



Mental Health Concerns, Insomnia, and Loneliness Among Intern Doctors Amidst the COVID-19 Pandemic: Evidence from a Large Tertiary Care Hospital in Bangladesh

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Abstract

Precisely how intern doctors (or trainee physicians) have been impacted during the COVID-19 pandemic is currently poorly understood. The present study aimed to investigate the mental health consequences (i.e., depression, anxiety, and stress), insomnia, and loneliness among intern doctors in Bangladesh amidst the pandemic. A cross-sectional offline survey of 108 intern doctors (53.7% female; mean age = 24.80 ± 1.08; age range = 23–29 years) in a large tertiary care hospital in Bangladesh was conducted. The participants were surveyed randomly from respective wards during their duties with an anonymous and self-reported questionnaire assessing socio-demographics, COVID-19-related consideration, mental health, insomnia, loneliness, and other measures. Hierarchical regression analyses were conducted to examine relationships. The prevalence estimates of mild to extremely severe depression, anxiety, and stress were 53.7%, 63.9%, and 38.9%, respectively. Sub-threshold to severe insomnia was acknowledged by 53.7% and loneliness by 43.5%. Depression was associated with not receiving mental health counseling during the pandemic, anxiety, stress, and loneliness; anxiety was associated with depression and stress; stress was associated with depression, anxiety, and loneliness; insomnia was associated with being married; and loneliness was associated with poorer quality of life, depression, and stress. Depression, but not anxiety and insomnia, fully mediated the relationship between loneliness and regret regarding choice of profession because of the pandemic and its many unexpected experiences. The findings showed considerable mental health concerns, insomnia, and loneliness among intern doctors in Bangladesh during the COVID-19 pandemic. Future studies should further explore the role of mental health concerns in healthcare providers and perceptions of their profession during the pandemic, and examine interventions to help this vulnerable population.

Keywords Stress · COVID-19 · Sleep · Loneliness · Depression · Anxiety

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Coronavirus disease 2019 (COVID-19) is an infectious disease caused by severe acute respiratory syndrome corona virus-2 (SARS-CoV-2). It was first identified in December 2019 in Wuhan, China, and has since spread globally, resulting in a pandemic (Hui et al., 2020). The World Health Organization (WHO) declared the emergence of the novel coronavirus as a global public health emergency on January 30, 2020 (Ferdous et al., 2020). Bangladesh's Institute of Epidemiology, Disease Control and Research (IEDCR) declared the first confirmed case of COVID-19 in Bangladesh on March 8, 2020 (Islam et al., 2021; Rahman et al., 2020).

Between March 8 and December 6, 2020, there were according to the country's Directorate General of Health Services (DGHS) 477,545 COVID-19 confirmed cases by RT-PCR, including 6,838 related deaths, generating a confirmed fatality rate of 1.43% in Bangladesh. Bangladesh is estimated to account for 0.75% of the COVID-19 disease burden in the world (World Health Organization, 2020).

With the COVID-19 pandemic, people may be experiencing increases in anxiety, panic, stress, and depression. Pandemic issues, such as spatial or physical distancing, isolation, and quarantine, as well as occupational, educational, and economic impacts, may generate psychological distress including anger, boredom, depression, fear, frustration, grief, panic, sadness, shame, and stress (Banerjee, 2020; Hossain et al., 2021; Islam et al., 2020; Islam et al., 2021). These are common mental health concerns that many individuals may experience during and after the crisis (Banerjee, 2020; Islam et al., 2020), with possible exacerbation through social media and television broadcasting coverage of infection spread (Pandey et al., 2020). Several existing studies conducted with different cohorts including individuals from the general population, students, healthcare workers, impoverished urban residents, and COVID-19 survivors reported these common mental health problems during the pandemic (Banna et al., 2020; Gong et al., 2021; Islam et al., 2021; Islam et al., 2021; Li & Wang, 2020; Safa et al., 2021; Tasnim et al., 2021). During acute health crises, health services are often under excess pressure, making working lives of healthcare providers even more stressful than normal (Tam et al., 2004). In a pandemic, the number of patients requiring treatment increases significantly, placing strain on healthcare resources and personnel (Galbraith et al., 2020).

Healthcare workers on the front line who are directly involved in the diagnosis, treatment, and care of patients with COVID-19 may be at particularly high risk of developing psychological distress and other mental health symptoms. With increases in confirmed and suspected cases, long work shifts, depletion of personal protection equipment, widespread media coverage, lack of efficacious drugs, and feelings of being inadequately supported may all contribute to the mental burden of healthcare workers (Lai et al., 2020). Studies have suggested that doctors may find it difficult to communicate to colleagues or employers their mental health concerns (Hassan et al., 2009).

Much research on wellness during the COVID-19 pandemic has focused on nurses, attending physicians, and healthcare support staff (Bettinsoli et al., 2020; Lai et al., 2020), and has not included intern doctors. However, medical students undergoing internships find themselves in an intermediary situation. The internship is the stage in which students begin their in-hospital activities, with some kind of theoretical content as a foundation (Carrascosa et al., 2020). Interns represent a unique group, and they act both as learners and caregivers.

Several studies conducted among Bangladeshi doctors, nurses, and other healthcare workers during this pandemic reported frequent anxiety (20.7–69.5%), depression (26.5–52.1%), insomnia (18.6–54.2%), and psychological distress (41.7–67.7%) (Ali et al., 2021; Barua et al., 2020; Hasan et al., 2020; Khatun et al., 2021; Mahmud et al.,

2020; Tasnim et al., 2021). A recent rapid review shows that presence on frontlines, being younger, and being more junior is associated with an increased risk of psychological distress in healthcare workers during viral outbreaks (Kisely et al., 2020). Intern doctors may also suffer from mental health problems due to spillover effects from patients or healthcare burdens, during the COVID-19 pandemic (Li et al., 2021). As interns are frontline healthcare workers and these individuals have shown particular vulnerability to mental health concerns during the COVID-19 pandemic (with links between mental health concerns and COVID-19 experiences) (De Kock et al., 2021), it is particularly important to understand mental health concerns in this population. However, there has been no study conducted among interns in Bangladesh to assess their mental health during the pandemic.

