

Research Article

The COVID-19 Pandemic: Age Differences in Sleep Quality and Mental Health Across 59 Countries

Stephanie A. Kolakowsky-Hayner¹, Jiabin Shen², Yelena Goldin³, Kristine Kingsley⁴, Elisabet Alzueta^{5,6}, Juan Carlos Arango-Lasprilla⁷⁻⁹, Paul B. Perrin¹⁰, Fiona C. Baker^{5,11}, Fofi Constantinidou¹², Yelena Bogdanova^{13,14}.

¹Magellan Federal, Silver Springs, MD, USA

²University of Massachusetts Lowell, Lowell, MA, USA

³JFK Johnson Rehabilitation Institute, Edison, NJ, USA

⁴Institute of Cognitive and Emotional Wellness, Westchester, NY, USA

⁵Center for Health Sciences, SRI International, Menlo Park, CA 94025, USA

⁶Autonomous University of Madrid, Madrid, Spain

⁷Biocruces Bizkaia Health Research Institute, Barakaldo, Spain

⁸Department of Cell Biology and Histology, University of the Basque Country, Leioa, Spain

⁹KERBASQUE, Basque Foundation for Science, Bilbao, Spain

¹⁰Department of Psychology, Virginia Commonwealth University, Richmond, VA, USA

¹¹School of Physiology, University of the Witwatersrand, Johannesburg, South Africa

¹²Department of Psychology & Center for Applied Neuroscience, University of Cyprus, Cyprus

¹³Department of Psychiatry, Boston University School of Medicine, Boston, MA, USA

¹⁴Physical Medicine & Rehabilitation, VA Boston Healthcare System, Boston, MA, USA

***Correspondence:** Stephanie A. Kolakowsky-Hayner, 111 Morgan Drive, Royersford, PA 19468, USA; Tel: +1-408-966-9151; E-mail: momof1plus4@yahoo.com

Received: June 06, 2021; **Accepted:** June 24, 2021; **Published:** July 07, 2021

©2021 Kolakowsky-Hayner SA. This article is distributed under the terms of the Creative Commons Attribution 4.0 International License.

ABSTRACT

Objective: To determine if there are pandemic-related sleep and mental health problems at different ages in the general population.

Design: Survey data were collected following a snowball sampling method via social media platforms and mailing lists.

Setting: General population

Participants: Participants included 6,882 individuals from the general population, from 59 countries.

Interventions: None

Main Outcome Measures: Children's Revised Impact of Events Scale - 8 (CRIES-8); Depression, Anxiety and Stress Scale - 21 (DASS-21); Generalized Anxiety Disorder-7 (GAD-7); and Regulatory Satisfaction Alertness Timing Efficiency Duration (RU-SATED).

Results: The current findings show significant differences among age groups in sleep quality and mental health. The younger group (19-29 years) seemed to be the most impacted during the COVID-19 pandemic, reporting lower sleep quality and higher rates of trauma-related distress, stress, depression, and anxiety symptomatology during the lockdown.

Conclusion: The current findings underscore the importance of screening for and treating mental health and sleep problems in the global population, and particularly among younger adults.

Key Words: COVID-19, anxiety, depression, sleep quality, stress, trauma-related distress

INTRODUCTION

The pandemic created by the severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2/COVID-19) outbreak has created unprecedented and persisting health, societal, financial, and lifestyle changes for people around the world. Governments made

swift responses to curtail the spread of the disease and reduce its deadly effects. Treading into uncharted waters, most countries implemented severe restrictions in movement and lock-down measures. The term 'social distancing' was coined to promote the need for physical distance and reduction in social activities. Fear

of the disease, changes in lifestyle, and social isolation created unprecedented circumstances and an increase in health care challenges including mental health concerns [1]. Studies from early in the pandemic revealed increased anxiety and depression rates, an increase of sleep problems, and reductions in quality of life [1-4]. The COVID-19 pandemic imposed a significant burden on populations across the globe, and resulting lockdowns and quarantine restrictions [5,6] had a significant impact on sleep quality and psychological/mental health worldwide [7,8].

Research on age differences has not always yielded consistent findings. In the general population, anxiety disorders tend to be most prevalent, followed by mood disorders, impulse control disorders, and substance use disorders, with the former two most widely examined as a function of age [9,10]. Most studies indicate onset in late adolescence/young adulthood, with a linear increase in prevalence into middle adulthood, followed by a slower plateaued prevalence in older age [11,12]. Older adults have been shown to have a lower lifetime and recent prevalence of depression, anxiety, and distress [9,10,13], with lower severity in older adults despite increasing comorbidity of physical disorders [14]. Blazer and Hybels [9] evaluated biological, psychological, and social factors associated with depression and concluded that while older adults have a greater biological risk for depression than younger adults, younger adults experience depression at higher rates, which the authors suggest may be due to socio-emotional factors that buffer older adults. Evaluation of specific symptom presentation revealed that older adults are less likely to experience worry [15], while younger adults endorse higher rates of cognitive symptoms of anxiety, depressive symptoms, and negative affect [13]. This suggests that, while there may be variation in symptom profiles that warrants examination and clinical consideration, younger adults appear to endorse higher rates of symptoms traditionally associated with psychological disorders and therefore may be particularly at risk for mental health issues during the COVID-19 pandemic.

In terms of sleep issues during the COVID-19 pandemic, a systematic review and meta-analysis involving thirteen countries reported the global pooled prevalence rate of sleep disturbance among all populations of 35.7% [7]. However, the association between age and pandemic-related changes in sleep quality is not yet clearly understood. A cross-sectional study of 2410 participants (Age: ≥ 17) conducted in China in March 2020 reported several independent factors associated with poor sleep quality, including older age (24 and older), anxiety, and depression [16]. While another survey of 1230 participants (Age: 18+) in Mexico performed during the first two months of pandemic isolation found that younger people (Age: 18-40) reported more sleep disturbances, while older participants (>40-year-old) showed only slight changes in sleep [17].

