ORIGINAL RESEARCH

Insomnia Prevalence and Associated Factors Among University Students in Saudi Arabia During the COVID-19 Pandemic and Lockdown: A Large-Scale Survey

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Purpose: The coronavirus disease 2019 (COVID-19) pandemic has many psychological and physical effects to which university students are vulnerable. We aimed in this study to assess the prevalence of insomnia among university students in Saudi Arabia during the COVID-19 pandemic and lockdown and associated factors.

Patients and Methods: We conducted a cross-sectional study using a questionnaire to collect the responses of 5140 students from Saudi universities between April 24 and 30, 2020. Responders completed demographic questions and psychological scales, including the Insomnia Severity Scale (ISI), during the national lockdown period in Saudi Arabia.

Results: Approximately, 41% of the sample suffered from moderate to severe insomnia. The mean ISI score was recorded as 12.9 (SD 6.62). Insomnia was associated with female sex, younger age, students from new universities, junior students, if a relative suffered from COVID-19, having a chronic medical illness, and having a psychiatric disorder. Insomnia was associated also with suicidal ideation.

Conclusion: Insomnia prevalence was very high among Saudi university students during the COVID-19 pandemic lockdown. There were sociodemographic and medical factors associated with high insomnia prevalence. Universities need to plan and implement protective and intervention strategies to deal with this important issue.

Keywords: insomnia, COVID-19, college student, suicide

Plain Language Summary

Insomnia is a sleeping disorder that can affect many areas in patients' lives. Previous studies found increase of insomnia prevalence during the coronavirus disease 2019 (COVID-19) pandemic among the public. We aimed to assess the insomnia prevalence among university students in Saudi Arabia during the pandemic.

We distributed a questionnaire to measure the prevalence and other factors like age, sex, and medical history. We found that 41% of university students had moderate to severe insomnia. Insomnia rates were higher among younger females, junior students, students who have medical or mental disorders history, and who have a relative tested positive recently. Moreover, insomnia was associated with suicidal thoughts.

These findings will help universities to have better understanding of this problem and to plan and apply protective and treatment strategies.

Introduction

By the last days of 2019, the first diagnosis of a new atypical serious respiratory infection was announced in Wuhan, China. Coronavirus disease 2019 (COVID-19) was defined as a public health emergency of international concern, and as

a pandemic by the World Health Organization (WHO) soon thereafter.[1] The new coronavirus was distinguished by fast spreading and lethal outcome.[2] Globally, COVID-19 has caused more than 6 million deaths, reported by the WHO.[3]

With the new pandemic and lack of knowledge about treatment, management, or even vaccination,[2] many countries, especially during the early stage of the pandemic, exercised extraordinary measures to try to control the spread of the infection and protect their nation and health-care systems from collapse. They enforced quarantine and general lockdown of unnecessary activities, such as gym, leisure, and visits to shopping malls, and transferred schools and universities to online teaching.[1,4] The Kingdom of Saudi Arabia was one of the first countries to apply strict roles during the COVID-19 crises.[5] Initially, all people were instructed to stay home, and schools and higher education were shifted to digital education. Many people were forced to work from home and, therefore, sit for long hours at a desk. Going out was only permitted for essential shopping or medical emergencies.[6]

COVID-19 has not only affected physical health but has also created fear of the infection and curfews, and such complications as lack of socialization and disturbances to general routines.[7] This has placed a new burden on mental health.[2] University students were also affected psychologically by the change to electronic teaching and lack of clinical practice in some specialties such as medical colleges.[8] This added another stressor to students, in addition to the existing lifestyle stressors of high academic load, independency, and financial difficulties.[1,9] This was evident in a study of the COVID-19 pandemic in April 2020 in Switzerland, where student stress, anxiety, loneliness, and depressive symptoms worsened when compared to pre-crisis assessments.[9]

