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RESEARCH ARTICLE

Mental health consequences of COVID-19 in house staff physicians [version 1; peer review: awaiting peer review]

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Abstract

Background: A new coronavirus, SARS-CoV-2, was associated with a newly identified respiratory syndrome, COVID-19 in Wuhan, China, in early December 2019. SARS-CoV-2 rapidly spread across the globe, imposing increased working hours and workloads for healthcare workers. We have evaluated the prevalence of mental health outcomes and associated factors in house staff physicians in Panama.
Methods: A cross-sectional study was undertaken from July 23, 2020, to August 13, 2020. Snowball sampling was used to recruit participants. Then, an electronic questionnaire with scales to evaluate anxiety disorders (GAD-7), depression (PHQ-9) and post-traumatic stress (IES-R) was administered. In addition, socio-demographic variables, clinical history of mental disorders and COVID-19 exposure were evaluated. Independent analyses for each mental health outcome were undertaken using a logistic regression analysis.
Results: A total of 517/1,205 (42.9%) interns and residents were recruited nationwide. The overall prevalence of depression symptoms was 25.3%, 13.7% for anxiety and 12.2% for post-traumatic stress. At least 9.3% participants reported having suicidal ideation. The most parsimonious model showed females had a higher prevalence of mental health disorders across results, and married participants were more likely to present depression (OR, 1.73; 95% CI, 1.03-2.91; P = 0.039) or at least one mental health disorder (OR, 1.66; 95% CI, 1.03-2.68; P = 0.039).
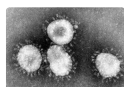**Conclusions:** A high prevalence of mental health disorders was found, showing the need to mitigate this emotional burden among healthcare workers in the current context of the COVID-19 pandemic.

Keywords

depression, anxiety, stress, Mental health, house staff physicians

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Introduction

The global health emergency caused by the coronavirus disease 2019 (COVID-19) that emerged in the city of Wuhan, capital of Hubei province in China, in late 2019 has posed one of the greatest challenges to frontline health care workers.[1] In Panama, COVID-19 was detected early March 2020; although the country rapidly implemented control and mitigation strategies, Panama has one of the highest cumulative case incidences in the Americas.[2] By July 7, 2020, COVID-19 seroprevalence in Panama was estimated around 11.7% in health care worker.[3]

As countries have adopted draconian social distancing measures to reduce infections, there has been an increase in stressors that will likely increase the risk of psychiatric illness in the months following infection waves.[4] In health care workers, the workload, the scarcity of personal protective equipment and the fear of contaminating family and friends are added to the risk for those who are in the front line of patient care, potentially triggering anxiety, fatigue, depression, irritability, fear, insomnia, among others. However, despite the efforts to comply with governmental plans to control the epidemic, it has been seen in studies related to severe acute respiratory syndrome (SARS) in 2003, that although affected people and health workers were motivated to comply with quarantine to reduce the risk of infecting others, emotional distress tempted some to consider violating disease control measures.[5]

It is evident that the pandemic has led to an increase in the prevalence of mental health disorders in the world's population.[6] Health care workers are no exception to this reality, so it is necessary to know the factors that influence mental health outcomes due to de COVID-19 pandemic, in order to make a comprehensive approach to support those who are in the first line of care.

Intern physicians carry out visits, prepare clinical histories, evaluate the daily evolutions of the clinical condition of patients, and attend teaching meetings, under the supervision of a medical officer. The responsibilities of resident physicians are established according to each medical residency program in their training hospital, but in general, they admit patients, undertake rotations in different medical specialties, conduct daily patient evaluations, among other responsibilities.

In Panama, medical internship and residency are carried out in public hospitals nationwide and affiliated with the Federación Nacional de Médicos Residentes e Internos (FENAMERI). Being in the front line of care, these physicians spend long working hours in hospitals and care centers, performing shifts on both weekdays and weekends. This poses a greater risk of infection, due to high workloads as the public health system reaches maximum capacity, added to the shortage of personal protective equipment, potentially triggering poor mental health.

Methods

This cross-sectional study was conducted during the COVID-19 pandemic based on a survey of resident physicians and interns working in public health facilities in Panama (potential respondents were 408 resident physicians and 797 interns nationwide) in July 2020 and affiliated with the National Federation of Resident Physicians and Interns (FENAMERI). The minimum respondent number needed was 349 house staff physicians (residents and interns), calculated through the statistical tool STATCALC (Epi Info) for population survey or descriptive study, and expecting a prevalence of mental alteration of at least 35% considering previous evidence following the 2003 SARS outbreak.[7]

The objective of the study was to determine the prevalence of mental health disorders in these populations, and identify associated factors related to sociodemographic characteristics, personal history, and exposure to SARS-CoV-2.