During the COVID-19 pandemic, interns have been a main workforce dealing with the influx of patients in tertiary care hospitals. Even prior to the pandemic, the tertiary care hospitals in Bangladesh had been seeing large numbers of cases, with very limited staff and infrastructure. Most interns see little of their families and have long shifts that may adversely impact their mental health (e.g., anxiety and depression), sleep, and feelings of connectedness. These may be worsened during the COVID-19 pandemic, and may be particularly relevant to the Bangladeshi situation given the lower-middle income status of the country and busy tertiary hospital environments. As such, this may generate loneliness which has been identified as a potential risk factor for mental health problems including affective concerns and sleep difficulties (Mushtaq et al., 2014). Further, while less well studied, loneliness may exacerbate concerns about decisions of entering the medical field given the COVID-19 pandemic, and these may be particularly relevant to individuals experiencing mental health concerns. Thus, it is plausible that loneliness may operate through mental health concerns to increase regrets about their professional choice to pursue medicine during the pandemic, and this possibility warrants direct examination.

To address this gap in understanding intern mental health, the present study aimed to evaluate the mental health concerns, insomnia, and loneliness among intern doctors during the COVID-19 pandemic in a large tertiary care hospital in Bangladesh. It was hypothesized that mental health concerns (e.g., anxiety and depression) would be frequently acknowledged and related to insomnia and loneliness. We also hypothesized that the mental health concerns, insomnia, and loneliness would relate to interns' COVID-19 experiences. Additionally, it was hypothesized that depression, anxiety, and insomnia would mediate a relationship between loneliness and regrets regarding choice of profession because of the pandemic and its many unexpected experiences.

Materials and Methods

Study Design, Setting, and Population

A cross-sectional survey was conducted involving 108 intern doctors (trainee physicians) out of a total 160 in the Sher-e-Bangla Medical College Hospital, a 1000-bed facilities with indoor and outdoor components located in the southern part of Bangladesh (Banglapedia, 2015). The Sher-e-Bangla Medical College hospital, which is confined within the college, serves more than 1500–1800 patients each term. The survey was conducted was from December 7 to 20, 2020. The inclusion criteria included being adults (≥ 18 years) and intern doctors. Internship is a key part of the transition from medical school to independent practice and specialty training. Internship focuses on

practical training under supervision from senior colleagues, who also provide the trainees with support, feedback, teaching, and assessment (Noman et al., 2017). Medical students in Bangladesh have to enroll for a 1-year log-book-based rotatory internship program after passing the final professional Bachelor of Medicine and Bachelor of Surgery (MBBS) examination. Internship training is a prerequisite for Bangladesh Medical and Dental Council (BM&DC) registration. This training prepares interns to serve people at a graduate level. During this internship period, they are regarded as “intern” or “intern doctor” in Bangladesh.

Sample Size Determination and Data Collection

The sample size was calculated using the following formula:

$$n = \frac{z^2 \cdot p(1-p) \cdot N}{e^2(N-1) + z^2 \cdot p(1-p)} = \frac{1.96^2 \times 0.695 \times (1 - 0.695) \times 160}{0.05^2(160 - 1) + 1.96^2 \times 0.695 \times (1 - 0.695)} = 107.52 \approx 108$$

Here, n is the number of samples; z is 1.96 (95 % confidence level); p is the prevalence estimate (0.395); q is $(1-p)$; e is the margin of error (5 %); N is the population size equal to 160.

As there is no prior study in Bangladesh conducted with intern doctors, the present study used the prevalence estimate of anxiety ($p = .695$) reported by Tasnim et al. (2020) focusing on healthcare providers (Tasnim et al., 2021). In the present study, the calculated sample was to be 108. The interns were recruited randomly from respective wards during their duties. Approximately 130 participants were approached to take part in the survey, of whom 108 participated in the survey, generating a response rate of 83 %. Data were collected using a self-reported English-language questionnaire as participants’ academic language was completely English. Approximately 10–15 minutes were required to complete the entire survey for each participant. The participants were surveyed voluntarily without any incentives or remunerations.

Ethics

The present study followed the highest possible ethical standards in line with the Helsinki declaration and Institutional research ethics. The formal ethics approval was granted by the Ethical Review Committee of the Sher-e-Bangla Medical College [Ref. no: SBMC/Barishal/ERC/2020/1866]. Written informed consent was obtained from each participant prior to data collection. During consent, the aims, objectives, procedures, risk-benefit, and option to participate in the study were clearly documented. Anonymity and confidentiality of information provided were ensured during the survey. All data were collected anonymously and analyzed using a coding system.

Measures

A semi-structured survey assessed socio-demographics, lifestyle measures, COVID-19-related information, stress, depression, anxiety, insomnia, and loneliness.

Socio-demographic and Lifestyle Measures

Information was collected on age, gender, marital status, monthly family income, and living with family (yes/no). Health status and quality of life were assessed using two questions with a five-point Likert scale ranging from 1 (“poor”) to 5 (“excellent”) (i.e., “In general, how would you rate your overall health?” and “In general, how would you rate your overall quality of life?”), as previously (Ahmed et al., 2020; Magee et al., 2011). Responses were collapsed into a dichotomous form: good (i.e., excellent/very good/good) and fair/poor (i.e., poor/fair) (Ahmed et al., 2020). In addition, “yes/no” questions were asked during the survey with regard to physical exercise and current cigarette smoking (Islam et al., 2021, 2021, 2020; Rahman et al., 2020).

COVID-19-Related Questions

Four ‘yes/no’ questions were asked in relation to the COVID-19 pandemic as follows: (1) *Did you get infected with COVID-19 while at work?* (2) *Do you feel adequately trained to conduct COVID-19 treatment/ perform PCR tests/ provide patient care?* (3) *Have you had regret feelings about your profession because of the pandemic and its many unexpected experiences?* and (4) *Have you been counseled regarding how to maintain your mental health in the current situation?*, as described previously (Tasnim et al., 2021).