Despite this body of research beginning to document mental health and sleep issues common across the globe during the COVID-19 pandemic, as well as some initial studies suggesting that younger adults may be at greater risk for mental health issues and inconclusive findings of age differences in sleep problems, no large-

scale, multinational study to date have systematically examined whether different age groups may be experiencing a differential mental health burden. As a result, the purpose of the current study was to examine sleep and mental health problems across age groups during the first phase of the COVID-19 pandemic. It was hypothesized that sleep and mental health problems would decrease linearly with the increasing age group.

MATERIALS AND METHODS

Participants

Participants were recruited from the general population of 59 countries categorized by the World Bank geographical region classification system [18]. Demographics appear in table 1. The average age of participants was 42.3 years (SD = 13.9).

Procedure

The current study is a secondary analysis of cross-sectional data collected from a larger study [2]. Standardized and adapted measures were combined in an online survey in English, then translated into French, German, Italian, Spanish, and Turkish. Using a snowball sampling method, the survey was open April 19 to May 3, 2020 and was promoted on social media such as Instagram, Facebook, Twitter, and WhatsApp, as well as email lists. Participants were informed about the study aims before giving their informed consent. Participation was anonymous and voluntary—participants did not receive any monetary compensation for their participation.

Table 1. Demographic characteristics of the sample (N=6882).

Variable	Percent
Age	
18-29	22.6
30-49	44.5
50-64	26.5
65 and above	6.3
Sex	
Female	78.8
Male	20.9
Other	0.2
Marital Status	
Single (never married)	35.5
Married/Domestic Partnership	51.1
Widowed	1.9
Divorced/ Separated	11.5
Employment	
Employed/Engaged	80.1
Unemployed	19.9
Household	
One Person	11.7
More than One Person	88.3

The study was approved by the Universidad Autónoma de Madrid Ethical Committee (Spain, CEI-106-206) and was conducted in compliance with the declaration of Helsinki. The average response time was 15 minutes.

MEASURES

Children's Revised Impact of Events Scale - 8 (CRIES-8)

The CRIES-8 is an eight-item Likert scale ($\alpha = .88$) measuring trauma-related distress including 2 subscales: Intrusion and Avoidance [19,20]. The CRIES-8 has been shown to have good reliability and validity in samples of children, adolescents, and adults aged 8 to 75 [21-23]. It has been translated into more than 20 languages and maintained its factor structure and validity after translation via associations with other indices of trauma and distress [24,25].

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

The DASS-21 is a psychometrically sound [26-29] measure of depression, anxiety, and stress. The current study only included the Depression ($\alpha = .91$) and Stress ($\alpha = .91$) subscales which measure hopelessness, low self-esteem, and low positive affect and tension, agitation, and negative affect, respectively.

Generalized Anxiety Disorder-7 (GAD-7)

The GAD-7 is a quick measure of anxiety and worry ($\alpha = .92$). It has been shown to have strong reliability, construct validity, internal consistency, and convergent validity [30-33]. Total scores range from 0-21 with higher scores indicating more anxiety [30,31].

Regulatory Satisfaction Alertness Timing Efficiency Duration (RU-SATED)

RU-SATED is a 6-item 3-point Likert scale ($\alpha = .63$) measuring sleep health including regularity, subjective satisfaction, alertness during waking hours, appropriate timing, high efficiency, and adequate

duration [34]. With total scores ranging from 0-12, higher scores indicate better sleep health. This measure has been shown to have good item correlation, reliability, convergent validity and adequate internal consistency [35,36].

Data Analysis

In addition to descriptive statistics, chi-square and one-way ANOVAs were used to describe the sample and to determine differences between age groupings. Participants were categorized into four age groups: 18-29, 30-49, 50-64, and 65 and older. Data were analyzed according to six main areas of interest including sleep quality, trauma-related distress, stress, depression, and anxiety. A conservative alpha level of $p < .01$ was set to minimize the chance of a type I error. Analyses were conducted using SPSS version 26.

RESULTS

Sleep Quality

Overall sleep quality was significantly ($F(3, 6881) = 84.63, p < .001$) different among age groups (Figure 1). Younger participants had far more sleep quality issues compared with older participants. As seen in table 2, younger groups tended to have worse overall sleep quality, and scored poorly on several items on the RUSATED scale (regularity, satisfaction, timing, efficiency, and duration) than older age groups. Younger groups were also more likely than older groups to endorse taking sleep medications. While also statistically significant ($p \leq .001$), a linear pattern of age was not clear with regard to alertness and the use of natural sleep aids or therapies.

Trauma-Related Distress

Regarding Intrusion and Avoidance Subscales (Table 3), younger participants had significantly ($p < .001$) greater symptom severity of trauma-related distress than the older age groups, with a linear decrease in symptom severity as each age category increased.

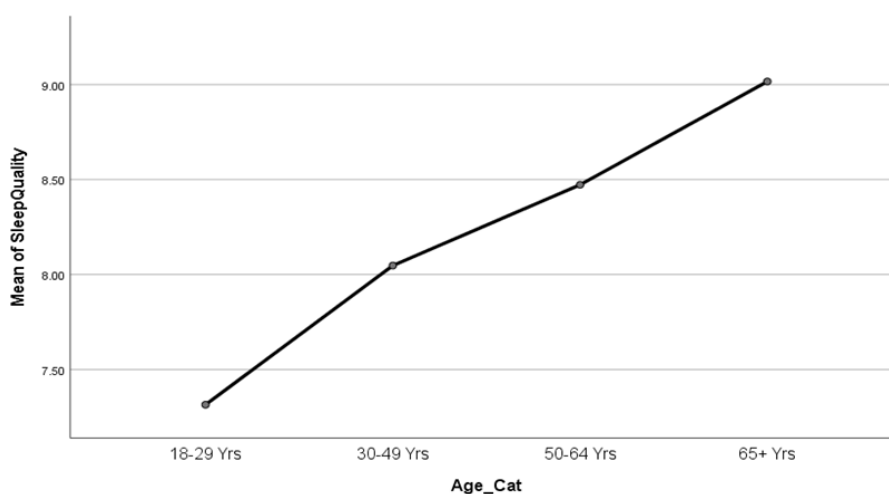


Figure 1. Sleep quality by age grouping ($p < .0001$)

