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Trends and factors associated with depression among adults in the United States

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ARTICLE INFO	ABSTRACT
	Purpose: Examine the trends and risk factors of depression among adults in the USA. **Methods:** The national health interview survey (NHIS) data were analyzed. NHIS early release data provided the prevalence of depression from 2019 to 2022. We assessed depression covariates using SPSS 29. **Results:** The prevalence of depression decreased from 4.7% in 2019 to 4.5% in 2020, before rising to 5% in 2022. Of 31,536 participants in 2022 NHIS, 51.7% were female and 40% were 26 to 49 years old. Logistic regression showed that being female, obese and having diabetes and lower level of education as well as smoking cigarettes were significantly associated with higher levels of depression. Conversely, being married and aged 60 years+ were significantly associated with lower likelihood of depression. **Conclusion:** The decrease trends of depression at the onset the pandemic underscores the needs for further study. Targeted public health strategies and collaborative efforts are essential to mitigate depression's impact and improve mental health outcomes.

INTRODUCTION

Depression, also known as major depressive disorder (MDD), is a prevalent mental disorder affecting approximately 264 million people worldwide, making it the second largest contributor to global morbidity [1]. Although depression was the third leading cause of disease burden in 2018, it is projected to become the leading cause by 2030 [2]. This mental condition is characterized by episodes of low mood, anhedonia or loss of interest, feelings of guilt or worthlessness, suicidal thoughts, psychomotor retardation or agitation, impaired cognitive function, and physical symptoms such as changes in appetite and disrupted sleep patterns [3].

The impact of depression on health and social well-being is significant and widespread. At the individual level, depression is associated with an elevated risk of cardiovascular diseases, likely due to the physiological stress and inflammatory responses associated with depressive states [4, 5]. Additionally, individuals experiencing depression are more prone to engage in detrimental behaviors, such as poor dietary choices, physical inactivity, and smoking, all of which exacerbate the risk and progression of cardiovascular conditions [4]. Moreover, depressed individuals have a higher risk of mortality, particularly due to suicide [6].

Socially, depression can hinder an individual's daily functioning, impacting work performance, relationships, and overall quality of life [7]. Families of individuals with depression often experience significant emotional and financial strain. As the depressed family member is at greatest need of social support, depression tends to disrupt family stability frequently leading to separation or divorce [8]. At the societal level, depression contributes to substantial economic costs owing to lost productivity, increased healthcare utilization, and disability [9, 10].

Depression results from a complex interplay between biological, psychological, social, and environmental factors [11]. Demographic factors, such as age, sex, and ethnicity, also influence the prevalence of depression [12]. Women are generally at a higher risk of developing depression than are men [13]. Age-related trends indicate that young adults (20-39 years) and older adults (≥ 65 years) show increasing trends in moderate and severe depression, respectively [14]. Ethnic disparities in the prevalence of depression have been observed, with studies showing varying rates among different racial groups. Chronic health conditions have been consistently

linked to depression. A meta-analysis in [15] found a robust association between diabetes and anxiety, further complicating the mental health landscape of individuals with chronic illness such as such as chronic obstructive pulmonary disease, stroke, Alzheimer disease.

In the USA, depression is a growing health challenge. According to the National Institute of Mental Health, an estimated 21 million adults had at least one major depressive episode in 2022, representing 8.0% of all US adults [16]. Despite the extensive research on depression, an estimated 80-90% of people living with depression in low- and middle-income countries as well as in the USA are not diagnosed or treated [17]. Depression remains undiagnosed because its signs and symptoms are generally misunderstood [18]. One of the main challenges is the diverse nature of depression, where individuals with MDD exhibit significantly different symptoms and progression patterns, indicating that the underlying neurobiological factors may also differ greatly [19]. Furthermore, people suffering from this condition are reluctant to seek care. The shortage of trained healthcare providers and the social stigma associated with mental disorders compound the problem [20]. The growing use of digital media and smartphones also affect mental health through various mechanisms. These include reduction in time spent in face-to-face social interactions, disruption in-person social interactions, interference with sleep duration and quality, exposure of individuals to cyberbullying and toxic online environments, and spread of information and behaviors related to self-harm [21]. Adolescent cultural norms are also shifting, affecting social interactions across generations [22].

