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The role of the COVID-19 pandemic and economic crisis in insomnia and post-traumatic stress symptoms in the Lebanese population: A cross-sectional assessment

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Abstract

Based on an online cross-sectional survey, this study aimed to evaluate the role of the coronavirus disease 2019 (COVID-19) pandemic and economy-related factors in post-traumatic stress symptoms (PTSSs) and sleep in a sample of the general Lebanese population using the post-traumatic stress disorder checklist. The online survey was conducted between May 10, and May 20, 2020, and 502 Lebanese adults who have access to the internet were enrolled. Results highlighted that positive correlates of PTSS were fear of COVID-19, female gender, and waterpipe smoking; negative correlates were higher family satisfaction, higher financial wellness, older age, having access to healthcare, and never having to work. When including insomnia as an independent variable to explain PTSS, the model did not substantially change. Positive correlates of insomnia included fear of poverty, fear of COVID-19, violence at home, the number of dependent children, having a job, and having a chronic disease. Conversely, higher family satisfaction and financial wellness were associated with lower likelihood of insomnia. When entering PTSS, insomnia remained positively associated with fear of poverty, PTSS, and violence at home. However, fear of COVID-19 was no longer associated with insomnia. We concluded that both the fear of COVID-19 and the economic crisis are correlated with PTSS and insomnia.

Keywords: Coronavirus disease 2019; Economic crisis; Post-traumatic stress symptoms insomnia; Sleep disorders; Financial well-being; Lebanon

1. Introduction

The novel coronavirus has rapidly impacted the world with deleterious consequences on mental health, particularly in countries with financial hardships and preexisting mental health conditions induced by war or socioeconomic difficulties (Abou Hassan *et al.*, 2023; Sacre *et al.*, 2022; Salameh *et al.*, 2020; the United Nations Office for the Coordination of Humanitarian Affairs, 2022). Lebanon, a Middle Eastern developing country, falls within this category (El Khoury-Malhame *et al.*, 2023; Farran, 2021). It has been shattered by local and regional religious, political, and social conflicts, including a 15-year-long civil war, political instability, military tensions at the borders (Farran, 2021), and the inflow of Syrian refugees since the declaration of the war in Syria in 2012 (the United Nations High Commissioner for Refugees, 2023). All these factors, combined with corruption and mismanagement of resources, have crippled Lebanon's economy and resulted in both a downgrade by the World Bank from a high-income to upper-middle-income country and an unprecedented socioeconomic crisis, with massive demonstrations, strikes, and temporary bank closures (Arezki *et al.*, 2018; Harake & Abou Hamde, 2019).

Since the first positive case of coronavirus disease 2019 (COVID-19) was reported in Lebanon on February 21, 2020, the government implemented several measures to curb the spread of the disease, including a sanitary lockdown on March 15, 2020 (Rossi *et al.*, 2020). Such actions further deepened the currently collapsing economy, and households started experiencing more job losses, long-term unemployment, salary cuts, and mortgage payment difficulties (Abou Hassan *et al.*, 2023; Bizri *et al.*, 2021; Farran, 2021). In this economic and sanitary double hit, Lebanese people may have been exposed to death and suffered from severe illnesses due to COVID-19 infection, especially in an exhausted and overwhelmed healthcare system (Fleifel & Abi Farraj, 2022; Zahreddine *et al.*, 2022). The economic crisis made things much more complicated due to the medications and medical supply shortages (mainly oxygen and ventilators) and the inability to subsist in scarce resources (Bizri *et al.*, 2021; Koweyes *et al.*, 2021). Thus, Lebanese experienced various mental adverse outcomes, including increased stress and irritability, uncertainty, nightmares, emotional distress, hypervigilance, sadness, anxiety, isolation, and grief (El Khoury-Malhame *et al.*, 2023; Sacre *et al.*, 2022; Salameh *et al.*, 2020; Younes *et al.*, 2022), which may trigger post-traumatic stress symptoms (PTSS) or disorders (PTSD) (American Psychiatric Association, 2015; Hawryluck *et al.*, 2004; Sprang & Silman, 2013) as well as sleep difficulties that are already highly prevalent among the Lebanese population (estimated to be 17.9% using the Lebanese Insomnia Scale-18 scale [Hallit *et al.*, 2019] and 47.1% using the Athens Insomnia Scale [Al Karaki *et al.*, 2020]).

PTSS is likely to occur "after exposure to a potentially traumatic event that is beyond a typical stressor; events that may lead to it include, but are not limited to, violent personal assaults, natural or human-caused disasters, accidents, combat, and other forms of violence." The previous reports among the Lebanese population shed light on the prevalence of PTSD among adolescents, adult victims of cluster munitions, and habitants of South Lebanon who have endured years-long conflicts and multiple traumatic events (Fares *et al.*, 2017; Farhood *et al.*, 2016; Shaar, 2013). Furthermore, studies have found a close interaction between PTSD and sleep patterns. Sleep disturbances have often been identified as core symptoms of PTSD; they increase psychiatric comorbidity, including substance use disorder, and decrease quality of life in PTSD (Richards *et al.*, 2020). Additional research published during COVID-19 pandemic supported this hypothesis and pinpointed perceived stress as a critical factor in sleep outcomes (Wu *et al.*, 2021; Wu *et al.*, 2020).