Table 2. Age differences in sleep quality (N=6882)

	18-29 Yrs. Mean (SD)	30-49 Yrs. Mean (SD)	50-64 Yrs. Mean (SD)	65+ Mean (SD)	Total Mean (SD)	F	p
Overall	7.31 (2.59)	8.04 (2.53)	8.47 (2.39)	9.02 (2.25)	8.06 (2.54)	84.633	<.001
Regularity	2.15 (0.77)	2.33 (0.75)	2.44 (0.71)	2.58 (0.65)	2.33 (0.75)	63.171	<.001
Satisfaction	1.91 (0.73)	2.06 (0.74)	2.21 (0.72)	2.43 (0.70)	2.09 (0.74)	83.250	<.001
Alertness	2.32 (0.74)	2.42 (0.74)	2.40 (0.75)	2.38 (0.71)	2.39 (0.74)	6.489	<.001
Timing	2.52 (0.67)	2.65 (0.61)	2.70 (0.58)	2.76 (0.56)	2.76 (0.56)	32.527	<.001
Efficiency	1.94 (0.79)	2.08 (0.79)	2.15 (0.78)	2.17 (0.76)	2.07 (0.79)	22.894	<.001
Duration	2.48 (0.64)	2.51 (0.66)	2.56 (0.64)	2.69 (0.56)	2.53 (0.65)	14.445	<.001
Medicine	1.15 (0.43)	1.20 (0.52)	1.29 (0.62)	1.33 (0.68)	1.22 (0.54)	27.896	<.001
Aid/Therapy	1.44 (0.65)	1.41 (0.63)	1.48 (0.68)	1.36 (0.63)	1.43 (0.65)	5.242	.001

Table 3. Age differences in trauma-related distress symptoms related to COVID-19 pandemic in the general population (N=6882).

CRIS-8* Scale	18-29 Yrs. Mean (SD)	30-49 Yrs. Mean (SD)	50-64 Yrs. Mean (SD)	65+ Mean (SD)	F Statistic	p
Intrusion	10.32 (3.20)	10.22 (3.27)	10.07 (3.30)	9.45 (3.21)	8.929	<.001
Avoidance	9.69 (3.49)	9.47 (3.48)	9.41 (3.49)	8.58 (3.37)	11.558	<.001
Total	20.01 (6.03)	19.69 (6.09)	19.48 (6.11)	18.03 (5.82)	12.486	<.001

*CRIS-8 = Children's Revised Impact of Events Scale-8

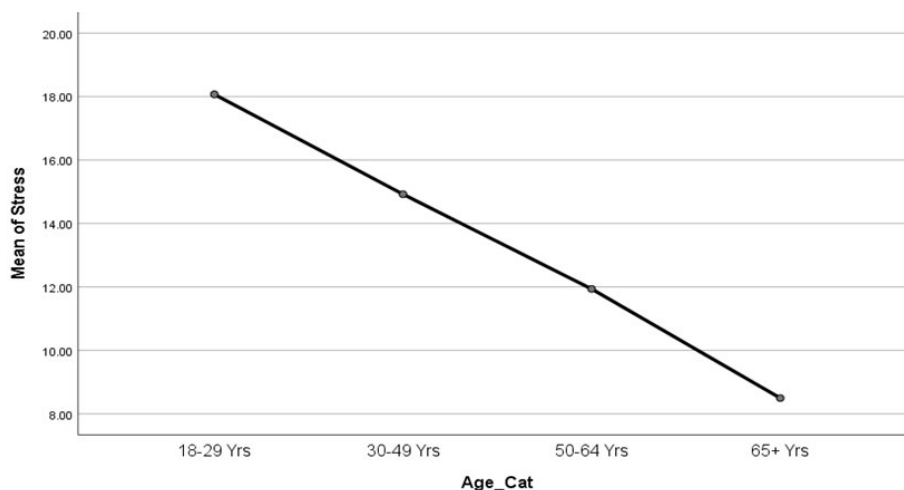


Figure 2. Stress symptoms by age grouping ($p < .0001$)

Stress

The stress subscale of the DASS-21 revealed significant differences among age groups ($F(3, 6881) = 149.78, p < .001$) (Figure 2). Younger age groups experienced significantly greater stress symptoms than the older groups. Younger groups tended to: find it harder to wind down; over-react to situations; feel like they were using a lot of nervous energy; feel more agitated; find it difficult to relax; feel intolerant of anything keeping them from getting on with what they were doing; and feel rather touchy (Table 4).

Depression

The depression subscale of the DASS-21 revealed significant

differences between age groups ($F(3, 6881) = 111.84, p < .001$) (Figure 3). Younger age groups reported significantly more depression symptoms than the older groups. Younger groups were more likely to endorse feeling that they couldn't experience any positive feelings at all very much or considerably (Table 5). Similarly, younger groups felt considerably or very much more downhearted and bluer than older groups. They were also more likely to endorse being unable to become enthusiastic about anything and feeling they weren't worth much as a person. While no clear pattern emerged in the older groups, the younger was more likely to endorse finding it difficult to work up the initiative to do things, feeling that they had nothing to look forward to, and feeling that life was meaningless.

Table 4. Age difference in the impact COVID-19 on stress symptoms in the general population (N=6882).