Research has reported mixed findings regarding the impact of the COVID-19 pandemic on mental health. On one hand studies have reported increased rates of mental illnesses during the COVID-19 pandemic [23-26], on the other hand other studies found no or little change in depressive and anxiety symptoms compared with pre-pandemic levels [27-30]. Furthermore, other studies reported a high prevalence of depression and anxiety in the initial phases of the lockdown, followed by a fairly rapid decline [31, 32]. This study was carried out to contribute to the discussion. The aim of the study is to compare the prevalence of depression among adults before and after COVID-19 using a large population-based survey and assess the factors associated with depression after the COVID-19 pandemic. This knowledge will not only contribute to the ongoing discussion about the mental effect of COVID-19, but also inform the design of effective prevention programs tailored to specific needs of different populations.

METHODS

Data Source

We analyzed data from the national health interview survey (NHIS). NHIS is an ongoing nationally representative survey of the civilian, noninstitutionalized population aged 18 years and older. The NHIS has been conducted by the National Center for Health Statistics of the Centers for Disease Control and Prevention since 1957. The NHIS sampling and data collection methods have been described elsewhere [33].

Briefly, the NHIS has four main modules: the household composition section, family core, sample adult core, and sample child core. From each participating family, one sample child (if there are any children aged 17 years and under) and one sample adult aged 18 years and over are randomly selected. Information on each is collected with the sample child and sample adult questionnaires, respectively. The sample adult core interview collects additional data on health status and conditions, health behaviors, functioning and disability, and access to and utilization of health care services. Data were collected by trained interviewers with the US Census Bureau using computer-assisted personal interviewing, a data collection method in which an interviewer meets with respondents face-to-face to ask questions and enter the answers into a laptop computer. When necessary, interviewers completed missing portions of the interview over the telephone.

To examine the trends of depression, we used the NHIS data from 2019 to 2022. Only the 2022 NHIS data were used to assess the risk factors. Data were drawn from the sample adult core which included the records of adults aged 18 years and older.

Study Variables

Self-reported depression was the primary dependent variable for this study. Survey respondents were asked:

(1) How often do you feel depressed? Would you say daily, weekly, monthly, a few times a year or never?

(2) Thinking about the last time you felt depressed, how depressed did you feel? Would you say a little, a lot, or somewhere in between.

Depression or regularly having feelings of depression was defined as reporting:

(a) feeling depressed daily and describing the level of depression as "somewhere in between a little and a lot" or "a lot," or

(b) feeling depressed weekly and describing the level of depression as "a lot" [34, 35].

The independent variables were risk factors or potential confounders in previous studies on depression. They included demographic characteristics (age less than 25, 26-49, 50-64, 65 years and older), sex, race (Hispanic, White, Black, Asian, American Indian and Alaska Native [AIAN], and multiple races), marital status (single, married, separated/divorced/widowed, and living with a partner)]; socioeconomic factors (health insurance (yes/no), and educational attainment (up to associate degree, bachelor and master degree, professional and doctorate); and health and behavioral indicators [body mass index (underweight, healthy, overweight, and obese), smoking (yes/no), physical activity how measured?, cigarette smoking (yes/no), alcohol consumption (yes/no). US region of residence (Northeast, Midwest, South, and West) were included in the analysis. Participants were also asked, "Has a doctor or other health professional ever told you that you had diabetes (not including gestational diabetes, prediabetes)". We recorded the variable into "diabetes" if the response was 'yes', and "no diabetes" if the response was 'no'.