Between July 23 and August 13, a link containing an anonymized, self-report questionnaire was sent, disseminated through emails and WhatsApp using a snowball technique. Approval for this study was obtained from the National Committee on Research Bioethics (CNBI) and participants' informed consent was obtained online. The sampling period corresponded to the period of high incidence of COVID-19 infection, in accordance with high hospital occupancy at the national level.[8]

The questionnaire collected data on sociodemographic variables (sex, age, marital status, occupation), personal history (smoking, harmful use of alcohol assessed by the AUDIT-C scale,[9] history of psychological trauma, history of psychiatric illness, family history of psychiatric illness) and exposure information (history of COVID-19 diagnosis, family member with COVID-19 diagnosis, infected colleagues, and whether they attended patients with COVID-19 in the last 15 days).

Mental health outcomes were self-reported symptoms of depression, generalized anxiety, and post-traumatic stress, using the nine-item Patient Health Questionnaire (PHQ-9) scales,[10] the seven-item Generalized Anxiety Disorder scale (GAD-7),[11] and the 22-item Impact of Events Scale (IES-R).[12]

Study participants were sorted according to the presence or absence of these symptoms with the following cutoff points: at least 10 on the PHQ-9 questionnaire, at least 10 on the GAD-7, and at least 26 on the IES-R. Those who scored higher were considered as having a clinically significant range of mental health impairment. The cut-off points were extracted from the original articles describing each measure.[10–12]

In order to protect the confidentiality of the participants, the data on the type of specialty were grouped into: surgical specialties (general surgery, cardiovascular surgery, ophthalmology, otorhinolaryngology, maxillofacial surgery, neurosurgery, vascular surgery, orthopedics), medical specialties (internal medicine and its subspecialties, psychiatry, physical medicine and rehabilitation, pediatrics and its subspecialties, occupational medicine, anesthesiology, preventive medicine), and diagnostic support specialties (pathology, radiology).

To analyse the results, frequencies and percentages were calculated for sociodemographic data, personal and family history, exposure to COVID-19 and prevalence of each mental health finding; then, univariable and multivariable logistic regression models were performed to explore associations between these results.

Statistical analysis

The scales used in this study (PHQ-9, GAD-7 and IES-R) have widely used, adequate indicators of validity and reliability. Independent analyses were undertaken for each mental health impairment: depression (PHQ-9 $\geq$ 10), generalized anxiety (GAD-7 $\geq$ 10), post-traumatic stress (IES-R $\geq$ 26), presence of at least one impairment, and presence of all three impairments. In each case, the outcome variable was the presence/absence of mental health disturbances, as determined by the cutoff point. Associations between each outcome and the study variables were tested using chi-square and Fisher's exact tests; $P<0.05$ was considered significant. Associations between each outcome and the independent variables were estimated using generalized estimating equations for logistic regression models and expressed as odds ratios (OR). Interaction variables between all variables identified as significant in the univariate analysis were examined, and marginal effects of significant interaction terms were determined. Model diagnostics were performed to check for model specification errors. Multicollinearity was also explored. The most parsimonious model was obtained with variable selection of the log likelihood test.[13] Univariable and multivariable ORs were calculated with 95% confidence intervals (Cis). Analyses were performed in Stata/SE version 16.1 (StataCorp, College Station, Texas).

Ethical considerations

The National Research Bioethics Committee of Panama approved the study protocol by resolution EC-CNBI-2020-06-74. Participants provided online informed consent prior to completing the questionnaire.

Results

Characteristics of the study population

Participants demographics are shown in Table 1. A total of 517 physicians completed the online questionnaire, of whom 243 (47%) were resident physicians and 274 (53%) were interns, for a response rate of 42.9% (517/1205). Of all participants, 48.5% were concentrated in the province of Panama, the capital of the country. Their mean age was 28 years (SD 3.1), with a majority of respondents being female (61.5%). A fraction of 78.9% were single or separated. Of the respondents, 14.9% reported having been diagnosed with COVID-19 by lab tests.