Stress Symptom	Age Group	Response Category (n = 6882)				Pearson Chi-Square	df	p
		Did not apply to me at all n (%)	Applied to some degree n (%)	Applied a considerable degree n (%)	Applied very much n (%)			
I found it hard to wind down	18-29	314 (20.2)	569 (36.5)	454 (29.1)	221 (14.2)	228.676	9	<.001
	30-49	753 (24.6)	1139 (37.2)	802 (26.2)	371 (12.1)			
	50-64	586 (32.1)	682 (37.4)	391 (21.4)	164 (9.0)			
	65+	221 (50.7)	136 (31.2)	58 (13.3)	21 (4.8)			
I tended to over-react to situations	18-29	385 (24.7)	569 (36.5)	400 (25.7)	204 (13.1)	317.114	9	<.001
	30-49	917 (29.8)	1264 (41.2)	649 (21.2)	235 (7.7)			
	50-64	733 (40.2)	741 (40.6)	277 (15.2)	72 (3.9)			
	65+	230 (52.8)	157 (36.0)	42 (9.6)	7 (1.6)			
I felt that I was using a lot of nervous energy	18-29	366 (23.5)	477 (30.6)	434 (27.9)	281 (18.0)	360.298	9	<.001
	30-49	919 (30.0)	1115 (36.4)	712 (23.2)	319 (10.4)			
	50-64	725 (39.8)	671 (36.8)	302 (16.6)	125 (6.9)			
	65+	240 (55.0)	134 (30.7)	52 (11.9)	10 (2.3)			
I found myself getting agitated	18-29	566 (36.3)	450 (28.9)	348 (22.3)	194 (12.5)	217.644	9	<.001
	30-49	1358 (44.3)	978 (31.9)	518 (16.9)	211 (6.9)			
	50-64	919 (50.4)	584 (32.0)	229 (12.6)	91 (5.0)			
	65+	255 (58.5)	140 (32.1)	30 (6.9)	11 (2.5)			
I found it difficult to relax	18-29	347 (22.3)	535 (34.3)	412 (26.4)	264 (16.9)	289.846	9	<.001
	30-49	870 (28.4)	1180 (38.5)	672 (21.9)	343 (11.2)			
	50-64	680 (37.3)	702 (38.5)	292 (16.0)	149 (8.2)			
	65+	231 (53.0)	136 (31.2)	51 (11.7)	18 (4.1)			
I was intolerant of anything that kept me from getting on with what I was doing	18-29	506 (32.5)	512 (32.9)	362 (23.2)	178 (11.4)	287.419	9	<.001
	30-49	1173 (38.3)	1190 (38.8)	501 (16.3)	201 (6.6)			
	50-64	869 (47.7)	679 (37.2)	206 (11.3)	69 (3.8)			
	65+	260 (59.6)	132 (30.3)	30 (6.9)	14 (3.2)			
I felt that I was rather touchy	18-29	361 (23.2)	544 (34.9)	385 (24.7)	268 (17.2)	464.999	9	<.001
	30-49	938 (30.6)	1276 (41.6)	577 (18.8)	274 (8.9)			
	50-64	796 (43.7)	712 (39.1)	241 (13.2)	74 (4.1)			
	65+	244 (56.0)	149 (34.2)	30 (6.9)	13 (3.0)			

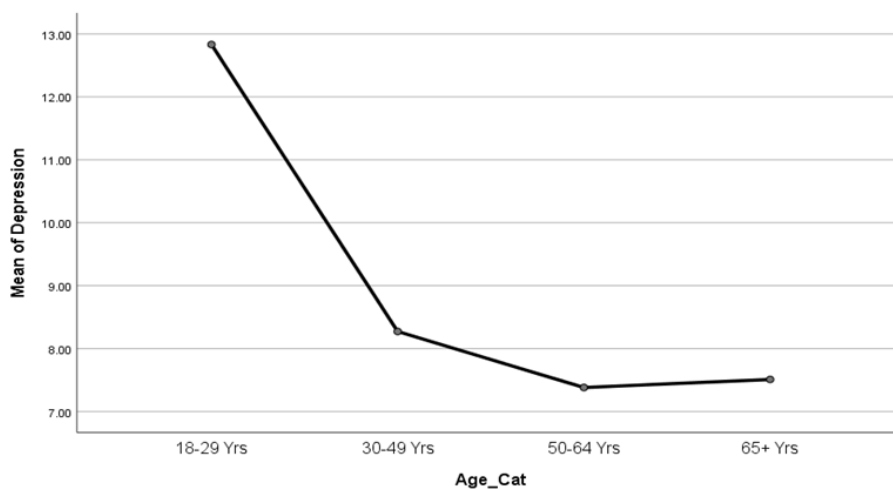


Figure 3. Depression symptoms by age grouping ($p < .0001$)

Table 5. Age difference in the impact COVID-19 on depression symptoms in the general population (N=6882).

