENT

Written informed consent was obtained from all individual participants included in the study.

CONFLICT OF INTERESTS

No competing interest were disclosed.

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