Depression, Anxiety, and Stress Scale (DASS-21)

Participants’ depression, anxiety, and stress were assessed using the DASS-21 which is a modified and shorter version of the original DASS-42 (Lovibond & Lovibond 1995). It consists of 21 questions including three subscales: 7 items each for depression, anxiety, and stress with a four-point Likert scale ranging from 0 (“never”) to 3 (“always”) (Lovibond & Lovibond 1995). The total scores were calculated by summing scores on each subscale’s items (i.e., depression, anxiety, and stress) and multiplying them by 2; greater scores reflect more depression, anxiety, and stress. Cutoffs were used to categorize levels of depression, anxiety, and stress, as follows: normal (depression 0–9, anxiety 0–7, and stress 0–14), mild (depression 10–13, anxiety 8–9, and stress 15–18), moderate (depression 14–20, anxiety 10–14, and stress 19–25), severe (depression 21–27, anxiety 15–19, and stress 26–33), and extremely severe (depression ≥ 28 , anxiety ≥ 20 , and stress ≥ 34) as previously (Islam et al., 2020; Lovibond & Lovibond 1995; Tasnim et al., 2020). In the present study, the Cronbach’s alpha for the depression, anxiety, and stress subscales was 0.81, 0.71, and 0.74, respectively, and the overall DASS-21 scale was found to have excellent reliability (Cronbach’s $\alpha = 0.90$).

Insomnia Severity Index

Participants’ insomnia was assessed using the Insomnia Severity Index. This scale consists of seven items regarding problems related to insomnia symptomatology over the past 2 weeks (e.g., “How satisfied/dissatisfied are you with your current sleep pattern?”) with a five-point Likert scale (e.g., 0 = *Not at all* to 4 = *Nearly every day*) (Bastien et al., 2001; Morin, 1993). The total score was obtained via summation with scores ranging from 0 to 28, with higher scores reflecting more severe insomnia. Participants’ insomnia levels were

classified into four classes according to the total scores as follows: none (0–7), subthreshold (8–14), moderate (15–21), and severe (22–28) as previously (Bastien et al., 2001). In the present study, the Cronbach's alpha was 0.84.

University of California, Los Angeles (UCLA) Loneliness Scale

Participants' loneliness was assessed using the UCLA scale (Hughes et al., 2004). This scale consists of three items regarding problems related to loneliness over the past days (e.g., "How often do you feel that you lack companionship?") with a three-point Likert scale (e.g., 1 = *Hardly ever* to 3 = *Often*). The total score was obtained via summation with scores ranging from 3 to 9, with higher scores reflecting greater loneliness. In the present study, a cutoff (≥ 6) was used to for determining significant loneliness as previously (Hughes et al., 2004; Steptoe et al., 2013). The Cronbach's alpha was 0.83.

Statistical Analyses

Data entry, cleaning, sorting, and coding were performed using Microsoft Excel 2019. Subsequently, the excel sheet was imported onto SPSS. Using SPSS version 25, descriptive statistics (i.e., frequencies, percentages, means, standard deviations) were computed. Inferential statistics included conducting *t*-tests or one-way analyses of variance (ANOVAs) to determine mean differences among variable groups. Additionally, skewness, kurtosis, and Pearson correlation were assessed among continuous variables. Finally, variables (e.g., socio-demographics and mental health concerns) that showed group differences in initial analyses were included in hierarchical regression analyses. Mediation analyses were conducted with SPSS PROCESS and 5000 bootstrap resamples (Hayes, 2017) to test the model of whether depression, anxiety, and insomnia statistically mediated the relationship between loneliness and regrets regarding choice of profession because of the pandemic and its many unexpected experiences. Loneliness was included as the independent variable; regrets regarding choice of profession as the dependent variable; depression, anxiety, and insomnia scores as potential mediators; and sociodemographic, health, and quality of life variables as covariates to control for their potentially biasing effects. Direct and total indirect effects were calculated, but the total effects option is not available in analyses with dichotomous dependent variables in SPSS PROCESS (Hayes, 2017). Associations, indirect effects, and bootstrapped confidence intervals (CIs) were calculated. Results were expressed as log-odds and significant indirect effects were determined by CIs that did not include zero.

Results

Participants' Profile

One-hundred-and-eight individuals with a mean age of 24.80 years ($SD = 1.08$; range: 23–29) participated. Most were female (53.7%), unmarried (76.9%), and living apart from families (61.1%) (Table 1). A minority reported fair/poor health (13.9%) and poor quality of life (14.8%) during the pandemic. Nearly two-thirds reported not engaging in physical exercise during the pandemic (63.9%) and a minority reported current cigarette smoking (14.8%).

Table 1 Descriptive characteristics and relationships to depression, anxiety, stress, insomnia, and loneliness