Prevalence of mental health disturbances

The prevalence rates of mental health disorders were: 25.3% (131/517) for depressive symptoms, 13.7% (71/517) for generalized anxiety, and 12.2% (63/517) for post-traumatic stress disorder (Table 2). Of the respondents, 32.7% (169/517) presented at least one disturbance and 5.8% (30/517) presented all three mental health disturbances.

In response to item 9 of the PHQ-9 questionnaire "How often do you think you would be better off dead or would hurt yourself in some way?" 9.3% (48/517) of respondents reported having suicidal thoughts; 0.8% (4/517) reported having suicidal ideation "more than half the days" and 8.5% (44/517) reported experiencing it "several days."

Scores of depression, generalized anxiety and post-traumatic stress of interns and resident physicians according to specialties in Panama are shown in Table 3.

Logistic regression models: univariable analysis

Female sex and personal history of psychological trauma and psychiatric pathology were associated with all three mental health outcomes investigated (Table 4). For example, results showed, for depression among women: OR = 1.75; 95% CI, 1.14-2.69; p = 0.010; generalized anxiety OR = 3.19; 95% CI, 1.70-5.99; p < 0.001; post-traumatic stress OR = 2.98; 95% CI, 1.54-5.74; p = 0.001; presenting at least one mental health disturbance OR = 1.93; 95% CI, 1.30-2.87; p = 0.001; and presenting all three mental health disturbances OR = 4.34; 95% CI, 1.49-12.63; p = 0.007.

Table 1. Demographic characteristics of the study population.

Characteristics	No. (%)
Total	517 (100)
Gender	
Male	199 (38.5)
Female	318 (61.5)
Age (mean ± SD)	27.9 (3.1)
Marital status	
Unmarried or divorced	408 (78.9)
Married	109 (21.1)
Provinces	
Bocas del Toro	11 (2.1)
Chiriquí	41 (7.9)
Coclé	13 (2.5)
Colón	12 (2.3)
Darién	3 (0.6)
Herrera	8 (1.5)
Los Santos	4 (0.8)
Panamá	251 (48.5)
Panamá Oeste	5 (1.0)
Veraguas	6 (1.2)
Unanswered	163 (31.5)
Main occupation	
Intern physician	274 (53)
Medical specialties (resident)	131 (25.3)
Surgical specialties (resident)	94 (18.2)
Diagnostic support specialties (resident)	18 (3.5)
Background information	
Smoking	
Yes	46 (8.9)
No	471 (91.1)
Alcohol misuse	
Yes	209 (40.4)
No	308 (59.6)
Psychological trauma	
Yes	67 (13)
No	450 (87)
Psychiatric pathology	
Yes	88 (17)
No	429 (83)
Psychiatric pathology in family members	
Yes	189 (36.6)
No	328 (63.4)

Table 1. *Continued*

Characteristics	No. (%)
Exposure to COVID-19	
Been diagnosed with COVID-19	
Yes	77 (14.9)
No	440 (85.1)
Diagnosis of COVID-19 in family members	
Yes	138 (26.7)
No	379 (73.3)
Diagnosis of COVID-19 in colleague	
Yes	476 (92.1)
No	41 (7.9)
Attending COVID-19 patients	
Yes	371 (71.8)
No	146 (28.2)
Mental health disturbances	
Depression[1]	131 (25.3)
Generalized anxiety[2]	71 (13.7)
Posttraumatic stress[3]	63 (12.2)
Suicidal ideation[4]	48 (9.3)

*SD Standard Deviation.
[1] At least 10 points on the PHQ-9 questionnaire.
[2] At least 10 points on the GAD-7 questionnaire.
[3] At least 33 points on the IES-R questionnaire.
[4] In response to item 9 of the PHQ-9 questionnaire.

Table 2. Symptom severity of depression, generalized anxiety and posttraumatic stress (n = 517).

Severity category	No. (%)
PHQ-9: depression symptoms	
Normal (0–4)	187 (36.2)
Mild (5–9)	199 (38.5)
Moderate (10–14)	87 (16.8)
Severe (15–21)	44 (8.5)
GAD-7: generalized anxiety symptoms	
Normal (0–4)	260 (50.3)
Mild (5–9)	186 (35.9)
Moderate (10–14)	52 (10.1)
Severe (15–21)	19 (3.7)
IES-R: posttraumatic stress disorder symptoms	
Normal (0–8)	394 (76.2)
Mild (9–25)	60 (11.6)
Moderate (26-43)	22 (4.3)
Severe (44–88)	41 (7.9)

Abbreviations: PHQ-9, 9-item Patient Health Questionnaire; GAD-7, 7-item Generalized Anxiety Disorder; IES-R, 22-item Impact of Event Scale–Revised.