While several studies have assessed the impact of the current pandemic on PTSS occurrence (Liu *et al.*, 2020; Rossi *et al.*, 2020) and quality of sleep (Huang & Zhao, 2020; Rossi *et al.*, 2020; Voitsidis *et al.*, 2020) in the general population worldwide, none, to our knowledge, has evaluated the combined association of the economy and COVID-19 on PSTD and insomnia. Such an assessment would identify the predictors for the co-occurrence of these disorders and is essential information for mental-health providers when establishing appropriate rescue plans and care. Therefore, the objective of this study was to evaluate the association of COVID-19 and economy-related factors on PTSS and sleep in a sample of the general Lebanese population.

2. Data and methods

2.1. Study design and sampling

An online cross-sectional survey was conducted between May 10, and 20, 2020, and 502 participants were recruited through snowball sampling due to the government-mandated sanitary lockdown. A questionnaire, which required 15 – 20 min to be completed, was created on Google Forms and shared with participants on social media platforms and WhatsApp groups. All individuals over 18 years of age with access to the internet were eligible to participate.

2.2. Sample size

The minimum sample size was calculated using the G-Power software, version 3.0.10. The calculated effect

size was 0.0526, expecting a squared multiple correlation of 0.05 (R_2 deviation from 0) related to the Omnibus test of multiple regression. The minimum necessary sample was $n = 454$, considering an alpha error of 5%, a power of 80%, and allowing 25 predictors to be included in the model.

2.3. Questionnaire

The online questionnaire was available in Arabic (Part A in Supplementary File), the native language in Lebanon. It consisted of three parts. The first part assessed the sociodemographic features of the participants, such as age, gender (female vs. male), marital status (single, married, and widowed/divorced), educational level categories, employment status (works vs. others), region (Lebanese governorates), household size, number of dependent children, number of rooms, violence at home (verbal, physical, sexual, or no violence), and current monthly household income. This part also included questions about medical coverage (yes vs. no), smoking (cigarette and waterpipe) and alcohol consumption (previous, none, occasional, regular), self-perception of the financial situation, having been infected or in contact with people infected with coronavirus (yes vs. no), and physical activity before and during the COVID-19 pandemic (yes vs. no).

The second part of the questionnaire assessed the impact of the economic crisis and the COVID-19 pandemic on the status of current employment using 20 work-related questions addressed to working people and those seeking employment. More details can be found in Part B in Supplementary File.

The last part of the questionnaire included the following validated scales:

2.3.1. The post-traumatic stress disorder checklist for DSM-5 (PCL-5)

This 20-item self-report tool evaluates the 20 DSM-5 symptoms of PTSD in the past month. It is available in Arabic and validated in Syria (Ibrahim *et al.*, 2018). Responses are rated on a five-point Likert scale from 0 (not at all) to 4 (extremely). The total symptom severity score (range 0 – 80) is obtained by summing the responses to all items. Higher scores reflect higher symptoms resulting from a stressful experience. Several PCL-5 cutoff scores have been suggested for an optimal diagnosis of probable PTSD (between 31 and 33); the 33-cutoff point was adopted as previously described for the COVID-19-induced PTSS (Liu *et al.*, 2020) ($\alpha_{Cronbach} = 0.971$). Since online questionnaires do not allow an accurate PTSD diagnosis but rather the PTS symptoms, in this manuscript, "PTSS" is used to refer to this evaluation. The PCL-5 was later dichotomized into PTSS versus no PTSS, according to 33-cutoff point.

2.3.2. The Lebanese insomnia scale (LIS-18)

This self-reported 18-item tool, recently validated in Lebanon (Hallit *et al.*, 2019), is used to screen for insomnia. Answers are graded on a five-point Likert scale from 1 (never) to 5 (always), with higher scores indicating higher insomnia ($\alpha_{Cronbach} = 0.847$). The LIS-18 was later dichotomized according to its median (45) into insomnia versus no insomnia.

2.3.3. The fear of COVID-19 (FOC) scale

This 7-item tool is used to measure the extent of fear of COVID-19 (FOC) in adult people (Ahorsu *et al.*, 2020). It is scored on a five-point Likert scale from 1 (strongly disagree) to 5 (strongly agree). The total score (range 1 – 35) is calculated by summing the answers to all questions. Higher scores indicate a greater FOC ($\alpha_{Cronbach}$=0.893).

2.3.4. The family Adaptation, Partnership, Growth, Affection, and Resolve (APGAR) index

This short self-reported instrument evaluates the satisfaction with global family function (Good *et al.*, 1979). It consists of five questions, each corresponding to a component of family function, that is, APGAR. All five items are scored on a three-point Likert scale: 0 (hardly ever), 1 (some of the time), and 2 (almost always). The total score ranging from 0 to 10 is obtained by summing the answers to all items. The higher the scores, the higher the satisfaction with family function ($\alpha_{Cronbach} = 0.927$).

2.3.5. The InCharge financial distress/financial well-being scale (IFDFW)

This tool includes eight items assessing the perceived financial distress/financial well-being on a 1 – 10 linear scale (Prawitz *et al.*, 2006). Lower scores reflect higher financial distress and lower well-being ($\alpha_{Cronbach} = 0.925$). Since this tool is copyrighted, written permission was obtained from the authors to use it and validate it in Lebanon.