A systematic review and meta-analysis of 89 studies regarding depressive symptoms, anxiety symptoms, and sleep disturbance in higher education students found the prevalence of these to be 34%, 32%, and 33%, respectively.[2] Another study assessing sleep among students and employees of a Swiss university during the pandemic found the prevalence of low sleep quality to be 44%.[4] Similarly, an online-based cross-sectional survey was used to examine 1521 students from Vietnamese universities, and fear and anxiety of COVID-19 were found to be substantially linked to psychological distress, life satisfaction, and sleep disturbance.[10] A large-scale study in Poland included 1111 university students found 58% had sleep difficulties but it decreased to 21% when took into account only moderate and severe insomnia on Insomnia Severity Index (ISI) scale while it was 27% in Argentina.[11,12] In Saudi Arabia, a cross-sectional study was performed with 790 participants during the COVID-19 quarantine, and results showed that 55.5% had poor sleep quality and 54.4% had insomnia.[13] Additionally, being female and married were risk factors. Another cross-sectional online questionnaire evaluated depression, anxiety, stress, resilience, and insomnia among 582 undergraduate university students in Saudi Arabia using the ISI. The results showed that more than half of students said they had trouble sleeping, and 1.4% said they were taking melatonin pills to help them sleep. Only 4.3% had a very mild sleep problem, whereas 16% had a mild sleep problem; 21.8%, a moderate sleep problem; 9.3%, a severe sleep problem; and 1.2%, a very severe sleep problem.[14] However, data regarding insomnia and sleep quality across students in different Saudi universities during the COVID-19 pandemic is lacking. According to our knowledge, in Saudi Arabia, there is no study assessed insomnia prevalence during national lockdown among students in different universities. We, therefore, aimed to assess sleep disturbances and related factors among university students in Saudi Arabia during the pandemic and especially during lockdown, to assist in the planning and implementation of protective and intervention strategies to assist students during this time.

Materials and Methods
Study Population and Sample
We conducted a cross-sectional quantitative observational study using an online platform and a link to a questionnaire, which was disseminated to the target population by volunteer university students (data collectors). We asked help from university students in almost all universities in Saudi Arabia through announcements in authors' social media accounts. Data collectors number depends on the university size, it ranges from 1 to 9 students for each university. Each data collector has a unique link to distribute among his colleagues. They distributed the link through emails, SMS, or WhatsApp platform to their colleagues. To prevent duplicate participation, SurveyMonkey platform allowed only one participation for each IP address. Inclusion criteria included: 1. Being current Saudi Arabian university students, 2. Could

communicate in Arabic language, 3. Had access to the online survey. Exclusion criteria includes: 1. Not being a university student in Saudi Arabia, 2. Does not read Arabic language, 3. Had no access to internet and the survey. We used a convenient sampling strategy to send the link to students in Saudi universities, and data was collected from April 24–30, 2020. The sample size was calculated based on the assumption of a prevalence of insomnia symptoms of 33% according to Deng et al.[2] We assumed a precision of 5%, a confidence interval of 95%, and an estimated accuracy of 5%. The minimum target sample size was 408 individuals, assuming a 20% non-response rate.

Data Collection

Due to social distancing, no face-to-face interaction was allowed. The survey was a self-reporting online survey that was delivered by data collectors by distributing the link to participants through emails, SMS, and WhatsApp messages. The first part of the survey was about demographic data, such as age, sex, grade point average (GPA), medical history, and mental health. In the Saudi high education system (in universities), the year consists of two main semesters called academic level. We used this variable instead of the academic year to be more accurate. To assess medical and mental diseases, we asked participants if they have been diagnosed (in the past or currently) with chronic medical disease (eg, Diabetes Mellitus, Hypertension, Bronchial Asthma, Thyroid diseases or others). Also, we asked them if they have been diagnosed with any mental disorder, and if yes, to mention it. The second part was a valid and reliable Arabic version of the ISI,[15] which included seven questions. Permission was obtained from the author for use thereof. The questions were answered on a scale of 0 (none) to 4 (very severe). All seven answers were totaled, and the score categorized as: 0–7, no clinically significant insomnia; 8–14, subthreshold insomnia; 15–21, clinical insomnia (moderate severity); or 22–28, clinical insomnia (severe). Also, we used scales validated in Arabic including patient health questionnaire 9 (PHQ9) and generalized anxiety disorder 7 (GAD7) to assess depression and anxiety symptoms. More details can be found in our previous publication.[6] A pilot study was conducted with ten participants (not included in the sample) to estimate the duration to complete the survey and to test logistics and readability.