Table 3. Scores of depression, generalized anxiety and posttraumatic stress in participants (n = 517).

Scale	Total scores, mean (IC 95%)	Occupation Mean (IC 95%)			
		Intern physician	Medical specialties (resident)	Surgical specialties (resident)	Diagnostic support specialties (resident)
PHQ-9: depression symptoms	7.0 (6.5-7.4)	7.7 (7.2-8.1)	6.3 (5.5-7.0)	5.9 (4.9-6.8)	6.1 (3.6-8.7)
GAD-7: generalized anxiety symptoms	5.2 (4.8-5.5)	5.6 (5.0-6.1)	4.8 (4.2-5.5)	4.7 (3.8-5.6)	4.6 (2.6-6.6)
IES-R: posttraumatic stress disorder symptoms	15.0 (13.8-16.2)	17.5 (13.8-17.2)	13.5 (11.3-15.7)	10.1 (7.9-12.3)	14.0 (7.8-20.1)

Abbreviations: PHQ-9, 9-item Patient Health Questionnaire; GAD-7, 7-item Generalized Anxiety Disorder; IES-R, 22-item Impact of Event Scale–Revised.

Table 4. Independent factors associated with mental health outcomes in univariate generalized estimating equations for logistic regression models (n = 517).

Factor	Depression[1]			Generalized anxiety[2]			Post-traumatic stress[3]			At least one outcome			Presence of all three outcomes		
	OR	CI 95%	p	OR	CI 95%	p	OR	CI 95%	p	OR	CI 95%	p	OR	CI 95%	p
Gender															
Male	Ref.	-	-	Ref.	-	-	Ref.	-	-	Ref.	-	-	Ref.	-	-
Female	**1.75**	**(1.14-2.69)**	**0.010**	**3.19**	**(1.70-5.99)**	**0.001**	**2.98**	**(1.54-5.74)**	**0.001**	**1.93**	**(1.30-2.87)**	**0.001**	**4.34**	**(1.49-12.63)**	**0.007**
Age	0.99	(0.92-1.05)	0.703	1.00	(0.93-1.09)	0.909	0.91	(0.82-1.00)	0.059	0.95	(0.89-1.01)	0.126	0.99	(0.89-1.12)	0.988
Marital status															
Unmarried or divorce	Ref.	-	-	Ref.	-	-	Ref.	-	-	Ref.	-	-	Ref.	-	-
Married	1.37	(0.86-2.19)	0.183	1.00	(0.54-1.85)	0.992	0.77	(0.39-1.53)	0.453	1.32	(0.85-2.05)	0.218	0.93	(0.37-2.34)	0.881
Main occupation															
Intern physician	Ref.	-	-	Ref.	-	-	Ref.	-	-	Ref.	-	-	Ref.	-	-
Medical specialties (resident)	0.73	(0.45-1.19)	0.209	0.59	(0.31-1.12)	0.109	0.56	(0.29-1.08)	0.0884	0.65	(0.41-1.01)	0.058	0.76	(0.31-1.85)	0.542
Surgical specialties (resident)	0.62	(0.35-1.10)	0.105	0.52	(0.25-1.12)	0.095	**0.23**	**(0.08-0.65)**	**0.006**	**0.45**	**(0.26-0.78)**	**0.005**	0.44	(0.13-1.53)	0.198
Diagnostic support specialties (resident)	0.49	(0.13-1.75)	0.275	0.62	(0.14-2.79)	0.533	0.30	(0.04-2.31)	0.247	0.45	(0.14-1.41)	0.172	0.79	(0.10-6.26)	0.823