2.4. Translation procedure and piloting

All the scales used were translated into Arabic, except for PCL-5 and LIS-18 already validated and available in this language. Three authors performed the forward translation, and the other three did the backward translation. Discrepancies between the original English versions and translated ones were resolved by consensus. The final questionnaire was pilot-tested on ten people unfamiliar with the study; answers were not included in the final dataset.

2.5. Statistical analysis

Data were collected using Google Forms, a tool that automatically generates an Excel database, then transferred

to IBM SPSS® version 23.0 for analysis. Following the practice in other populations in the literature (e.g., Huang & Zhao, 2020), the database was weighted to match the population distribution according to gender, age, and dwelling region based on the Central Administration of Statistics, Lebanon. In the descriptive analysis, frequency and percentage were used for categorical variables, while mean and standard deviations were used for quantitative variables. For the dependent variables (PCL-5 for PTSS and LIS-18 for insomnia), the median and interquartile regions were presented as well; the distribution of these variables was considered normal using visual inspection of the histogram, while the skewness and kurtosis were lower than 1. These conditions are deemed compatible with normality in a sample size higher than 300 (Mishra *et al.*, 2019).

For the bivariate analysis of continuous variables, the Student's t-test and analysis of variance (ANOVA) were used to compare the means between two groups and three groups or more, respectively, after checking for homogeneity of variances using the Levene's test. When variances were not homogeneous, the corrected t-test and the Kruskal–Wallis's test were used, respectively. *Post hoc* analyses were conducted after ANOVA and Kruskal–Wallis comparisons using Bonferroni adjustment. A Spearman's correlation coefficient was used to correlate between continuous variables. The gamma coefficient was calculated to assess the association between ordinal variables (quartiles of continuous variables). In all cases, $P < 0.05$ was considered significant.

For the multivariable analysis, two logistic regression models were used, taking PTSS and insomnia as dichotomous dependent variables, respectively. A stepwise method was used to reach the most parsimonious model. Independent variables included in the models had $P < 0.1$ in the bivariate analysis, taking into account the maximum allowed number of variables according to the sample size; hence, sociodemographic, family, health, FOC, and economy-related variables were introduced as appropriate. The exponential of beta coefficient (the adjusted OR), its 95% confidence interval, and p-value were reported. Moreover, two additional multiple regressions were conducted: one using PTSS as a dependent variable (dichotomized variable) and introducing insomnia as an independent variable, and the other using insomnia (dichotomized variable) as a dependent variable and the PTSS as an independent variable, aiming to assess how these maneuvers would affect the models.

In addition, to check the dose-effect relationship, four multiple linear regression models were conducted to assess the correlates of dependent variables in the whole sample, after checking the residues' normality, the linearity of the relationship, the absence of multicollinearity, and the homoscedasticity assumptions. The beta coefficient, its 95% confidence interval, and *p*-value were reported in all models.

3. Results

3.1. Sociodemographic characteristics, PTSS, and insomnia

In this sample of the general Lebanese population, the mean PCL-5 score was 17.64 (standard deviation [SD] = 17.0) (median = 13, IQR = 3 – 28), while the mean LIS-18 score was 44.61 (SD = 11.24) (median = 44, IQR = 35 – 53]. The prevalence of PTSS was 21.68% (n = 109; 95% CI [18.07%; 25.30%]), and that of insomnia 11.48% (n = 58; 95% CI [8.58%; 14.25%]).

The PCL-5 score was divided into quartiles: 141 (28%) had a score lower than 4, 133 (26.5%) between 4 and 16, 110 (21.9%) between 17 and 29, and 129 (23.7%) scored 30 or more. The insomnia score was also divided into quartiles: 143 (28.5%) had a score <37, 139 (27.6%) between 37 and 45, 103 (20.5%) between 46 and 53, and 117 (23.3%) scored 54 and more. The PTSS and insomnia scores had a correlation coefficient $r = 0.418$ ($p < 0.001$), while the association between quartiles yielded a gamma coefficient of 0.563 ($p < 0.001$) (Figure 1).

A higher PCL-5 score was associated with the female gender and smokers (cigarette and waterpipe). Participants who reported physical and other forms of violence in their household, who were older, and who had higher APGAR family scores had significantly lower levels of PCL-5 score (Table 1). Moreover, a higher insomnia score was associated with being married, having a higher number of dependent children, being a past alcohol or waterpipe consumer, living with violence at home (verbal, physical, sexual, or other), being employed or looking for employment, being a housewife/never working, and having higher APGAR family scores (Table 1). Additional results are detailed in Part C in Supplementary File (Table S1).