Depression Symptom	Age Group	Response Category (n = 6882)				Pearson Chi-Square	df	p
		Did not apply to me at all n (%)	Applied to some degree n (%)	Applied a considerable degree n (%)	Applied very much n (%)			
I couldn't seem to experience any positive feeling at all	18-29	726 (46.6)	544 (34.9)	224 (14.4)	64 (4.1)	77.063	9	<.001
	30-49	1757 (57.3)	911 (29.7)	306 (10.0)	91 (3.0)			
	50-64	1052 (57.7)	555 (30.4)	166 (9.1)	50 (2.7)			
	65+	258 (59.2)	141 (32.3)	29 (6.7)	8 (1.8)			
I found it difficult to work up the initiative to do things	18-29	387 (24.8)	554 (35.6)	376 (24.1)	241 (15.5)	311.447	9	<.001
	30-49	1227 (40.0)	1130 (36.9)	514 (16.8)	194 (6.3)			
	50-64	813 (44.6)	690 (37.8)	224 (12.3)	96 (5.3)			
	65+	195 (44.7)	154 (35.3)	62 (14.2)	25 (5.7)			
I felt that I had nothing to look forward to	18-29	902 (57.9)	316 (20.3)	196 (12.6)	144 (9.2)	184.756	9	<.001
	30-49	2271 (74.1)	458 (14.9)	211 (6.9)	125 (4.1)			
	50-64	1341 (73.6)	288 (15.8)	130 (7.1)	64 (3.5)			
	65+	280 (64.2)	92 (21.1)	47 (10.8)	17 (3.9)			
I felt down-hearted and blue	18-29	403 (25.9)	637 (40.9)	302 (19.4)	216 (13.9)	276.544	9	<.001
	30-49	1232 (40.2)	1227 (40.0)	392 (12.8)	214 (7.0)			
	50-64	842 (46.2)	685 (38.1)	202 (11.1)	84 (4.6)			
	65+	219 (50.2)	164 (37.6)	33 (7.6)	20 (4.6)			
I was unable to become enthusiastic about anything	18-29	647 (41.5)	480 (30.8)	275 (17.7)	156 (10.0)	186.882	9	<.001
	30-49	1696 (55.3)	904 (29.5)	311 (10.1)	154 (5.0)			
	50-64	1075 (59.0)	502 (27.5)	172 (9.4)	74 (4.1)			
	65+	259 (59.4)	119 (27.3)	40 (9.2)	18 (4.1)			
I felt I wasn't worth much as a person	18-29	853 (54.7)	336 (21.6)	205 (13.2)	164 (10.5)	317.717	9	<.001
	30-49	2264 (73.9)	455 (14.8)	214 (7.0)	132 (4.3)			
	50-64	1419 (77.8)	266 (14.6)	92 (5.0)	46 (2.5)			
	65+	341 (78.2)	64 (14.7)	19 (4.4)	12 (2.8)			
I felt that life was meaningless	18-29	971 (62.3)	288 (18.5)	168 (10.8)	131 (8.4)	247.500	9	<.001
	30-49	2442 (79.7)	383 (12.5)	138 (12.5)	102 (3.3)			
	50-64	1476 (81.0)	225 (12.3)	73 (4.0)	49 (2.7)			
	65+	345 (79.1)	53 (12.2)	24 (5.5)	14 (3.2)			

Anxiety

Based on the GAD-7 responses, there was a significant age difference ($F(3, 6881) = 116.36, p < .001$) with regard to anxiety symptoms (Figure 4). Again, younger groups tended to report an overall greater severity of anxiety symptoms. The younger groups were more likely than the older groups to endorse all seven GAD-7 symptoms more than half the days or nearly every day (Table 6).

DISCUSSION

Age Differences in Mental Health

The current findings show significant differences among age groups in mental health. The younger group (19-29 years) seemed to be the most psychologically impacted during the COVID-19 pandemic,

reporting higher rates of trauma-related distress, stress, depression, and anxiety symptomatology during the lockdown. This is in line with other cross-sectional studies in the general population that showed younger individuals are at higher risk of deleterious effects from the pandemic on mental health when compared with older adults [3,37,38]. A Canadian study showed how pandemic-related stress, anxiety, and depression rates were highest among those aged less than 25 and lowest amongst those aged more than 60 years old [39]. Longitudinal evidence assessing mental health and well-being during the pandemic among middle-aged and older adults in the United States showed psychological problems prevalence decreased with increasing age [40].

Despite COVID-19 posing a greater physical health threat for older adults – given its increasing age-related death rate – overall

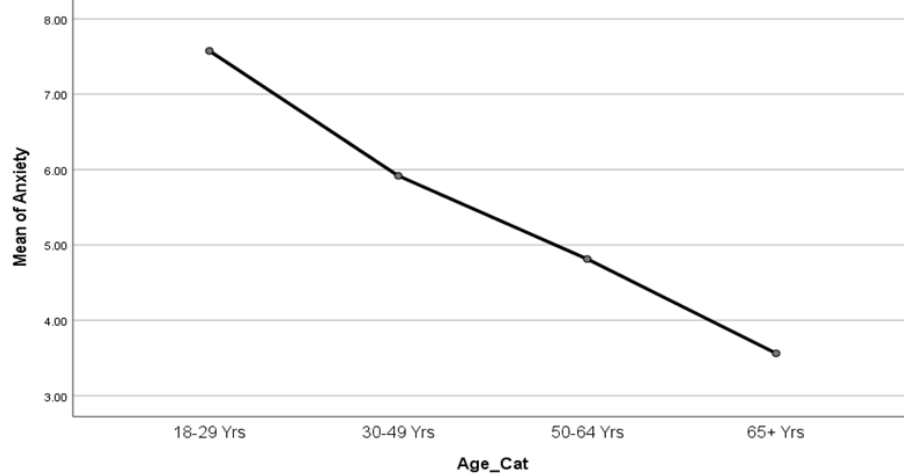


Figure 4. Anxiety symptoms by age grouping ($p < .0001$)

Table 6. Age difference in the impact COVID-19 on anxiety symptoms in the general population (N=6882)