Variables	Total N=108		Depression		Anxiety		Stress		Insomnia		Loneliness						
	n	(%)	M	(SD)	t/F	(SD)	M	(SD)	t/F	(SD)	M	(SD)	t/F	(SD)			
Gender																	
Male	50	(46.3)	11.6	(7.6)	0.95	10.0	(6.7)	0.02	13.2	(6.4)	0.01	8.1	(5.2)	0.10	6.1	(2.0)	2.65
Female	58	(53.7)	10.2	(6.9)		10.1	(5.6)		13.4	(5.9)		8.5	(5.6)		5.5	(1.8)	
Marital status																	
Unmarried	83	(76.9)	10.6	(7.5)	0.68	10.0	(6.0)	0.04	13.3	(6.3)	0.01	7.7	(5.5)	4.46*	5.8	(1.9)	0.29
Married	25	(23.1)	11.9	(6.4)		10.2	(6.6)		13.2	(5.6)		10.3	(4.8)		5.6	(1.9)	
Living with family																	
Yes	42	(38.9)	10.6	(6.0)	0.08	10.0	(5.4)	0.01	13.5	(4.9)	0.05	8.7	(4.8)	0.29	5.9	(1.9)	0.26
No	66	(61.1)	11.0	(8.0)		10.1	(6.5)		13.2	(6.9)		8.1	(5.8)		5.7	(1.9)	
Health status																	
Good	93	(86.1)	10.1	(6.8)	7.91**	9.2	(5.7)	12.41**	12.7	(5.9)	6.35*	7.9	(5.4)	4.93*	5.5	(1.9)	10.09**
Fair/poor	15	(13.9)	15.6	(8.1)		14.9	(6.2)		16.9	(6.3)		11.1	(4.9)		7.1	(1.6)	
Quality of life																	
Good	92	(85.2)	9.9	(6.6)	11.97**	9.1	(5.2)	18.30***	12.7	(5.7)	5.70*	7.9	(5.2)	4.37*	5.4	(1.8)	21.95***
Poor	16	(14.8)	16.4	(8.6)		15.6	(8.0)		16.6	(7.6)		10.9	(5.8)		7.6	(1.6)	
Physical exercise																	
Yes	39	(36.1)	10.2	(8.2)	0.51	9.2	(5.5)	1.21	12.9	(5.5)	0.32	7.4	(5.4)	1.94	5.7	(1.9)	0.04
No	69	(63.9)	11.2	(6.7)		10.5	(6.4)		13.6	(6.5)		8.9	(5.3)		5.8	(1.9)	
Cigarette smoking																	
Yes	16	(14.8)	12.4	(9.1)	0.81	11.5	(8.4)	1.08	13.4	(8.4)	<0.01	9.1	(6.9)	0.36	6.5	(2.1)	3.04
No	92	(85.2)	10.6	(6.9)		9.8	(5.6)		13.3	(5.7)		8.2	(5.1)		5.6	(1.9)	
Did you get infected with COVID-19 while at work?																	
Yes	21	(19.4)	11.1	(8.5)	0.04	9.0	(6.5)	0.68	13.3	(7.5)	<0.01	7.4	(5.0)	0.70	5.3	(1.7)	1.19
No	87	(80.6)	10.8	(7.0)		10.3	(6.0)		13.3	(5.8)		8.5	(5.5)		5.8	(1.9)	

Table 1 (continued)

Variables	Total N=108		Depression		Anxiety		Stress		Insomnia		Loneliness			
	n	(%)	M	(SD)	t/F	M	(SD)	t/F	M	(SD)	t/F	M	(SD)	t/F
Do you feel adequately trained to conduct COVID-19 treatment / perform PCR tests / provide patient care?														
Yes	15	(13.9)	10.7	(7.2)	0.01	10.3	(5.7)	0.02	13.5	(6.3)	0.01	7.6	(4.7)	0.30
No	93	(86.1)	10.9	(7.3)		10.0	(6.2)		13.3	(6.2)		8.4	(5.5)	
Have you had regret feelings about your profession because of the pandemic and its many unexpected experiences?														
Yes	32	(29.6)	12.9	(7.8)	3.80	10.6	(6.4)	0.34	13.8	(6.2)	0.30	8.3	(4.8)	<0.01
No	76	(70.4)	10.0	(6.9)		9.8	(6.0)		13.1	(6.1)		8.3	(5.7)	
Have you been counseled regarding how to maintain your mental health in the current situation?														
Yes	27	(25.0)	7.3	(6.0)	9.68**	8.4	(6.0)	2.49	12.7	(6.5)	0.31	8.3	(5.6)	<0.01
No	81	(75.0)	12.1	(7.2)		10.6	(6.1)		13.5	(6.0)		8.3	(5.4)	

Note:

M, mean

SD, standard deviation

* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

A considerable minority (19.4%) reported having become infected with COVID-19 while working, and most (86.1%) reported that they had not received adequate training to conduct COVID-19 treatment/perform PCR tests/provide patient care. Nearly one-third (29.6%) had regrets regarding their choice of profession because of the pandemic and its many unexpected experiences. One-quarter (25.0%) reported having been counseled regarding how to maintain their mental health during the pandemic.

Figure 1 shows the severity levels of depression, anxiety, stress, insomnia, and loneliness within the full sample.

Depression

Depression scores were higher among participants reporting fair/poor health, poor quality of life, and not having been counseled regarding mental health maintenance during the pandemic (Table 1). Depression was positively correlated with anxiety, stress, insomnia, and loneliness (Table 2).

Table 3 represents the findings of a hierarchical regression analysis by depression. Factors that were statistically significant in the group difference analyses (*t*-tests/