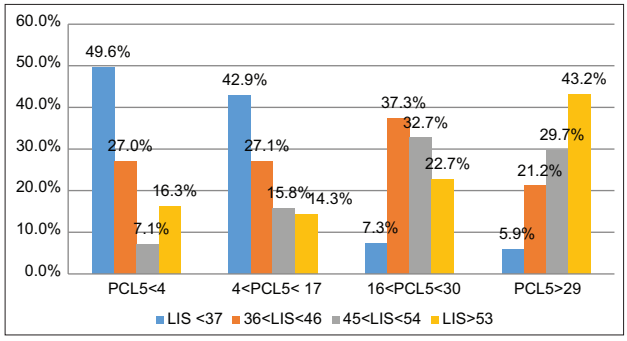

Figure 1. Association between PTSS and insomnia quartiles in the Lebanese population
Note: PTSS: Post-traumatic stress symptoms. $N = 502$; gamma = 0.563; $p < 0.001$.

Table 1. Sample distribution by sociodemographic characteristics, PTSS, and insomnia

Characteristics	Frequency (%) N=502 (100%)	PTSS mean (SD)	*p*-value	Insomnia mean (SD)	*p*-value
Gender			<0.001		0.114
Male	237 (47.3)	13.57 (14.77)		43.77 (11.60)	
Female	265 (52.7)	21.29 (18.04)		45.36 (10.87)	
Marital status			0.430		0.024
Single	189 (37.6)	18.85 (18.08)		42.85 (10.73)	Ref
Married	290 (57.8)	17.02 (16.37)		45.70 (11.31)	0.020
Widowed/Divorced	23 (4.6)	15.57 (15.63)		45.41 (11.24)	0.894
Number of dependent children			0.988		0.007
None	207 (41.2)	17.88 (17.33)		42.63 (10.61)	Ref
1 child	46 (9.1)	17.99 (16.21)		47.11 (12.38)	0.085
2 children	132 (26.3)	17.48 (18.31)		45.26 (11.01)	0.206
3 or more	118 (23.4)	17.26 (15.29)		46.41 (11.66)	0.020
Number of rooms			0.081		0.174
<5 rooms	167 (33.2)	18.05 (16.54)		44.33 (11.13)	
5 rooms	138 (27.6)	16.16 (16.65)		45.92 (12.24)	
6 rooms	109 (218)	15.22 (13.78)		45.02 (10.83)	
7 or more	87 (17.4)	22.25 (20.94)		42.58 (10.08)	
Alcohol consumption			0.141		<0.001
Previous	14 (2.8)	8.96 (15.85)		54.33 (06.17)	Ref
None	197 (39.3)	18.78 (17.30)		43.82 (10.89)	<0.001
Occasional	248 (49.3)	17.66 (16.88)		45.17 (11.44)	<0.001
Regular	44 (8.7)	15.13 (16.09)		41.94 (11.30)	<0.001
Cigarette smoking			0.002		0.139
Previous	21 (4.1)	7.71 (13.48)	Ref	47.05 (12.98)	
None	334 (66.6)	17.11 (16.10)	0.001	44.15 (11.31)	
Occasional	87 (17.4)	21.57 (20.10)	0.001	46.72 (11.12)	
Regular	60 (11.9)	18.33 (16.73)	0.001	43.25 (10.07)	
Waterpipe smoking			0.005		<0.001
Previous	27 (5.3)	12.82 (12.73)	0.034	51.46 (7.15)	Ref
None	363 (72.3)	16.57 (16.58)	0.008	43.75 (11.45)	<0.001
Occasional	79 (15.7)	19.66 (16.82)	Ref	45.27 (11.43)	0.001
Regular	33 (6.7)	23.32 (19.02)	1.000	46.01 (10.47)	0.005
Violence at home[a]					
Verbal violence versus no	30 (5.9)	15.07 (17.65)	0.469	53.89 (12.84)	<0.001
Physical violence versus no	8 (1.6)	12.98 (11.24)	0.009	55.86 (9.48)	0.006
Sexual violence versus no	7 (1.4)	0	<0.001	54.16 (7.30)	0.024
Other violence versus no	8 (1.6)	12.98 (11.24)	0.008	55.86 (9.48)	0.005
No violence	472 (94.1)	17.41 (16.89)	Ref	43.84 (11.14)	Ref
Professional status			0.775		0.015
Works/looking for a job	361 (71.9)	17.55 (16.42)		45.15 (11.29)	0.022
Housewife/never work	52 (10.3)	16.18 (12.79)		46.33 (09.86)	0.037
Student	50 (9.9)	18.37 (19.42)		40.22 (11.54)	Ref
Retired	40 (7.9)	19.47 (23.18)		43.00 (11.03)	1.000
	Mean (SD)	**Unadjusted correlation coefficient (r)**	***p*-value**	**Unadjusted correlation coefficient (r)**	***p*-value**
Age in years	42.47 (14.06)	−0.146	0.001	0.070	0.118
APGAR family	7.81 (2.72)	−0.263	<0.001	−0.227	<0.001

Note: [a]More than one answer is possible. PTSS: Post-traumatic stress symptoms; APGAR: Adaptation, Partnership, Growth, Affection, and Resolve.

3.2. Economic characteristics, PTSS, and insomnia

Higher socioeconomic quartiles and financial wellbeing (IFDWF) scores were significantly associated with a lower PCL-5 score, while a greater fear of poverty was associated with a higher PCL-5 score. Lower insomnia score was associated with a poor socioeconomic class before the COVID-19, with middle and low classes after the pandemic, high household income, and high IFDWF

score, while fear of poverty was associated with a higher insomnia score (Table 2).