Table 4. *Continued*

Factor	Depression[1]			Generalized anxiety[2]			Post-traumatic stress[3]			At least one outcome			Presence of all three outcomes		
	OR	CI 95%	p	OR	CI 95%	p	OR	CI 95%	p	OR	CI 95%	p	OR	CI 95%	p
Background information															
Smoking	1.65	(0.87-3.14)	0.126	1.87	(0.88-3.95)	0.103	3.77	(1.88-7.54)	<0.001	2.02	(1.10-3.72)	0.024	2.79	(1.08-7.23)	0.034
Alcohol misuse	1.46	(0.98-2.18)	0.063	0.95	(0.57-1.59)	0.855	1.21	(0.71-2.05)	0.488	1.10	(0.76-1.60)	0.609	1.51	(0.72-3.16)	0.274
Psychological trauma	2.42	(1.42-4.12)	0.001	4.00	(2.21-7.22)	<0.001	2.69	(1.42-5.09)	0.002	2.40	(1.43-4.04)	0.001	5.23	(2.39-11.45)	<0.001
Psychiatric pathology	2.43	(1.50-3.94)	<0.001	5.29	(3.07-9.12)	<0.001	2.64	(1.46-4.76)	0.001	2.88	(1.80-4.61)	<0.001	4.20	(1.96-9.01)	<0.001
Psychiatric pathology in family members	1.30	(0.87-1.96)	0.200	1.72	(1.04-2.86)	0.034	1.95	(1.15-3.32)	0.013	1.31	(0.90-1.91)	0.160	2.77	(1.30-5.89)	0.008
Exposure to COVID-19															
Been diagnosed with COVID-19	1.74	(1.04-2.93)	0.035	1.65	(0.88-3.11)	0.115	1.97	(1.04-3.74)	0.037	1.21	(0.73-2.01)	0.457	3.13	(1.40-6.99)	0.005
Diagnosis of COVID-19 in family members	1.23	(0.79-1.90)	0.357	1.00	(0.57-1.77)	0.989	1.83	(1.06-3.18)	0.031	1.35	(0.90-2.03)	0.145	1.19	(0.53-2.66)	0.673
Diagnosis of COVID-19 in colleague	2.08	(0.85-5.06)	0.107	3.30	(0.78-14.00)	0.105	1.83	(0.55-6.10)	0.327	1.80	(0.84-3.86)	0.131	*	*	*
Attending COVID-19 patients	1.37	(0.87-2.16)	0.179	1.18	(0.67-2.10)	0.561	0.70	(0.40-1.22)	0.210	1.23	(0.81-1.87)	0.325	1.08	(0.47-2.50)	0.844
How difficult have these problems made it for you to do your work?															
Not difficult at al	Ref.	-	-	Ref.	-	-	-	-	-	-	-	-	-	-	-
Somewhat difficult	3.85	(2.44-6.08)	<0.001	6.60	(3.14-13.89)	<0.001	-	-	-	-	-	-	-	-	-
Very/extremely difficult	22.28	(8.85-56.08)	<0.001	53.41	(19.37-147.24)	<0.001	-	-	-	-	-	-	-	-	-

*No one has answered the question with this outcome.
[1]At least 10 points on the PHQ-9 questionnaire.
[2]At least 10 points on the GAD-7 questionnaire.
[3]At least 26 points on the IES-R questionnaire.

Table 5. Independent factors associated with mental health outcomes in multivariable generalized estimating equations for logistic regression models (n = 517).