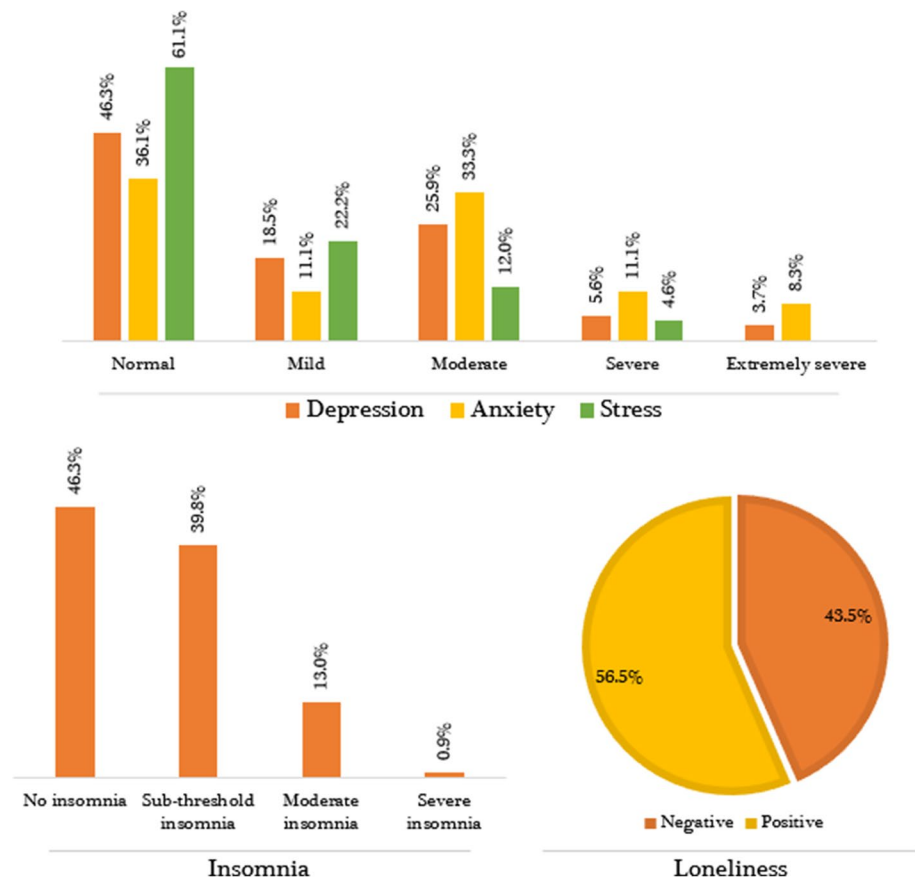


Fig. 1 The severity levels of depression, anxiety, stress, insomnia, and loneliness

Table 2 Reliability indices, descriptive analyses, and correlations among all continuous variables

Variables	α	M (SD)	Min–max	1	2	3	4	5	6
1. Age	—	24.80 (1.08)	23–29	—					
2. Monthly family income	—	36472.22 (23650.28)	15000–118000	0.01	—				
3. Depression	0.81	10.87 (7.24)	0–30	0.18	0.14	—			
4. Anxiety	0.71	10.04 (6.10)	0–28	0.16	0.02	0.75**	—		
5. Stress	0.74	13.31 (6.14)	0–32	0.10	0.11	0.65**	0.69**	—	
6. Insomnia	0.84	8.31 (5.39)	0–24	0.17	–0.12	0.33**	0.37**	0.37**	—
7. Loneliness	0.83	5.74 (1.91)	3–9	0.16	0.02	0.54**	0.45**	0.49**	0.24*

Note:

α , Cronbach alpha

M, mean

SD, standard deviation

Min, minimum

Max, maximum

* $p < 0.05$, ** $p < 0.01$

Table 3 Hierarchical regression analysis by depression

Model	B	SE	β	t	ΔR^2
Block 1 – General variables ($F_{(3,104)} = 8.41; p < 0.001$)					0.20
Health status ^a	–0.06	1.52	<–0.01	–0.04	
Quality of life ^a	0.02	1.57	<0.01	0.01	
Mental health counseling ^b	3.17	0.99	0.19	3.21**	
Block 2 – Mental health concerns ($F_{(4,103)} = 43.28; p < 0.001$)					0.63
Anxiety	0.56	0.10	0.47	5.36***	
Stress	0.24	0.10	0.20	2.36*	
Insomnia	0.04	0.09	0.03	0.48	
Loneliness	0.79	0.27	0.21	2.91**	

Note:

B, unstandardized regression coefficient; SE, standard error; β , standardized regression coefficient; ^a1 = good, 2 = poor; ^b1 = yes, 2 = no; $F_{(7,100)} = 28.00, p < 0.001, R^2_{Adj} = 0.64; *p < 0.05, **p < 0.01, ***p < 0.001$

ANOVAs) and in the correlation matrix were included in a hierarchical regression analysis. General variables (i.e., socio-demographics, health status, quality of life, and mental health counseling) were included in block 1, and mental health concerns (i.e., anxiety, stress, insomnia, and loneliness) comprised block 2 in this and subsequent hierarchical regression analyses. Depression was associated with not having been counseled on mental health maintenance during the pandemic, anxiety, stress, and loneliness (Table 3). Overall, the regression model explained 64 % of the total variance in depression [$F_{(7,100)} = 28.00, p < 0.001$].

Table 4 Hierarchical regression analysis by anxiety

Model	<i>B</i>	<i>SE</i>	β	<i>t</i>	ΔR^2
Block 1 – General variables ($F_{(2,105)} = 10.16; p < 0.001$)					0.16
Health status ^a	0.61	1.27	0.03	0.48	
Quality of life ^a	2.53	1.30	0.15	1.95	
Block 2 – Mental health concerns ($F_{(4,103)} = 44.97; p < 0.001$)					0.64
Depression	0.40	0.07	0.47	5.75*	
Stress	0.35	0.08	0.35	4.36*	
Insomnia	0.07	0.07	0.06	0.98	
Loneliness	-0.21	0.24	-0.07	-0.90	

Note:

B, unstandardized regression coefficient; *SE*, standard error; β , standardized regression coefficient; ^a1 = good, 2 = fair/poor or poor; $F_{(6,101)} = 32.55, p < 0.001, R^2_{Adj} = 0.64; *p < 0.001$

Table 5 Hierarchical regression analysis by stress

Model	<i>B</i>	<i>SE</i>	β	<i>t</i>	ΔR^2
Block 1 – Background variables ($F_{(2,105)} = 3.83; p = 0.025$)					0.05
Health status ^a	0.66	1.45	0.04	0.46	
Quality of life ^a	-2.38	1.49	-0.14	-1.60	
Block 2 – Mental health concerns ($F_{(4,103)} = 31.72; p < 0.001$)					0.55
Depression	0.18	0.09	0.21	2.01*	
Anxiety	0.45	0.10	0.45	4.36**	
Insomnia	0.12	0.08	0.10	1.45	
Loneliness	0.63	0.27	0.20	2.37*	

Note:

B, unstandardized regression coefficient; *SE*, Standard error; β , standardized regression coefficient; ^a1 = good, 2 = fair/poor or poor; $F_{(6,101)} = 31.72, p < 0.001, R^2_{Adj} = 0.54; *p < 0.05, **p < 0.001$

Anxiety

Anxiety was higher among participants reporting fair/poor health status and poor quality of life (Table 1). Anxiety was positively correlated with depression, stress, insomnia, and loneliness (Table 2). The results of a hierarchical regression analysis by anxiety are presented in Table 4. Anxiety was associated with depression, and stress (Table 4). The regression model explained 64% of the total variance in anxiety [$F_{(6,101)} = 32.55, p < 0.001$].