3.3. Exposure to COVID-19, health characteristics, PTSS, and insomnia

As for health-related matters, a lower PCL-5 score was associated with being in contact with a COVID-19 patient or knowing someone infected with COVID-19, while a higher PCL-5 score was associated with worrying about a family member becoming infected with the virus and fear of the virus. Physical activity during confinement was significantly associated with lower insomnia, while FOC was associated with higher insomnia (Table 3). Additional results are detailed in in Part C in Supplementary File (Table S2).

3.4. Multivariable analyses: correlates of PTSS and insomnia

In the multivariable analysis, positive correlates of PTSS were FOC, fear of poverty score, the female gender, and current cigarette smoking; negative correlates were a higher APGAR family score, older age, and never having to work (mainly retired, housewives, and students). Adding insomnia as an independent variable to the model did not substantially change it, and insomnia was positively associated with PTSS.

Positive correlates of insomnia included fear of poverty, FOC, physical violence at home, number of dependent children, and being afraid of not having access to treatment. In contrast, having a higher APGAR family score was associated with lower insomnia. When PTSS was additionally included in the model, the majority associations of these variables did not change, and PTSS was positively associated with insomnia. However, the fear of the COVID-19 scale was not associated anymore with insomnia (Table 4). Results from sensitivity analysis of the multiple linear regressions confirmed the above relationships (Part C in Supplementary File; Table S3).

Table 2. Economic characteristics, PTSS, and insomnia

	Frequency (%) N=502 (100%)	PTSS mean (SD)	*p*-value*	Insomnia mean (SD)	*p*-value*
Subjective assessment of economic status before COVID			0.673		<0.001
No answer	5 (1.0)	15.11 (18.08)		55.38 (12.65)	0.282
Rich	30 (6.1)	16.66 (18.70)		48.18 (13.47)	0.013
Middle class	448 (89.2)	17.85 (16.91)		43.93 (1.97)	<0.001
Middle to low	11 (2.1)	19.25 (15.16)		47.74 (8.82)	0.002
Below poverty line	8 (1.6)	9.24 (18.52)		57.89 (3.33)	Ref
Subjective assessment of economic status after COVID			0.526		<0.001
No answer	14 (2.8)	16.82 (16.57)		47.55 (14.68)	0.282
Rich	5 (1.1)	21.95 (22.19)		49.66 (10.20)	0.013
Middle class	327 (65.1)	16.99 (17.21)		42.65 (10.60)	<0.001
Middle to low	137 (27.2)	19.54 (15.68)		48.24 (11.24)	0.002
Below poverty line	19 (3.8)	14.51 (21.23)		48.67 (12.01)	Ref
Current health coverage			0.064		0.006
No health coverage	53 (10.5)	22.92 (15.36)		45.41 (11.26)	0.121
Private insurance	205 (40.8)	18.41 (16.49)		45.88 (11.04)	0.005
Social security	155 (30.9)	16.29 (17.01)		45.07 (11.69)	0.019
Other public coverage	90 (17.8)	16.30 (18.30)		40.90 (9.84)	Ref
Household income			0.072		0.001
<675,000 LP	15 (2.9)	21.21 (15.88)		46.43 (11.32)	0.892
675,000 – 1,500,000 LP	64 (12.8)	19.63 (17.81)		46.53 (08.79)	Ref
1,500,000 – 3,000,000 LP	149 (29.7)	19.76 (17.93)		45.96 (10.70)	0.776
More than 3,000,000 LP	274 (54.5)	15.82 (16.20)		43.32 (11.90)	0.003
Socioeconomic quartile			0.002		0.231
Quartile 1	134 (26.6)	18.64 (16.27)	Ref	45.75 (10.38)	
Quartile 2	142 (28.3)	21.75 (19.79)	0.135	43.80 (11.24)	
Quartile 3	119 (23.7)	13.78 (15.57)	0.014	45.49 (11.76)	
Quartile 4	101 (20.1)	14.52 (13.85)	0.199	43.25 (11.80)	
	Mean (SD)	**Unadjusted correlation (r)**	***p*-value****	**Unadjusted correlation (r)**	***p*-value****
Fear of poverty	6.90 (2.65)	0.314	<0.001	0.326	<0.001
IFDWF financial wellbeing scale	39.9 (17.33)	-0.329	<0.001	−0.299	<0.001

Note: APGAR: Adaptation, Partnership, Growth, Affection, and Resolve; IFDFW: The InCharge financial distress/financial well-being scale; PTSS: Post-traumatic stress symptoms. **p*-values were based on ANOVA test (and *post hoc* with Bonferroni adjustment). ***p*-values were based on Spearman's correlation test.