Data Analysis

To test for significant differences in ISI scores between groups, we used a Student's t-test or chi-square test, according to the type of variable. Spearman's coefficient determined correlations between scale scores. The level of statistical significance was set at 0.05. As a final step, we used a linear regression model to estimate how sleep disturbances can be predicted. First, we did univariate logistic regression to get the odds ratio, and then we made a multivariable logistic regression by including variables that were important from the literature and statistically significant variables from the univariate logistic regression. The Statistical Package for the Social Sciences (SPSS), Version 21.0 (IBM Corp., Armonk, NY) was utilized to analyze the data.[16]

Ethical Considerations

The Institutional Review Board of King Saud University granted ethical permission (number E-20-4846). The study is complied with the Declaration of Helsinki. Participant identities were kept anonymous because no identifying data was collected. We obtained informed consent from all participants, who were told about the study's goal, and their right to withdraw at any moment without facing any obligations to the research team. The participants were not offered any incentives or rewards.

Results
Demographic Characteristics

Table 1 shows the demographic and sociodemographic characteristics of the study population. Out of 6338 participants, 5140 (81%) completed the questionnaire; approximately four-fifths of these were the female (4146 participants, 80.66%). Our participants were on average 21.85 years old (SD 4.75). Only 477 (9.28%) of our participants were married, while 4600 (89.49%) were single, the remainder were widowed or divorced. Participants were students from 38 different Saudi universities. We grouped them into five groups according to their geographical location.

Table 1 Demographic Data and Insomnia

Variables	Total		ISI		
	n	%	Mean	SD	P
Sex					
Male	994	19.34	11.54	6.56	<0.001
Female	4146	80.66	13.23	6.60	
Age					
Mean	5140	100.00	12.90	6.62	r (5138) = −0.053, p<0.0001
Marital state					
Single	4600	89.49	12.99	6.61	0.007
Married	477	9.28	11.94	6.58	
Divorce	59	1.15	13.73	7.09	
Widow	4	0.08	11.75	9.81	
State - Region					
Western	774	15.06	12.46	6.54	<0.001
Eastern	869	16.91	14.20	6.72	
Northern	294	5.72	12.82	6.61	
Southern	355	6.91	12.49	6.87	
Central	2848	55.41	12.69	6.54	
University type					
Government	4679	91.03	12.90	6.62	0.849
Private	461	8.97	12.96	6.69	
University age					
Old universities	2111	41.07	12.66	6.57	0.028
New universities	3029	58.93	13.07	6.65	
College specialty					
Scientific colleges	1893	36.83	13.16	6.53	0.088
Health colleges	1642	31.95	12.81	6.66	
Humanities colleges	1605	31.23	12.69	6.68	
Academic level					
1	446	8.68	13.64	6.62	<0.001
2	953	18.54	13.55	6.66	
3	342	6.65	12.70	6.39	
4	939	18.27	12.74	6.55	
5	210	4.09	12.76	6.75	

(*Continued*)

Table 1 (Continued).

Variables	Total		ISI		
	n	**%**	**Mean**	**SD**	**P**
6	759	14.77	13.47	6.67	
7	285	5.54	12.58	6.79	
8	739	14.38	12.00	6.46	
9	72	1.40	12.08	6.83	
10	161	3.13	12.19	6.14	
11	31	0.60	11.10	7.04	
12	203	3.95	12.19	6.88	
GPA					
Excellent: above 4.5	1884	36.65	12.43	6.51	0.001
Very good: from 3.75 to 4.50	2026	39.42	13.24	6.61	
Good: 2.75 to 3.75	968	18.83	13.10	6.75	
Acceptable: From 2 to 2.75	262	5.10	12.95	6.88	
A family member is a health worker					
Yes	1898	36.93	13.06	6.60	0.185
No	3242	63.07	12.81	6.64	
During your study, you lived with					
Family	4770	92.80	12.89	6.59	0.066
Colleagues	87	1.69	11.68	6.95	
Alone	283	5.51	13.52	6.96	
Relative or acquaintance got COVID-19					
Yes	156	3.04	15.06	7.31	<0.001
No	4984	96.96	12.83	6.59	
Has chronic medical illness					
Yes	578	11.25	14.95	6.67	<0.001
No	4562	88.75	12.64	6.57	
Diagnosed with mental illness					
Yes	371	7.22	15.68	6.18	<0.001
No	4769	92.78	12.68	6.61	

Abbreviations: n, number; ISI, Insomnia Severity Index; SD, standard deviation.