Stress

Depression was higher among participants reporting fair/poor health status and poor quality of life (Table 1). Stress was positively correlated with depression, anxiety, insomnia, and loneliness (Table 2). Table 5 demonstrates the findings of a hierarchical regression analysis by stress. Stress was associated with depression, anxiety, and

Table 6 Hierarchical regression analysis by insomnia

Model	<i>B</i>	<i>SE</i>	β	<i>t</i>	ΔR^2
Block 1 – Background variables ($F_{(3,104)} = 3.62; p = 0.016$)					0.10
Marital status ^a	2.60	1.15	0.21	2.27*	
Health status ^b	1.47	1.72	0.10	0.86	
Quality of life ^b	0.19	1.79	0.01	0.11	
Block 2 – Mental health concerns ($F_{(4,103)} = 4.94; p = 0.001$)					0.16
Anxiety	<0.01	0.11	<0.01	0.01	
Stress	0.15	0.13	0.17	1.09	
Insomnia	0.18	0.12	0.21	1.56	
Loneliness	0.11	0.33	0.04	0.34	

Note:

B, unstandardized regression coefficient; *SE*, standard error; β , standardized regression coefficient; ^a1 = unmarried, 2 = married; ^b1 = good, 2 = fair/poor or poor; $F_{(7,100)} = 3.80, p = 0.001, R^2_{Adj} = 0.16; *p < 0.05$

Table 7 Hierarchical regression analysis by loneliness

Model	<i>B</i>	<i>SE</i>	β	<i>t</i>	ΔR^2
Block 1 – Background variables ($F_{(2,105)} = 11.19; p < 0.001$)					0.18
Health status ^a	0.06	0.53	0.01	0.11	
Quality of life ^a	1.47	0.53	0.28	2.78**	
Block 2 – Mental health concerns ($F_{(4,103)} = 12.62; p < 0.001$)					0.33
Depression	0.10	0.03	0.36	2.98**	
Anxiety	−0.04	0.04	−0.12	−0.90	
Stress	0.08	0.04	0.27	2.38*	
Insomnia	<0.01	0.03	<0.01	0.10	

Note:

B, unstandardized regression coefficient; *SE*, standard error; β , standardized regression coefficient; ^a1 = good, 2 = fair/poor or poor; ^b1 = yes, 2 = no; $F_{(6,101)} = 11.01, p < 0.001, R^2_{Adj} = .36; *p < 0.05, **p < 0.01$

loneliness (Table 5). The regression model explained 54% of the total variance in stress [$F_{(6,101)} = 31.72, p < 0.001$].

Insomnia

Insomnia was higher among participants reporting being married, fair/poor health status and poor quality of life (Table 1). Insomnia was positively correlated with depression, anxiety, stress, and loneliness (Table 2). The results of hierarchical regression analysis by insomnia are presented in Table 6. Insomnia was associated with being married (Table 6). The regression model explained 16% of the total variance in insomnia [$F_{(7,100)} = 3.80, p = 0.001$].

Loneliness

Loneliness was higher among participants reporting fair/poor health status and poor quality of life (Table 1). Loneliness was positively correlated with depression, anxiety, stress, and insomnia (Table 2). Table 7 presents the results of hierarchical regression analysis by loneliness. Loneliness was associated with poor quality of life, depression, and stress (Table 7). The regression model explained 36% of the total variance in loneliness [$F_{(6,101)} = 11.01, p < 0.001$]. Numerically greater odd of having regret regarding choice of profession because of the pandemic and its many unexpected experiences was observed among those with higher loneliness scores, but did not reach statistical significance (OR = 1.18, CI = 0.89, 1.56, $p = 0.25$). However, commonly used causal step methods of mediation testing proposed by Baron and Kenny (1986), which includes regressing the dependent variable on the independent variable, has been shown to have low power (MacKinnon et al., 2002). Additionally, current applications have emphasized the importance of significant indirect effects, irrespective of significant associations between independent and dependent variables which may not be necessary conditions for significant indirect effects (Preacher & Hayes, 2004; Rucker et al., 2011; Zhao et al., 2010).

Figure 2 depicts the path coefficients of the indirect relationships between loneliness and regrets regarding choice of profession because of the pandemic and its many unexpected experiences through depression, anxiety, and insomnia. The model fit were $R^2_{\text{McFadden}} = 0.20$, $R^2_{\text{Cox \& Snell}} = 0.22$, $R^2_{\text{Nagelkerke}} = 0.31$. Loneliness was associated with greater levels of depression ($p < 0.001$) and anxiety ($p = 0.002$), but not insomnia ($p = 0.08$). In turn, depression was associated with greater odds of regrets regarding choice of profession ($p = 0.01$), but anxiety ($p = 0.09$) and insomnia ($p = 0.39$) were not associated. Loneliness had significant indirect effects on regrets regarding choice of profession through depression ($b = 0.33, se = 0.62, CI = 0.05, 0.98$), but not through anxiety ($b = -0.13, se = 0.17$,