Table 3. Exposure to COVID-19, health characteristics, PTSS, and insomnia

Factor	Frequency (%) N=502 (100%)	PTSS Mean (SD)	*p*-value*	Insomnia mean (SD)	*p*-value*
Contact with COVID-19			0.035		0.439
Yes (work, family, store)	18 (3.5%)	11.27 (11.75)		42.58 (11.29)	
No	484 (96.5%)	17.87 (17.12)		44.69 (11.24)	
Knows someone infected			0.004		0.339
Yes	145 (28.8%)	14.47 (15.01)		43.86 (11.02)	
No	357 (71.2%)	18.92 (17.60)		44.92 (11.33)	
Physical activity			0.057		0.001
Yes	321 (64.0%)	16.55 (17.11)		43.32 (11.41)	
No	181 (36.0%)	19.57 (16.66)		46.91 (10.57)	
Having a chronic disease			0.524		0.057
Yes	103 (20.5%)	16.69 (16.02)		46.49 (12.24)	
No	399 (79.5%)	17.89 (17.25)		44.13 (10.93)	
Receiving regular treatment			0.755		0.044
Yes	127 (25.4%)	17.54 (16.67)		46.76 (11.62)	Ref
No	40 (8.0%)	15.78 (16.20)		44.05 (10.49)	0.545
Does not apply	334 (66.6%)	17.91 (17.25)		43.86 (11.10)	0.040
Fear no access to treatment			0.062		<0.001
No	153 (30.5%)	19.78 (15.01)		48.94 (10.87)	Ref
Yes	136 (27.0%)	15.16 (16.73)		42.59 (10.51)	<0.001
Does not apply	213 (42.4%)	18.06 (18.20)		43.31 (11.29)	<0.001
Fear to go out get treatment			0.119		0.074
No	217 (43.2%)	15.36 (15.02)		44.60 (11.53)	
Yes	77 (15.4%)	20.06 (17.82)		47.11 (10.78)	
Does not apply	208 (41.4%)	19.11 (18.37)		43.69 (11.01)	
Worried for family member			0.002		0.442
No	96 (19.1%)	12.72 (14.06)	Ref	45.81 (11.24)	
Yes	268 (53.4%)	19.96 (18.14)	0.001	44.12 (11.29)	
Does not apply	138 (27.4%)	16.55 (15.78)	0.037	44.74 (11.14)	
	Mean (SD)	**Unadjusted correlation (r)**	***p*-value****	**Unadjusted correlation (r)**	***p*-value****
Fear of COVID-19	11.35 (6.03)	0.424	<0.001	0.229	<0.001

Note: *Yes versus no modalities comparison. APGAR: Adaptation, Partnership, Growth, Affection, and Resolve; PTSS: Post-traumatic stress symptoms. **p*-values were based on ANOVA test (and post hoc with Bonferroni adjustment). ***p*-values were based on Spearman's correlation test.

4. Discussion

This study was carried out 3 months after the first case of COVID-19 was confirmed in Lebanon and 2 months after the national sanitary lockdown was declared. It revealed relatively high prevalence of PTSS (21.7%) as evaluated by the PCL-5 scores and moderate prevalence of insomnia (11.5%) among a sample of the general Lebanese population. The prevalence of insomnia in this study was higher than that reported in other populations (Rossi *et al.*, 2020; Zhou *et al.*, 2021) but lower than what was previously published in Lebanon (using the LIS-18 score: 17.9%) (Hallit *et al.*, 2019) and in other countries (Huang & Zhao, 2020; Kokou-Kpolou *et al.*, 2020; Voitsidis *et al.*, 2020). Discrepancies may be due to the use of different assessment tools and differences in demographic profiles of populations. Notably, the prevalence of PTSS was higher than that reported in China during the pandemic (4.6 and 7%) (Liu *et al.*, 2020; Sun *et al.*, 2020). Such a disparity could be related to the cumulation of stressful events experienced by the Lebanese population, including the current pandemic, past and prevailing local and regional wars, political instability, and the economic crisis. Interestingly, the PTSS prevalence found in this study was similar to the one reported in Lebanon (21.6%) immediately after "The Grapes of Wrath" war (South Lebanon, 1996). Therefore, in major life-threatening disease outbreaks occurring in societies already struggling with economic difficulties, understanding the interplay of factors on mental health is crucial to design detection and intervention strategies.

4.1. COVID-19, PTSS, and insomnia

Our results showed that FOC was the main factor impacting both PTSS and insomnia. Even if several studies have assessed PTSS (Liu *et al.*, 2020; Rossi *et al.*, 2020)