Factor	Depression[1]			Generalized anxiety[2]			Posttraumatic stress[3]			At least one outcome			Presence of all three outcomes		
	OR	CI 95%	p	OR	CI 95%	p	OR	CI 95%	p	OR	CI 95%	p	OR	CI 95%	p
Gender															
Male	Ref.	-	-	Ref.	-	-	Ref.	-	-	Ref.	-	-	Ref.	-	-
Female	1.64	(1.03-2.61)	0.035	2.62	(1.30-5.28)	0.007	3.70	(1.77-7.71)	<0.001	1.89	(1.24-2.88)	0.003	3.84	(1.29-11.50)	0.016
Marital status															
Unmarried or divorce	Ref.	-	-	-	-	-	-	-	-	Ref.	-	-	-	-	-
Married	1.73	(1.03-2.91)	0.039	-	-	-	-	-	-	1.66	(1.03-2.68)	0.039	-	-	-
Main occupation															
Intern physician	-	-	-	-	-	-	Ref.	-	-	Ref.	-	-	-	-	-
Medical specialties (resident)	-	-	-	-	-	-	0.61	(0.30-1.22)	0.164	0.62	(0.38-1.01)	0.055	-	-	-
Surgical specialties (resident)	-	-	-	-	-	-	0.20	(0.06-0.63)	0.006	0.46	(0.26-0.83)	0.010	-	-	-
Diagnostic support specialties (resident)	-	-	-	-	-	-	0.58	(0.07-4.71)	0.614	0.60	(0.18-1.95)	0.395	-	-	-
Background information															
Smoking	-	-	-	-	-	-	6.12	(2.71-13.81)	<0.001	2.19	(1.13-4.23)	0.020	-	-	-
Psychological trauma	1.98	(1.10-3.55)	0.022	2.61	(1.29-5.27)	0.007	2.12	(1.06-4.26)	0.034	-	-	-	4.01	(1.75-9.16)	0.001
Psychiatric pathology	-	-	-	3.21	(1.71-6.03)	<0.001	2.03	(1.07-3.84)	0.030	2.46	(1.51-4.02)	<0.001	2.98	(1.33-6.80)	0.008
Exposure to COVID-19															
Been diagnosed with COVID-19													2.48	(1.05-5.83)	0.037
Diagnosis of COVID-19 in family members	-	-	-	-	-	-	1.92	(1.06-3.48)	0.031	-	-	-	-	-	-
How difficult have these problems made it for you to do your work?															
Not difficult at al	Ref.	-	-	Ref.	-	-	-	-	-	-	-	-	-	-	-
Somewhat difficult	3.86	(2.42-6.16)	<0.001	5.48	(2.56-11.73)	<0.001	-	-	-	-	-	-	-	-	-
Very/extremely difficult	21.86	(8.54-55.96)	<0.001	30.53	(10.52-88.55)	<0.001	-	-	-	-	-	-	-	-	-

[1] At least 10 points on the PHQ-9 questionnaire.
[2] At least 10 points on the GAD-7 questionnaire.
[3] At least 26 points on the IES-R questionnaire.

Being a resident physician in surgical specialties was significantly associated with a reduced risk of post-traumatic stress (OR = 0.23; 95% CI, 0.08-0.65; p = 0.006) and of developing at least one mental health disorder (OR = 0.45; 95% CI, 0.26-0.78; p = 0.005).

Smoking was significantly associated with post-traumatic stress, having at least one disorder, and having all three mental health disorders (Table 4). On the other hand, having a history of COVID-19 diagnosis increased the risk of presenting depression, post-traumatic stress and all three mental health disorders, while having a history of a family member being diagnosed with COVID-19 was significantly associated with post-traumatic stress (Table 4).

Respondents who presented depression and generalized anxiety found these symptoms made it difficult to perform their work (Table 4).

Logistic regression models: multivariable analysis

The most parsimonious multivariable model revealed that female sex was positively associated with the prevalence of mental health disturbances in all the outcomes analyzed (Table 5). Married participants were more likely to have depression (OR = 1.73; 95% CI, 1.03-2.91; p = 0.039) or at least one mental health disturbance (OR = 1.66; 95% CI, 1.03-2.68; p = 0.039).

Surgical specialties were less likely to have PTSD or at least one mental health disturbance, while smoking was significantly associated with the self-reporting of these disturbances (Table 5).

Having a previous COVID-19 diagnosis was associated with having all three mental health disorders and having a family member with COVID-19 was significantly associated with post-traumatic stress.

Discussion

Our findings document a high prevalence of symptoms associated with mental health disorders during the first peak of COVID-19 cases in Panama. We found prevalence rates of 25.3% for depression, 13.7% for anxiety, and 12.2% for post-traumatic stress disorder, comparatively similar to those found in Dutch[14] and Italian[15] health personnel, but below those found during this outbreak in China.[16]

In high-incidence areas, an epidemic event of this magnitude is comparable to previous events such as SARS, during which a large percentage of health care workers in high-risk situations reported symptoms related to mental health disturbances.[17]

Female respondents were 1.74 to 4.34 times more likely to report a mental health disturbance compared to male participants, consistently with a systematic review by Ricci *et al.* where women were more likely than men to report mental health disorders, especially for schizotypal personality disorder (STPD).[18] The history of psychological trauma in females as a risk factor for the development of mental health disorders may be attributed to gender differences in the rates and types of trauma exposure (e.g., natural disasters, motor vehicle accidents, rape, physical attack, combat).[19]

Most participants were medical interns, indicating that most of them had fewer years of work experience and were probably exposed to a higher risk of infection. The present study results indicated that having a history of psychological trauma and psychiatric pathology was associated with experiencing depression, generalized anxiety and post-traumatic stress disorder outcomes, in all models conducted. This is consistent with the findings of Young *et al.*, in which healthcare workers with a history of mental illness were at increased risk for significant emotional symptoms.[20]