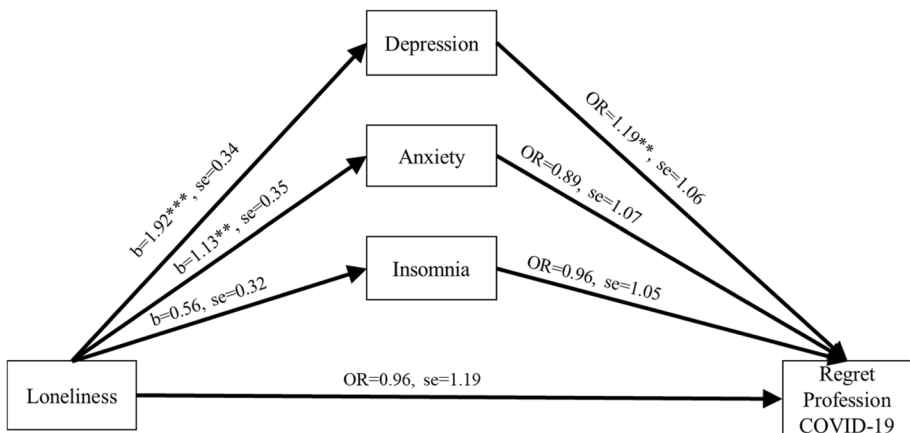


Fig. 2 Indirect effects of loneliness on regret regarding choice of profession because of the pandemic through mental health concerns and insomnia. Results of mediation analyses depicting coefficients, standard error (se), and significance of associations. Mediation analyses controlled for socio-demographic, health, and quality of life factors. * $p \leq 0.05$, ** $p \leq 0.01$, *** $p \leq 0.001$. The indirect effect between loneliness and regrets about choice of profession given the COVID-19 pandemic and related experiences was significant only through depression, indicating that depression, among other mental health and functioning concerns, mediated the relationship between loneliness and regrets regarding choice of profession because of the pandemic

CI = $-0.50, 0.10$) or insomnia ($b = -0.02, se = 0.06, CI = -0.17, 0.05$). The total indirect effects through the depression, anxiety, and insomnia was ($b = 0.17, se = 0.51, CI = -0.18, 0.58$). Additionally, the association between loneliness and regrets regarding choice of profession was not statistically significant ($b = 0.96, se = 1.19, p = 0.79$) while accounting for depression in the model. The direct effect was also not statistically significant ($b = -0.05, se = 0.17, CI = -0.38, 0.29$). Hence, only depression, but not anxiety or insomnia, may be interpreted as fully mediating the relationship between loneliness and regrets regarding choice of profession because of the pandemic and its many unexpected experiences.

Discussion

The COVID-19 pandemic has had a considerable impact on healthcare systems worldwide and threatens not only the physical health but also the psychological health of healthcare workers including intern doctors. To our best knowledge, this study is the first survey in Bangladesh to investigate the mental health consequences, insomnia, and loneliness among intern doctors (trainee physicians) during the COVID-19 pandemic. Our first hypothesis was largely supported in that a considerable portion of the interns reported mental health concerns, insomnia, and loneliness and these concerns were interrelated. Our second hypothesis was largely not supported in that these concerns were largely not associated with COVID-19-related measures with the exception of depression being associated with not having been counseled regarding how to maintain one's mental health during the pandemic. The third hypothesis, that depression, anxiety, and insomnia would mediate a relationship between loneliness and regrets regarding choice of profession because of the pandemic and its many unexpected experiences, was only partially supported in that only depression mediated the relationship, albeit in a fully mediating fashion. Implications are discussed below.

The present study found prevalence estimates of mild to extremely severe depression, anxiety, and stress were 53.7%, 63.7%, and 38.9%, respectively. Our results resonate with recent findings from other healthcare workers during the COVID-19 pandemic. Que et al., reported that the prevalence of symptoms of anxiety, depression, insomnia, and the overall psychological problems in healthcare workers during the COVID-19 pandemic in China was 46.0%, 44.4%, 28.7%, and 56.6%, respectively (Que et al., 2020). Another study of mental health outcomes among healthcare workers in China reported frequent symptoms of depression (50.4%), anxiety (44.6%), insomnia (34.0%), and distress (71.5%) (Galbraith et al., 2020). A prior study in Pakistan among healthcare professionals in the COVID-19 isolation wards reported large percentages of participants who suffered from moderate to extremely severe depression (72.3%), anxiety (85.7%), and stress (90.1%). It was reported that the most common reason for stress and anxiety was the fear that they might infect their family members (89.2%), followed by the fear of getting infected themselves (80.3%). Other reasons were increased workload (64.2%), lack of personal protective equipment (62.5%), lack of security (62.5%), and lack of awareness among the general population about COVID-19 (Sandesh et al., 2020). In another study in Pakistan, the psychological impact of the COVID-19 outbreak on postgraduate trainees documented that the prevalence of depressive symptoms, generalized anxiety disorder, and acute stress disorder were 26.4%, 22.6%, and 4.4%, respectively (Imran et al., 2020).

In Bangladesh, a survey assessing the psychological states on doctors working in a large COVID-19-dedicated facility in Bangladesh found that around 50% of the participating

doctors experienced symptoms of depression and anxiety (Mahmud et al., 2020). Another study found that anxiety and depression were common among healthcare workers in Bangladesh during the COVID-19 pandemic, with 69.5% screening positive for anxiety and 39.5% for depression (Tasnim et al., 2021).

A study in India of healthcare workers suggested a 17.1% prevalence of anxiety symptoms requiring additional evaluation and an 11.4% prevalence of depressive symptoms needing treatment, lower than estimates of anxiety and depression in the present study (Wilson et al., 2020). In India, another study assessed the mental health of medical students and trainees during the pandemic, with 7.3% classified with severe depression and 9.8% with moderate to severe anxiety (Pandey et al., 2020).

A US study assessed depression, anxiety, stress, burnout, and professional fulfillment among trainees who were exposed to patients being tested for COVID-19 and those who were not. A higher prevalence of stress was observed among the exposed relative to the non-exposed group (29.4% vs. 18.9%) (Kannampallil et al., 2020). In Italy, a study of mental health among healthcare workers involved with the COVID-19 pandemic reported that frequent endorsement of symptoms of post-traumatic stress disorder (PTSD), severe depression, anxiety, insomnia, and stress were 49.38%, 24.73%, 19.80%, 8.27%, and 21.90%, respectively (Rossi et al., 2020).

In our study, depression was associated with not having been counseled on mental health maintenance during the COVID-19 pandemic, anxiety, stress, and loneliness. Anxiety and depression frequently co-occur (Chen et al., 2020; Díaz et al., 2012; Kalin 2020), including in Bangladeshi groups (Tasnim et al., 2021). Stress contributes importantly to the development and expression of psychiatric symptomatology including depression and anxiety (Maren and Holmes 2016). Rodríguez-Hidalgo et al., reported that depression could be related both directly and positively to fear of COVID-19 and stress, and indirectly to two factors mediated by anxiety (Rodríguez-Hidalgo et al., 2020). Our finding that not having been counseled on mental health maintenance during the COVID-19 pandemic may be particularly relevant to experiencing depression suggests that counseling may help address depression for interns during the pandemic. The finding that depression fully mediated the relationship between loneliness and regrets about career choices suggests that screening for both loneliness and depression among intern doctors is needed and may help prevent adverse outcomes like burnout, although this currently speculative notion warrants direct investigation.