Anxiety Symptom	Age Group	Response Category (n = 6882)				Pearson Chi-Square	df	p
		Not at all n (%)	Several Days n (%)	More than half the days n (%)	Nearly every day n (%)			
Feeling nervous, anxious, or on edge	18-29	387 (24.8)	703 (45.1)	242 (15.5)	226 (14.5)	295.477	9	<.001
	30-49	1018 (33.2)	1451 (47.3)	302 (9.9)	294 (9.6)			
	50-64	790 (43.3)	771 (42.3)	144 (7.9)	118 (6.5)			
	65+	250 (57.3)	139 (31.9)	23 (5.3)	24 (5.5)			
Not being able to stop or control worrying	18-29	628 (40.3)	580 (37.2)	194 (12.5)	156 (10.0)	165.958	9	<.001
	30-49	1559 (50.9)	1005 (32.8)	288 (9.4)	213 (6.9)			
	50-64	1081 (59.3)	486 (26.7)	148 (8.1)	108 (5.9)			
	65+	287 (65.8)	102 (23.4)	24 (5.5)	23 (5.3)			
Worrying too much about things	18-29	375 (24.1)	714 (45.8)	259 (16.6)	210 (13.5)	309.218	9	<.001
	30-49	986 (32.2)	1522 (49.7)	313 (10.2)	244 (8.0)			
	50-64	773 (42.4)	783 (43.0)	156 (8.6)	111 (6.1)			
	65+	243 (55.7)	155 (35.6)	23 (5.3)	15 (3.4)			
Trouble relaxing	18-29	419 (26.9)	678 (43.5)	223 (14.3)	238 (15.3)	292.023	9	<.001
	30-49	1054 (34.4)	1419 (46.3)	286 (9.3)	306 (10.0)			
	50-64	811 (44.5)	733 (40.2)	140 (7.7)	139 (7.6)			
	65+	268 (61.5)	119 (27.3)	26 (6.0)	23 (5.3)			
Being so restless that it's hard to sit still	18-29	657 (42.2)	566 (36.3)	192 (12.3)	143 (9.2)	254.713	9	<.001
	30-49	1650 (53.8)	1015 (33.1)	229 (7.5)	171 (5.6)			
	50-64	1147 (62.9)	483 (26.5)	109 (6.0)	84 (4.6)			
	65+	328 (75.2)	77 (17.7)	25 (5.7)	6 (1.4)			
Becoming easily annoyed or irritable	18-29	379 (24.3)	703 (45.1)	265 (17.0)	211 (13.5)	498.744	9	<.001
	30-49	995 (32.5)	1509 (49.2)	333 (10.9)	228 (7.4)			
	50-64	897 (49.2)	722 (39.6)	128 (7.0)	76 (4.2)			
	65+	278 (63.8)	124 (28.4)	22 (5.0)	12 (2.8)			
Feeling afraid as if something awful might happen	18-29	595 (38.2)	572 (36.7)	190 (12.2)	201 (12.9)	149.574	9	<.001
	30-49	1433 (46.8)	1148 (37.5)	255 (8.3)	229 (7.5)			
	50-64	946 (51.9)	626 (34.3)	140 (7.7)	111 (6.1)			
	65+	263 (60.3)	128 (29.4)	21 (4.8)	24 (5.5)			

evidence indicates the younger individuals experience to a greater extent pandemic-related impacts on mental health. Exposure to media of the youngest, along with the life uncertainty brought about by the pandemic at this age might explain some of these differences [41,42]. On the other hand, older adults have been shown to have better emotional regulation, making use of more proactive coping, which may function as a resilience factor against pandemic-related stress [43,44].

Sleep and Psychological Consequences of COVID-19 Pandemic/Lockdowns

The current results indicated significant differences among age groups, with younger participants reporting more sleep quality problems than older participants. These findings are in line with a survey conducted in Mexico [17]. These results may reflect additional vulnerability of younger populations to social isolation and other factors such as employment and economic insecurity during lockdowns. A recent study identified poor sleep among other factors (e.g., depression, and anxiety) associated with suicidal ideation in university students (Mean age 21.4 years [SD = 1.9]) [45]. Another study reported that COVID-19-related anxiety correlated positively with insomnia severity and suicidal ideation [46].

Mental health symptoms and sleep disturbance may have a bidirectional association [7,47] and have important implications for mental health and sleep treatment planning and symptom management. The results of this study underscore the importance and necessity to both evaluate and treat/improve sleep quality, especially in younger age group, in the general population not only during this pandemic but also during the post-pandemic recovery period.

Interventions, Treatment Accessibility, and Support

Previous literature has identified social support as one of the protective factors and a potential intervention to improve sleep quality and reduce other commonly associated neuropsychiatric symptoms, including stress, depression, and anxiety [48,49]. A more recent report indicated that social support can improve sleep quality in self-quarantined people staying at home for 2 weeks due to COVID-19 restrictions [50]. Additionally, there are multiple telehealth and traditional treatments and techniques available, aimed to improve sleep quality, such as home-based treatments and relaxation techniques. Various mobile and web-based platforms/apps for self-assessment and sleep monitoring became more accessible and widely available for general public during the pandemic [51,52]. Future studies are needed to evaluate the effectiveness of mobile and web-based interventions to provide an evidence base for clinical recommendations and to inform the development of novel accessible treatments, targeting younger populations.

Limitations

The results of the current study should be interpreted in light of

the following limitations: First, in this study, mental health was evaluated based on questionnaires that measured anxiety, stress, and depression. It is likely that there are also differences by age group in other variables related to mental health that were not included in this study; Second, due to the cross-sectional nature of the study, we do not know if age differences in the outcomes studied remain constant over time or if they were specific to the beginning of the pandemic when the current data were collected; Third, although, the study had a sample of participants from 59 countries, caution should be exercised when generalizing these results to countries in which the study was not carried out; Fourth, the selection of the four age groups was made at the discretion of the study authors, which could also have influenced the differences found among these groups; Fifth, it is possible that since this study focused on the impact of the pandemic on mental health, many of the people who decided to take the survey could have been experiencing mental health problems at the time of the study, while those not experiencing mental health problems may have decided not to participate. Despite these limitations, the sample was one of the largest and most geographically diverse collected to date on sleep quality and psychological adjustment during the COVID-19 pandemic. As a result, it powerfully transcends many of the small sample size and culturally idiosyncratic studies conducted investigating similar topics.

CONCLUSION

The current study was the largest to date to examine age differences in sleep quality and mental health during the COVID-19 pandemic. Robustly, younger adults reported higher mental health symptomology than older adults, despite older adults' being at greater risk for adverse effects of COVID-19. The current findings underscore the importance of screening for and treating mental health and sleep problems in the global population, and particularly among younger adults. Future research is needed to examine why younger adults may be at such acute risk of psychological symptoms during the COVID-19 pandemic and to develop and deploy evidence-based interventions to reduce that symptom burden.

ACKNOWLEDGEMENTS

Publication of this article was supported by the International COVID-19 Task Force of the American Congress of Rehabilitation Medicine's (ACRM) International Interdisciplinary Special Interest Group. We would like to thank the ACRM staff for supporting the Task Force, particularly Ms. Terri Compos. Additionally, we would like to thank Dilara Yuksel, PhD and Sendy Caffarra, PhD for their contributions to the parent study, as well as all of the participants.