Insomnia and Associated Factors

In our sample, 2096 participants (40.8%) had moderate to severe insomnia (Table 2). Some sociodemographic factors showed statistically significant differences in mean ISI scores. Female students had more severe insomnia compared to males (mean ISI score 13.23 vs 11.54, respectively). Age and ISI scores were found to be negatively correlated. Students

Table 2 Number of Students with Insomnia Severity (n = 5140)

Disorder	Level	n	(%)
Insomnia	0–7 No clinically significant insomnia	1175	22.9
	8–14 Subthreshold insomnia	1869	36.4
	15–21 Moderate severity	1542	30.0
	22–28 Severe	554	10.8

who lived in the eastern region had severe insomnia compared to students in other regions. Moreover, we found that students with a very good or good GPA had worse insomnia compared to the students with excellent or acceptable GPA. Students who suffered from a chronic medical illness had higher mean ISI scores than those who did not. Lastly, students with mental illness had severe insomnia compared to students who did not. Similarly, suicide ideation was correlated with insomnia. The ISI total score and the last item in the patient health questionnaire 9 (PHQ9) were found to be positively correlated (r [5138] = 0.28, p < 0.0001).

Moreover, for insomnia univariate logistic regression, eleven variables were statistically significant among fourteen variables (Table 3). While in insomnia multivariable logistic regression, only seven variables were statistically significant among ten variables that were included in the model (Table 4). They are female sex, being married, living in eastern region, studying in scientific colleges, have a relative or acquaintances got COVID-19, have been diagnosed with a chronic medical or mental disorder.

Discussion

We aimed to determine the insomnia prevalence among university students in Saudi Arabia during COVID-19 pandemic (especially during the national lockdown), as well as associated factors. Approximately 41% of the sample suffered from moderate to severe insomnia. Insomnia was associated with female sex, younger age, being single or divorced, students from eastern region, students from new universities, junior students, relatives suffered from COVID-19, having a chronic medical illness, and having a psychiatric disorder. Insomnia was associated also with suicide ideation.

Approximately 41% of participants in our sample experienced moderate to severe insomnia. This percentage is higher than that in the pre-COVID-19 era when a cross-sectional study of Saudi medical students from 2011 to 2012 found that insomnia prevalence was 33%.[17] The reason for this change can be explained by multiple factors. First, our study was done during the peak of COVID-19, while the other study included a pre-COVID-19 period. Second, we used the ISI, while the previous study used the Pittsburgh Sleep Quality Index. Third, our study had a larger sample size (5140 compared to 320 in the previous study). Additionally, the previous study only included last years' medical students (fourth, fifth, or sixth year) compared to our study which included students from all years and colleges. This may affect the comparison, as it is well known that studying medicine can be stressful and a risk factor for insomnia.[17] On the other hand, a recent study was performed during the COVID-19 pandemic on a similar target population: 463 third to fifth-year medical students and medical interns in a single university in Saudi Arabia, also using the ISI. A total of 162 (34.9%) participants had insomnia.[18] This difference could be explained by the different population (medical students vs university students). Also, the cutoff score was lower in that study, as they included subthreshold insomnia where we included only moderate to severe insomnia. If we had included subthreshold insomnia, our prevalence would increase to 77%. Moreover, our study was done during the first month of lockdown, where that study was done months thereafter. Our findings are similar to those of a local study where moderate to severe insomnia prevalence rate was 32%,[14] but did not differentiate when the data collection was done. We believe that the difference lies in the period being during lockdown or not. Also, the sample size in that study was smaller (582 participants compared to ours), and 95% of the sample participants were from two universities only, while our sample included 38 universities.

Table 3 Univariate Logistic Regression for Insomnia

	Odds Ratio	95% CI		P value
		Lower	Upper	
Age	0.97	0.95	0.98	<0.001
Sex				
Male*	1.00			
Female	1.72	1.44	2.05	<0.001
Marital state				
Single*	1.00			
Married	0.66	0.52	0.84	0.001
Divorce	1.27	0.63	2.59	0.503
Widow	0.27	0.02	2.98	0.285
State- Region				
Western regions	0.94	0.76	1.15	0.546
Eastern regions	1.62	1.31	1.99	<0.001
Northern regions	1.09	0.80	1.49	0.576
Southern regions	0.90	0.68	1.20	0.474
Central regions*	1.00			
University type				
Government	1.01	0.79	1.30	0.912
Private*	1.00			
University age				
Old universities*	1.00			
New universities	1.15	0.99	1.32	0.066
College specialty				
Scientific colleges	1.28	1.08	1.53	0.005
Health colleges	1.09	0.91	1.31	0.338
Humanities colleges*	1.00			
Academic level				
1	1.75	1.14	2.68	0.010
2	1.71	1.17	2.51	0.006
3	1.36	0.87	2.11	0.174
4	1.36	0.93	1.98	0.115
5	1.35	0.83	2.20	0.224
6	1.69	1.15	2.50	0.008

(*Continued*)

Table 3 (Continued).