Increased workload, sleep deprivation, being a junior resident, and pay disparity have been associated with depression in postgraduate trainees from the College of Physicians and Surgeons in Pakistan. During the pandemic, stressors are likely to be compounded by risk of infection, inadequate safety equipment, social isolation especially from family, and physical exhaustion leading to psychological concerns (Imran et al., 2020).

In China, Gong et al., (2014) evaluated factors related to anxiety and depressive symptoms among physicians and found that anxiety and depressive symptoms were associated with poor self-reported physical health, frequent workplace violence, lengthy working hours (more than 60 h a week), frequent night shifts (twice or more per week), and lack of regular physical exercise (Y. Gong et al., 2014). Healthcare workers often experience higher levels of work stress relative to the general population, even under normal circumstances (Chew-Graham et al., 2003), and stress in doctors is associated with both physical (Buddeberg-Fischer et al., 2008) and mental health problems (Imai et al., 2010).

Prevalence of subthreshold, moderate, and severe insomnia in the present study was 39.8%, 13.0%, and 0.9%, respectively. According to a survey of doctors in Bangladesh, most (54.17%) were experiencing insomnia (Sandesh et al., 2020). In the current study,

insomnia was associated with being married. Speculatively, this finding may reflect challenges related to married doctors in maintaining a balance between their work place and family, including with respect to childcare and work-life balance (Kannampallil et al., 2020). In contrast, loneliness, prevalent at 43.5 %, was associated with poor quality of life, depression, and stress. This may relate to the majority not living with their families and working many hours. Those living away from home are most likely to feel lonely, which itself is an important risk factor for psychiatric symptoms (Mushtaq et al., 2014). However, further research is needed to provide more evidence.

The present study investigated several COVID-19-related variables including having experienced COVID-19 infection, having been adequately trained to conduct COVID-19 treatment/perform PCR tests/provide patient care, having experienced regret about their profession because of the pandemic and its many unexpected experiences, and having been counseled regarding how to maintain their mental health during the pandemic. With the exception of depression being related to not having been counseled on mental health maintenance, most COVID-19-related measures were not associated with mental health concerns, insomnia, or loneliness. Nonetheless, future studies should examine further such possibilities, especially as the pandemic continues and may have delayed and/or lasting impacts on mental health.

The extent to which the findings here as compared to previously published ones differ may represent age and cultural differences, differences in healthcare systems, variability in study settings, methodologies, instruments used to assess anxiety and depression, responses during the COVID-19 pandemic, or other factors warrant additional investigation. In a systematic review, De Brier et al., (2020) found that organizational and social support, clear communication, and developing a sense of control were protective factors in mitigating adverse mental health outcomes among healthcare workers during epidemics (De Brier et al., 2020), and these should be examined in future studies.

Limitations

This study has several limitations. Respondents were interns from a single tertiary care hospital in Bangladesh, and findings may not generalize this group. The sample size was small. The cross-sectional precludes drawing causal inferences and cannot distinguish pre-existing versus new mental health symptoms. Longitudinal surveys could provide additional insight into changes and long-term impact on interns' well-being. The results were based on self-reported questionnaires that investigated psychological problems, which may differ from results of clinical diagnostic interviews. To reduce subject burden, some variables (e.g., quality of life, health status, physical exercise, smoking) were measured using single-item questions. Future studies using validated measures that assess these domains are warranted.

Conclusions

The present study provides insight into mental health concerns of intern doctors during the COVID-19 pandemic. Depression, anxiety, stress, insomnia, and loneliness were frequently endorsed by interns caring for patients during the pandemic in a tertiary care hospital in Bangladesh. Further research is required to evaluate both short- and long-term effects of the pandemic on the mental health of intern doctors. Future

studies should assess the efficacy and tolerability of interventions targeting psychological distress in order to provide adequate psychosocial support for intern doctors during and following the pandemic. As the pandemic progresses, potential stressors related to lost educational opportunities and decreased work opportunities may also need to be assessed and addressed. Moreover, the findings may help hospitals generate more intern-friendly environments, perhaps through enhanced psychosocial supports including counselling.

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Author Contribution PRD and MSI contributed equally to this research. PRD planned, conducted, and supervised the study along contributed to the preparation of the original draft. MSI planned, designed the instruments, analyzed data, interpreted the results, contributed to writing the original draft, and edited the manuscript. PKK conducted the study and edited the manuscript. RS critically revised and edited the manuscript. ZWZ analyzed data, interpreted the results, and edited the manuscript. MNP supervised the study, and critically revised and edited the initial draft manuscript.

Data Availability The datasets used and/or analyzed during the current study are available from the corresponding author on reasonable request.

Declarations

Ethics Approval The formal ethics approval was granted by the Ethical Review Committee of Sher-e-Bangla Medical College [Ref. no: SBMC/Barishal/ERC/2020/1866].

Informed Consent Informed consent was obtained from all participants.

Conflict of Interest The authors declare that they have no conflict of interest with respect to the content of this manuscript. The authors alone are responsible for the content and writing of the manuscript. Dr. Potenza has the following disclosures. He has consulted for and advised Opiant Pharmaceuticals, Idorsia Pharmaceuticals, AXA, Game Day Data, and the Addiction Policy Forum; has been involved in a patent application with Yale University and Novartis; has received research support from the Mohegan Sun Casino, the Connecticut Council on Problem Gambling, and the National Center for Responsible Gaming; has participated in surveys, mailings or telephone consultations related to drug addiction, impulse control disorders or other health topics; and has consulted for law offices and gambling entities on issues related to impulse control or addictive disorders.

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