REFERENCES

1. Brooks SK, Webster RK, Smith LE, Woodland L, Wessely S Greenberg N, et al. The psychological impact of quarantine and how to reduce it: rapid review of the evidence. *Lancet*. 2020; 395: 912–920.
2. Alzueta E, Perrin P, Baker FC, Caffarra S, Ramos-Usuga D, Yuksel D, et al. How the COVID-19 pandemic has changed our lives: A study of psychological correlates across 59 countries. *J Clin Psychol*. 2021; 77: 556-570.

3. Solomou I, Constantinidou F. Prevalence and predictors of anxiety and depression symptoms during the COVID-19 pandemic and compliance with precautionary measures: Age and sex matter. *Int J Environ Res Public Health*. 2020; 17: 4924.
4. Yuksel D, McKee GB, Perrin PB, Alzueta E, Caffarra S, Ramos-Usuga D, et al. Sleeping when the world locks down: Correlates of sleep health during the COVID-19 pandemic across 59 countries. *Sleep Health*. 2021; 7: 134-142.
5. Ornell E, Schuch JB, Sordi AO, Kessler FHP. 'Pandemic fear' and COVID-19: Mental health burden and strategies. *Braz J Psychiatr*. 2020; 42: 232-235.
6. Triggler CR, Bansal D, Farag EABA, Ding H, Sultan AA. COVID-19: Learning from Lessons To Guide Treatment and Prevention Interventions. *mSphere*. 2020; 5.
7. Jahrami H, BaHammam AS, Bragazzi NL, Saif Z, Faris M, Vitiello MV. Sleep problems during the COVID-19 pandemic by population: a systematic review and meta-analysis. *J Clin Sleep Med*. 2021; 17: 299-313.
8. Wu K, Wei X. Analysis of Psychological and Sleep Status and Exercise Rehabilitation of Front-Line Clinical Staff in the Fight Against COVID-19 in China. *Med Sci Monit Basic Res*. 2020; 26, e924085.
9. Blazer DG, Hybels CF. Origins of depression in later life. *Psychol Med*. 2005; 35: 1241-1252.
10. Jorm AF. Does old age reduce the risk of anxiety and depression? A review of epidemiological studies across the adult life span. *Psychol Med*. 2000; 30: 11-22.
11. Byers AL, Yaffe K, Covinsky KE, Friedman MB, Bruce ML. High occurrence of mood and anxiety disorders among older adults: The National Comorbidity Survey Replication. *Arch Gen Psychiatry*. 2010; 67: 489-496.
12. Kessler RC, Amminger GP, Aguilar-Gaxiola S, Alonso J, Lee S, Ustun TB. Age of onset of mental disorders: a review of recent literature. *Curr Opin Psychiatry*. 2007; 20: 359-364.
13. Brenes GA, Knudson M, Vaughn McCall W, Williamson JD, Miller ME, Stanley MA. Age and racial differences in the presentation and treatment of Generalized Anxiety Disorder in primary care. *J Anxiety Disord*. 2008; 22: 1128-1136.
14. Kessler RC, Birnbaum H, Bromet E, Hwang I, Sampson N, Shahly V. Age differences in major depression: results from the national comorbidity surveys replication (NCS-R). *Psychol Med*. 2010; 40: 225-237.
15. Brenes GA. Age differences in the presentation of anxiety. *Aging Ment Health*. 2006; 10: 298-302.
16. Yang Y, Zhu JF, Yang SY, Lin HJ, Chen Y, Zhao Q, et al. Prevalence and associated factors of poor sleep quality among Chinese returning workers during the COVID-19 pandemic. *Sleep Med*. 2020; 73: 47-52.
17. Terán-Pérez G, Portillo-Vásquez A, Arana-Lechuga Y, Sánchez-Escandón O, Mercadillo-Caballero R, González-Robles RO, et al. Sleep and Mental Health Disturbances Due to Social Isolation during the COVID-19 Pandemic in Mexico. *Int J Environ Res Public Health*. 2021; 18: 2804.
18. worldbank.org [Internet]. How does the World Bank classify countries? [cited 2021 Mar 17]. Available from: <https://datahelpdesk.worldbank.org/knowledgebase/articles/378834-how-does-the-world-bank-classify-countries>.
19. Dyregrov A, Kuterovac G, Barath A. Factor analysis of the Impact of Event Scale with children in war. *Scand J Psychol*. 1996; 37: 339-350.
20. Horowitz M, Wilner N, Alvarez W. Impact of event scale: A measure of subjective stress. *Psychosomatic Medicine*. 1979; 41: 209-218.
21. French P, Barrett A, Allsopp K, Williams R, Brewin CR, Hind D, et al. Psychological screening of adults and young people following the Manchester Arena incident. *BJPsych Open*. 2019; 5: 1-6.
22. Leigh E, Yule W, Smith P. Measurement issues: Measurement of posttraumatic stress disorder in children and young people—lessons from research and practice. *Child Adolesc Ment Health*. 2016; 21: 124-135.
23. Perrin S, Meiser-Stedman R, Smith P. The Children's Revised Impact of Event Scale (CRIES): Validity as a screening instrument for PTSD. *Behavioural and Cognitive Psychotherapy*. 2005; 33: 487-498.
24. Smith P, Perrin S, Yule W, Rabe-Hesketh S. War exposure and maternal reactions in the psychological adjustment of children from Bosnia-Herzegovina. *J Child Psychol Psychiatry*. 2001; 42: 395-404.
25. Smith P, Perrin S, Dyregrov A, Yule W. Principal component analysis of the Impact of Event Scale in children in war. *Personality and Individual Differences*. 2003; 34: 315-322.
26. Gloster AT, Rhoades HM, Novy D, Klotsche J, Senior A, Kunik M, et al. Psychometric properties of the Depression Anxiety and Stress Scale-21 in older primary care patients. *J Affect Disord*. 2008; 110: 248-259.
27. Henry JD, Crawford JR. The short-form version of the Depression Anxiety Stress Scales (DASS-21): Construct validity and normative data in a large non-clinical sample. *Br J Clin Psychol*. 2005; 44: 227-239.
28. Lovibond PF, Lovibond SH. The structure of negative emotional states: Comparison of the Depression Anxiety Stress Scales (DASS) with the Beck Depression and Anxiety Inventories. *Behav Res Ther*. 1995; 33: 335-343.
29. Lovibond SH, Lovibond PF. Manual for the Depression Anxiety Stress Scales. 2nd ed. Sydney: Psychology Foundation; 1995.
30. Spitzer RL, Kroenke K, Williams JBW, Löwe B. A brief measure for assessing generalized anxiety disorder: the GAD-7. *Arch Intern Med*. 2006; 166: 1092-1097.
31. Kroenke K, Spitzer RL, Williams JBW, Monahan PO, Löwe B. Anxiety disorders in primary care: prevalence, impairment, comorbidity, and detection. *Ann Intern Med*. 2007; 146: 317-325.
32. Löwe B, Decker O, Müller S, Brähler E, Schellberg D, Herzog W, et al. Validation and standardization of the Generalized Anxiety Disorder Screener (GAD-7) in the general population. *Med care*. 2008; 46: 266-274.
33. Johnson SU, Ulvenes PG, Øktedalen T, Hoffart A. Psychometric properties of the general anxiety disorder 7-item (GAD-7) scale in a heterogeneous psychiatric sample. *Front Psychol*. 2019; 10: 1713.
34. Buysse DJ. Sleep health: can we define it? Does it matter? *Sleep*. 2014; 37: 9-17.
35. Becker NB, Martins RIS, de Neves Jesus S, Chiodelli R, Rieber MS. Sleep health assessment: A scale validation. *Psychiatry Res*. 2018; 259: 51-55.
36. Ravyts SG, Dzierzewski JM, Perez E, Donovan EK, Dautovich ND. Sleep Health as Measured by RU SATED: A Psychometric Evaluation. *Behav Sleep Med*. 2021; 19: 48-56.
37. Klaiber P, Wen JH, DeLongis A, Sin NL. The ups and downs of daily life during COVID-19: Age differences in affect, stress, and positive events. *J Gerontol B Psychol Sci Soc Sci*. 2021; 76: e30-e37.
38. Wickens CM, McDonald AJ, Elton-Marshall T, Wells S, Nigatu YT, Jankowicz D. Loneliness in the COVID-19 pandemic: associations with age, gender and their interaction. *J Psychiatr Res*. 2021; 136: 103-108.
39. Nwachukwu I, Nkire N, Shalaby R, Hrabok M, Vuong W, Gusnowski A. COVID-19 Pandemic: Age-Related Differences in Measures of Stress, Anxiety and Depression in Canada. *Int J Environ Res Public Health*. 2020; 17: 6366.