Table 4. Multivariable analyses: Correlates of PTSS and insomnia

Model 1: Correlates of PTSS symptoms (Nagelkerke R^2=0.332; Omnibus test <0.001; HL *p*-value=0.845)				
Factor	***p*-value**	**ORa**	**95% confidence interval of the ORa**	
Fear of COVID score	<0.001	1.114	1.065	1.165
Female versus male gender	<0.001	2.965	1.732	5.077
Current cigarette smoking	0.016	2.302	1.167	4.539
Never works versus others	0.004	0.213	0.075	0.601
APGAR score	<0.001	0.833	0.763	0.909
Age in years	0.001	0.967	0.948	0.987
Fear of poverty score	<0.001	1.218	1.086	1.366
Model 2: Correlates of PTSS symptoms, including insomnia as an independent variable (Nagelkerke R^2=0.392; Omnibus test <0.001; HL *p*-value=0.08)				
Factor	***p*-value**	**ORa**	**95% confidence interval of the ORa**	
Fear of COVID score	<0.001	1.135	1.080	1.194
Female versus male gender	<0.001	3.233	1.821	5.739
Current cigarette smoking	0.022	2.321	1.128	4.776
Current waterpipe smoking	0.020	2.911	1.180	7.182
Never works versus others	0.002	0.186	0.064	0.542
Afraid of not accessing treatment	0.029	0.501	0.269	0.933
APGAR score	<0.001	0.852	0.775	0.937
Age in years	<0.001	0.961	0.940	0.982
Income level	0.019	1.563	1.076	2.271
IFDWF wellness score	<0.001	0.968	0.949	0.986
Insomnia (yes vs. no)	<0.001	3.368	1.923	5.900
Model 3: Correlates of Insomnia (Nagelkerke R^2=0.247; Omnibus test <0.001; HL *p*-value=0.488)				
Factor	***p*-value**	**ORa**	**95% Confidence Interval of the ORa**	
Fear of COVID score	0.006	1.049	1.014	1.086
Number of children at your responsibility	0.029	1.201	1.019	1.415
Physical violence at home (yes vs. no)	0.006	20.292	2.354	174.947
APGAR score	<0.001	0.863	0.801	0.930
Fear of poverty score	<0.001	1.220	1.124	1.325
Being afraid of not accessing treatment (yes vs. no)	0.006	1.920	1.209	3.047
Sports during confinement (yes vs. no)	0.007	0.564	0.373	0.854

(Cont'd...)

Table 4. ***(Continued)***

Model 4: Correlates of Insomnia, including PTSS as an independent variable (Nagelkerke R^2=0.276; Omnibus test <0.001; HL *p*-value=0.173)				
Factor	***p*-value**	**ORa**	**95% confidence interval of the ORa**	
Number of children at your responsibility	0.009	1.250	1.057	1.477
Physical violence at home (yes vs. no)	0.015	14.398	1.674	123.809
APGAR score	0.004	0.892	0.826	0.964
Fear of poverty score	<0.001	1.202	1.106	1.305
Being afraid of not accessing treatment (yes vs. no)	<0.001	2.269	1.424	3.616
Sports during confinement (yes vs. no)	0.014	0.588	0.385	0.898
PTSS (yes vs. no)	<0.001	3.295	1.949	5.571

Note: PTSS scale added in the model as an independent variable. PTSS: Post-traumatic stress symptoms, APGAR: Adaptation, Partnership, Growth, Affection, and Resolve; IFDFW: The InCharge financial distress/financial well-being scale.

or sleep disorders (Huang & Zhao, 2020; Kokou-Kpolou *et al.*, 2020; Rossi *et al.*, 2020; Voitsidis *et al.*, 2020) in the general population during this pandemic, none has evaluated the direct relationships between the fear of the virus and PTSS and insomnia using a validated scale. Some authors even pointed out that they could not identify which of the fear of the disease or the restrictive measures imposed by governments were the direct causing factors of mental health-related issues (Casagrande *et al.*, 2020). FOC could also be related to the concern of contracting the disease or that it infects loved ones, in addition to fears of stigmatization and social exclusion in case of confirmed infection, being quarantined, losing one's job, etc. (Brooks *et al.*, 2020) All these smothering ideas and fear experiences, further fueled by media overflow of information and misinformation, could potentially lead to irrational and unclear thoughts, which, in turn, would exacerbate underlying mental health problems and be significant predictors of PTSS and insomnia.

4.2. Economy, PTSS, and insomnia

In Lebanon, FOC was magnified by the fear of uncertainties related to the economy. Indeed, our results showed that financial hardship was significantly associated with higher levels of PTSS and insomnia, similar to previous findings showing that people from low household incomes were more likely to exhibit PTSS (Hawryluck *et al.*, 2004). Increased sleep difficulties were associated with fear of

poverty and having more dependent children in this study. Employed people also displayed higher PTSS levels compared to those who never worked (mainly retired, housewives, and non-working students). Indeed, these persons were highly preoccupied with the wilting economy and the consequences of the COVID-19 pandemic and subsequent lockdown on their work. They were unable to resume their regular professional activities; they also faced unexpected expenses and could not anticipate the long-term detrimental impacts of the pandemic on the economy. Therefore, people who feared poverty and worried about not being able to secure their children's needs experienced uncontrollable cognitive arousal, which is known to affect the quality of sleep (Brooks *et al.*, 2020).

Finally, those who feared not being able to access treatment had higher levels of PTSS, which is directly related to the fear of contracting the virus and not being able to afford treatment and isolation measures. Even if human rights call for the "right to health," especially during this pandemic, granting access to health-care services and social security are hard to manage in economically crippled countries such as Lebanon (Armocida *et al.*, 2020; WHO, 2020).

4.3. Sociodemographic factors, PTSS, and insomnia

PTSS was associated with some sociodemographic factors, such as gender, age, and waterpipe/cigarette smoking status; it was higher among women and current smokers but inversely correlated with older age. Our results are consistent with existing literature showing that gender and age were predictors of PTSD during previous infectious disease outbreaks (Xu *et al.*, 2011) or the current pandemic (Casagrande *et al.*, 2020; Liu *et al.*, 2020). Indeed, women usually exhibit higher stress, anxiety, and helplessness than men, which could be related to the higher reactivity of fear-associated neural networks in women's brains (Felmingham *et al.*, 2010).