	Odds Ratio	95% CI		P value
		Lower	Upper	
7	1.36	0.86	2.16	0.190
8	1.04	0.71	1.53	0.839
9	1.09	0.55	2.19	0.803
10	1.15	0.68	1.96	0.607
11	0.86	0.35	2.08	0.735
12*	1.00			
GPA				
Excellent: above 4.5*	1.00			
Very good: from 3.75 to 4.50	1.32	1.12	1.56	0.001
Good: 2.75 to 3.75	1.19	0.98	1.46	0.085
Acceptable: From 2 to 2.75	1.22	0.87	1.71	0.246
A family member is a health worker				
Yes	1.12	0.96	1.29	0.151
No*	1.00			
During your Study Live with				
Family	0.84	0.61	1.15	0.281
Colleges	0.55	0.29	1.05	0.069
Alone*	1.00			
Relative or acquaintances got COVID-19				
Yes	1.75	1.15	2.68	0.001
No*	1.00			
Has chronic medical illness				
Yes	2.29	1.77	2.97	<0.001
No*	1.00			
Had been Diagnosed with mental illness				
Yes	3.42	2.41	4.84	<0.001
No*	1.00			

Note: *Used as a reference.
Abbreviation: CI, confidence interval.

When compared to Saudi Arabian university students, our sample had a different sex ratio. Females make up 49.4% of Saudi university students, compared to 80% in our sample.[19] However, a local study found a similar percentage (73% female students among participants).[14] Our sample is similar to Saudi Arabian university students in terms of other demographic features.[19] We found that females were more susceptible to sleep disturbances than male participants.

Table 4 Multivariable Logistic Regression for Insomnia

	Odds Ratio	95% CI		P value
		Lower	**Upper**	
Age	0.98	0.96	1.00	0.053
Sex				
Male*	1.00			
Female	1.74	1.43	2.11	<0.001
Marital state				
Single*	1.00			
Married	0.68	0.52	0.88	0.004
Divorce	1.06	0.49	2.29	0.884
Widow	0.39	0.03	5.73	0.491
State- Region				
Western regions	1.06	0.85	1.32	0.593
Eastern regions	1.57	1.26	1.95	<0.001
Northern regions	1.17	0.85	1.62	0.333
Southern regions	1.01	0.75	1.36	0.949
Central regions*	1.00			
College specialty				
Scientific colleges	1.26	1.04	1.53	0.016
Health colleges	1.03	0.84	1.25	0.802
Humanities colleges*	1.00			
Academic level				
1	1.26	0.80	2.01	0.322
2	1.30	0.86	1.97	0.212
3	1.09	0.68	1.74	0.721
4	1.03	0.69	1.56	0.876
5	1.14	0.69	1.91	0.606
6	1.44	0.95	2.17	0.087
7	1.28	0.79	2.08	0.324
8	0.94	0.62	1.41	0.760
9	1.09	0.53	2.23	0.814
10	1.16	0.67	2.03	0.591
11	0.66	0.26	1.68	0.381
12*	1.00			

(*Continued*)

Table 4 (Continued).

	Odds Ratio	95% CI		P value
		Lower	Upper	
GPA				
Excellent: above 4.5*	1.00			
Very good: from 3.75 to 4.50	0.76	0.54	1.09	0.139
Good: 2.75 to 3.75	1.03	0.72	1.47	0.865
Acceptable: From 2 to 2.75	0.99	0.68	1.43	0.953
Relative or acquaintances got COVID-19				
Yes	1.61	1.03	2.51	0.036
No*	1.00			
Has chronic medical illness				
Yes	1.97	1.50	2.57	<0.001
No*	1.00			
Had been Diagnosed with mental illness				
Yes	3.21	2.24	4.61	<0.001
No*	1.00			

Note: *Used as a reference.
Abbreviation: CI, confidence interval.