40. Kobayashi LC, O'Shea BQ, Kler JS, Nishimura R, Palavicino-Maggio CB, Eastman MR, et al. Cohort profile: the COVID-19 Coping Study, a longitudinal mixed-methods study of middle-aged and older adults' mental health and well-being during the COVID-19 pandemic in the USA. *BMJ Open*. 2021; 11: e044965.
41. Glowacz F, Schmits E. Psychological distress during the COVID-19 lockdown: the young adults most at risk. *Psychiatry Res*. 2020; 293: 113486.
42. Lisitsa E, Benjamin KS, Chun SK, Skalisky J, Hammond LE, Mezulis AH. Loneliness Among Young Adults During Covid-19 Pandemic: The Mediation Roles of Social Media Use and Social Support Seeking. *Journal of Social and Clinical Psychology*. 2020; 39(8), 708-726.
43. Bruine de Bruin W. Age differences in COVID-19 risk perceptions and mental health: Evidence from a national US survey conducted in March 2020. *J Gerontol B Psychol Sci Soc Sci*. 2021; 76: e24-e29.
44. Pearman A, Hughes ML, Smith EL, Neupert SD. Age differences in risk and resilience factors in COVID-19-related stress. *J Gerontol B Psychol Sci Soc Sci*. 2021; 76: e38-e44.
45. Tasnim R, Islam MS, Sujon MSH, Sikder MT, Potenza MN. Suicidal ideation among Bangladeshi university students early during the COVID-19 pandemic: Prevalence estimates and correlates. *Child Youth Ser Rev*. 2020; 119: 105703.
46. Killgore WDS, Cloonan SA, Taylor EC, Fernandez F, Grandner MA, Dailey NS. Suicidal ideation during the COVID-19 pandemic: The role of insomnia. *Psychiatry Res*. 2020; 290: 113134.
47. Rajkumar RP. COVID-19 and mental health: A review of the existing literature. *Asian J Psychiatr*. 2020; 52: 102066.
48. Roohafza HR, Afshar H, Keshteli AH, Mohammadi N, Feizi A, Taslimi M, et al. What's the role of perceived social support and coping styles in depression and anxiety? *J Res Med Sci*. 2014; 19: 944-949.
49. Yasin AS, Dzulkifli MA. The relationship between social support and psychological problems among students. *International Journal of Business and Social Science*. 2010; 1: 110-116.
50. Xiao H, Zhang Y, Kong D, Li S, Yang N. Social capital and sleep quality in individuals who self-isolated for 14 days during the coronavirus disease 2019 (COVID-19) outbreak in January 2020 in China. *Med Sci Monit*. 2020; 26: e923921.
51. Public Health Media Library. (cited 2020 December 7). Available from: <https://tools.cdc.gov/medialibrary/index.aspx#/results>.
52. American Academy of Sleep Medicine. (cited 2021 April 28). Sleep Education. Available from: <https://sleepeducation.org/how-technology-helping-hurting-sleep/>.

Citation: Kolakowsky-Hayner SA, Shen J, Goldin Y, Kingsley K, Alzueta E, Arango-Lasprilla JC. The COVID-19 Pandemic: Age Differences in Sleep Quality and Mental Health Across 59 Countries. *Epidem Pub Hel Res*. 2021; 1(1):1-10