Being married was associated with depressive symptoms, which may be due to competing family responsibilities and/or fear of partner contagion. This pattern was also observed during the SARS epidemics in 2003 in China[21] and Canada.[22] On the other hand, occupying physician in surgical specialties roles reduced the risk of post-traumatic stress and of developing at least one mental health disorder. Elective surgeries were suspended in all hospitals in the country, as a preventive measure adopted by the Ministry of Health, to limit transmission risks in hospital settings.[23]

As previous studies indicate, smoking is an important mental health aggravating factor, and in this study, smokers had a two to five times greater risk of PTSD, and a two-fold greater risk of at least one mental health disturbance compared to non-smokers.[24] These findings could be in part due to the pandemic generating factors that contribute to smoking initiation, or the vulnerability of people with a significant psychological history having triggered the habit of smoking.[25]

A troubling finding emerging from the depression data is the rate of individuals reporting positive responses to item 9 of the PHQ-9 questionnaire ("How often do you think you would be better off dead or hurt in some way?"). Of the respondents, 9.3% reported having suicidal thoughts; among them, 0.8% reported having suicidal ideation half of the days and 8.5% reported experiencing it almost every day. This result indicated elevated suicidal ideation above that found in U.S. health care workers by Young *et al.*[20] and close to that reported by the CDC, with 10.7% of persons experiencing suicidal thoughts associated with the COVID-19 pandemic.[26]

In a study to determine whether responses to the PHQ-9 questionnaire predict subsequent suicide attempt or death by suicide, Simon *et al.* found that those individuals with positive responses to item 9 of the PHQ-9 were six times more likely to attempt suicide and five times more likely to die by suicide within one year than those who did not report such thoughts.[27] Another study by Rossom *et al.* demonstrated that patients with any level of suicidal ideation on item 9 of the PHQ-9 were almost twice as likely to attempt suicide in the following year.[28]

Additionally, our findings indicate that exposure to COVID-19 at work or at home through the a family member being ill with COVID-19, independently contributed to presenting with all three mental health disturbances together and post-traumatic stress, respectively. Similar results were evident during the SARS epidemic in 2003 where having had a family member or friend with SARS was a strong predictor of the level of post-traumatic stress symptoms, suggesting a special feature of the psychosocial effects of infectious disease outbreaks, which can be differentiated from other disasters.[21]

Previous studies have shown that young physicians are a vulnerable professional group, requiring professional support to prevent mental health disorders due to long working hours, and support from senior physicians may have a positive effect on some of these disorders, especially in global health emergencies.[29]

Despite a response rate of 42.9%, non-response bias may exist if the remaining resident physicians and interns showed less interest in participating because they were not as emotionally affected by the current pandemic. Therefore, it is difficult to estimate how representative the responses are of the resident and intern population, or how biased the estimates might be due to nonresponse. On the other hand, we assume that the reliability of the responses is high, because the data collected in the survey are familiar to residents and interns and they are able to recognize the mental illnesses studied here. With the aim of assessing mental disturbances at the time of response, the questionnaire focused on symptoms during the last 15 days.

In summary, with a response rate of 42.9%, one third of our sample presented at least one clinically significant mental health disturbance (including suicidal ideation), with women being the most affected in all analyses. Our findings raise concerns about the psychological well-being of resident physicians and interns involved in care during the first wave of the COVID-19 epidemic in Panama. It is essential for institutions to intervene with those most at risk of presenting psychiatric symptoms and offer them sources of support to mitigate the emotional impact and increase resilience in situations of occupational stress.

Data availability
Underlying data
Complete raw data will be made available upon request to, and permission from the National Research Bioethics Committee of Panama in order to maintain the participants' confidentiality. Anyone wishing to access the data should first contact the corresponding author who will facilitate contact with the ethical review board (cnbi.panama@senacyt.gob.pa).

Extended data
Figshare: Mental health consequences of COVID-19 in house staff physicians - Survey.docx, https://doi.org/10.6084/m9.figshare.17019380.v1[30]

This project contains the following extended data: Supplementary file. Questionnaire sent to the house staff physician *(Translated from the Spanish version used for the survey)*.docx

Data are available under the terms of the Creative Commons Zero "No rights reserved" data waiver (CC0 1.0 Public domain dedication).

Acknowledgements

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