Regarding smoking status, a recent review of the literature revealed that smokers were approximately twice more likely to have PTSD than non-smokers in the general population and that individuals with PTSD were about twice as likely to be current smokers. These outcomes could be partly explained by the expectation that smoking would reduce the detrimental consequences of PTSD symptoms, which, in turn, would increase the smoking rate and nicotine dependence (Kearns *et al.*, 2018).

As for insomnia, patients suffering from violence (physical) were more prone to insomnia, in agreement with a recent review that identified an overall relationship between interpersonal violence and poor quality of sleep (Gallegos *et al.*, 2019). Moreover, higher levels of insomnia were perceived by patients who feared not being able to access treatment or not having enough money to afford medications and disease management (Kumar Kar *et al.*, 2020).

Finally, PTSS and insomnia levels were higher in individuals with lower family support (lower APGAR scores), consistent with the previous studies showing that loneliness was positively correlated with mental health issues during the COVID-19 pandemic (Kokou-Kpolou *et al.*, 2020; Voitsidis *et al.*, 2020) and that family support promoted positive mental health status (Zhang & Ma, 2020).

4.4. PTSS, fear of COVID-19, and insomnia

Regarding the correlation between PTSS and insomnia, our results showed that each of these disorders could be a predictive factor of the other after adjustment for potential confounders. This outcome was expected since previous studies widely explored their relationships (Casagrande *et al.*, 2020; Sun *et al.*, 2020), revealing that poor quality of sleep is linked to both onset and maintenance of PTSS (Brooks *et al.*, 2020), regardless of FOC. Interestingly, when including PTSS as an independent variable in the model with insomnia as a dependent variable, FOC was no longer associated with insomnia; this was not the case for economy-related variables that would be independently associated with insomnia. To the best of our knowledge, these results have never been described previously.

A recent review evidenced overlapping clinical characteristics between sleep disturbance and anxiety-related disorders, including PTSS, with a bidirectional relationship between both disorders (Richards *et al.*, 2020). The authors discussed that sleep disorders and nightmares occurred at a high frequency following trauma and/or in PTSS (Mysliwiec *et al.*, 2018; Mysliwiec *et al.*, 2014). One possible explanation is that FOC could lead to panicked awakenings, increased physical movement during sleep, and nightmares. These symptoms are typically observed following trauma, which explains the association of PTSS with insomnia (Richards *et al.*, 2020). Some authors call it "trauma-associated sleep disorder" (Mysliwiec *et al.*, 2018; Mysliwiec *et al.*, 2014). Additional studies are needed to elucidate the underlying mechanisms between FOC, PTSS, and insomnia.

4.5. Limitations and strengths

Our study presents some limitations, mainly due to the study design and online data collection that consists of a small cross-sectional non-randomized analysis without baseline evaluation. Furthermore, most participants were university graduates, had appropriate computer literacy, and access to the Internet, and we used a snowball technique for data; thus, selection bias might have

occurred, and our sample might not be representative of the whole population. However, education did not affect the overall outcomes of our study. Indeed, the sample size had adequate power to assess correlations, and the multivariate analysis was performed with appropriate adjustment on multiple potential confounders, including education; all these elements are expected to decrease the effect of the selection bias on the results. Furthermore, the cross-sectional design of the study precludes causality inferences. In addition, although multiple potential confounders were taken into account through the multivariable analysis, there is still a risk of residual confounding. However, the quantitative exposure-effect relationships found after multivariable analyses might limit this problem (results shown in multiple linear regression models – in Part C in Supplementary File; Tables S3).

Moreover, despite using validated scales with very good to excellent reliability, information bias cannot be ruled out as the questionnaire was self-reported. Nevertheless, this bias could be non-differential and direct the results towards the null, underestimating the magnitude of the associations found. However, this study is relatively large with acceptable methodology in the current circumstances, allowing the evaluation of the combined impact of COVID-19 and a collapsing economy on PTSS and insomnia. Additional robust studies using larger-size and more representative samples would help confirm these findings. Based on these results, decision-makers need to acknowledge that economic hardship and the pandemic can together impact mental health detrimentally. They need to define strategies to better screen for these disorders while identifying triggering factors, thus implementing individualized management plans when similar circumstances resurge.

5. Conclusion

This study revealed that the fear of COVID-19 and the economic crisis are correlated with PTSS and insomnia. Moreover, the association between the fear of COVID-19 and insomnia showed to be related to PTSS symptoms. Additional studies are needed to confirm our findings and allow a better generalization of the results.

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Conflict of interest

The authors declare no potential conflicts of interest with respect to the research, authorship, and/or publication of this article.

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Ethics approval and consent to participate

The Institutional Review Board of the American University of Science and Technology approved this study protocol (AUST-IRB-20200527-01), as this work has been performed in accordance with the ethical standards laid down in the 1964 Declaration of Helsinki and its later amendments. The topic was explained to all participants in the introductory section of the survey and consent to participate was implicit. Anonymity of participants was guaranteed throughout the process of data collection and analysis.

Consent for publication

Not applicable.

Availability of data

The datasets used and/or analyzed during the current study are available from the Figshare repository: https://figshare.com/s/939d0fc0032c7af0b8c9.

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