Female students had a 1.7 times higher risk of insomnia than male students, according to multivariable logistic regression analysis. Our findings were consistent with those of previous studies, eg, four studies found that female students had higher insomnia rates compared to males.[14,18,20,21] Female students appear to participate in research studies more than males.[14,22]

The prevalence rate of insomnia in our study appeared to be double that of insomnia worldwide during COVID-19 among the public (4–22%).[23] This may be explained by the fact that university students have higher stressors, especially during COVID-19, and that we collected our data during the exam season. Another reason may be that 80% of our sample participants were female, which may have led to a higher prevalence of insomnia compared to other studies. Conversely, a local study during the same period found an insomnia prevalence of 54% among the public.[13] The difference in findings may be explained by different assessment tools (ie, ISI in our study compared to the Athens Sleep Questionnaire), and different populations (university students vs the public). Italian study found that insomnia severity was increased during the lockdown compared to pre-pandemic era which may explain the increase prevalence in our study.[24]

Residing in the eastern region was a risk factor in our study, which can be explained by the fact that the first Saudi Arabia COVID-19 cases were detected in the eastern region.[25] Other risk factors such as medical or psychiatric illnesses or a relative with COVID-19 align with the findings of other studies.[14,18,26] These three variables were statistically significant in the multivariable logistic regression with odds ratio (1.97, 3.21, and 1.61), respectively. Having a psychiatric disorder will increase the insomnia risk by three folds. This can be explained by the fact that insomnia is a criterion for many psychiatric disorders, and there is a high comorbidity rate between psychiatric disorders and insomnia disorder.[11]

Having a higher GPA was a protective factor in the univariate logistic regression but was not the case in the multivariable logistic regression. We believe this could be due to less stress on the participant compared to lower GPA participants. Also, senior levels students showed lower insomnia rates, which is similar to the findings of a large-

scale study in China among university students.[27] This can be attributed to younger students being in a new environment and requiring more time to adapt. However, Alyoubi et al did find a difference in insomnia rates between older and younger students.[14] This difference was not statistically significant in the multivariable logistic regression.

We found a link between insomnia and suicidal ideation among our sample, similar to other studies.[26,28] One study found that insomnia is a mediator between COVID-19 anxiety and suicide.[29] Another study found that insomnia is related to suicide directly and indirectly (as a risk factor for depression).[30] Another study on depression, stress and insomnia among medical students during COVID-19 found that 44% of the total variance in depression can be accounted by the indirect effect of insomnia.[31]

To the best of our knowledge, this is the first insomnia study in Saudi Arabia that has revealed such high prevalence in the same population. As our study shows high levels of insomnia for university students, psychoeducation and cognitive behavioral therapy for insomnia (CBTi) could be helpful, especially for high-risk groups.[32]

There are some limitations in our study. First, we had a high female to male ratio (4:1) as a sample bias. Second, we acquired our sample through convenient sampling without randomization, which could lead to selection bias. Third, we did not have any past data from the same sample to compare to pre-COVID-19. Fourth, we used self-report questionnaires; however, structured clinical interviews are preferable for accurate diagnosis. We suggest that future studies collect longitudinal data to track the COVID-19 pandemic impact over time. We also strongly advise authorities (especially universities) to make easy access to mental health guidance and counseling services for students. Telemedicine is one example of this, and telepsychiatry and teletherapy are both efficient and acceptable.[32]

Conclusion

High insomnia prevalence among Saudi Arabian university students during COVID-19, with 41% of participants reporting moderate to severe insomnia. Female sex, living in the eastern region, having a medical or mental illness, having a family member who tested positive for COVID-19, or being a junior student are all risk factors. Universities and other interested individuals should pay closer attention to this critical issue and establish protection and management strategies.

Abbreviations

CI, Confidence interval; COVID-19, Coronavirus disease 2019; GPA, Grade point average; ISI, Insomnia index severity; SD, Standard deviation; SPSS, Statistical Package for the Social Sciences; WHO, World Health Organization.

Data Sharing Statement

Data are available from the corresponding author upon a reasonable request.

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Author Contributions

All authors made a significant contribution to the work reported, whether that is in the conception, study design, execution, acquisition of data, analysis and interpretation, or in all these areas; took part in drafting, revising or critically reviewing the article; gave final approval of the version to be published; have agreed on the journal to which the article has been submitted; and agree to be accountable for all aspects of the work.

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Disclosure

The authors report no conflicts of interest in this work.

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