Table 1. Characteristics of participants 18 years and older, NHIS 2022

Variables	Sample size: n= 31,536 unweighted	Weighted: % ± SE
Depression		
Yes	1,376	04.4 ± 0.2
No	30,192	95.6 ± 0.2
Ever had diabetes		
Yes	3,356	09.3 ± 0.2
No	28,180	90.7 ± 0.2
Sex		
Male	14,521	48.3 ± 0.4
Female	17,045	51.7 ± 0.4
Age groups		
Up to 25	2,062	13.3 ± 0.3
26-49	11,052	40.1 ± 0.4
50-64	8,359	24.7 ± 0.3
65+	10,095	21.8 ± 0.3
Race		
Hispanic	3,833	17.0 ± 0.7
White	22,090	63.7 ± 0.8
Black	3,201	11.8 ± 0.5
Asian	1,682	06.0 ± 0.3
AIAN	189	08.0 ± 0.2
Multiple races	244	07.0 ± 0.1
Education		
Up to associate	19,054	70.6 ± 0.5
Baccalaureate-master	11,129	26.7 ± 0.4
Professional & doctorate	1,236	02.7 ± 0.1
Marital status		
Single	6,027	23.3 ± 0.4
Married	14,666	52.0 ± 0.4
Divorced	7,946	16.2 ± 0.3
Living with partners	1,887	08.5 ± 0.2
Ever had diabetes		
Yes	3,356	09.3 ± 0.2
No	28,180	90.7 ± 0.2
Smoker		
Yes	11,762	35.2 ± 0.4
No	19,224	64.8 ± 0.4
Health insurance		
Yes	29,548	90.9 ± 0.3
No	1,984	09.1 ± 0.3
Social activities		
Yes	30,261	96.0 ± 0.3
No	1,279	04.0 ± 0.3
BMI category		
Underweight	461	1.6 ± 0.1
Healthy	9,755	31.4 ± 0.4
Overweight	10,748	34.0 ± 0.3
Obese	9,875	33.0 ± 0.4
Citizenship		
Yes		91.9
No		8.1
Region		
Northeast	5,619	17.6 ± 0.6
Midwest	7,175	20.9 ± 0.6
South	10,908	37.9 ± 0.8
West	7,866	23.6 ± 0.8
Alcohol		
Yes		33.8 ± 0.4
No		66.2 ± 0.4
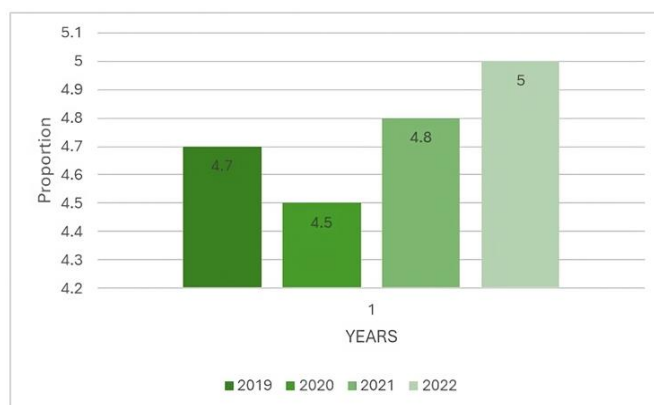
Figure 1. Trends of depression among adults in the USA, 2019-2022 NHIS data [36]

Data Analysis

The NHIS's interactive biannual early reactive estimates were used to determine the prevalence of depression between 2019 and 2022 [36]. Descriptive statistics based on unweighted sample sizes and weighted percentages for adults 18 years and older were used to characterize the study population in 2022. Chi-square statistic was used to test the association between each independent variables and the outcome of interest (depression). Logistic regression was also used to estimate the strength of the association between independent variables and the self-reported depression. Logistic regression was used to calculate multivariate-adjusted odds ratios (AOR) and their 95% confidence intervals (CIs) while adjusting for potential confounding. Statistical analyses were carried out with IBM SPSS statistics for Windows, version 29.0.2.0 [37] because of its ability to account for the complex sampling design in calculating unbiased standard error estimates. In **Table 1**, the sample sizes were unweighted but all estimates (proportions, standard errors, and AORs with their 95% CIs) were weighted. To determine the trends of depression, the National Center for Health Statistics's interactive biannual early reactive estimates were utilized [36].

RESULTS

Figure 1 depicts the trends of depression among adults from 2019 to 2022. The graph highlights a slight decrease in the prevalence of depression from 4.7% in 2019 to 4.5% in 2020. This trend reversed in subsequent years with the prevalence of depression rising to 4.8% in 2021 and further to 5% in 2022.

The weighted estimates of the characteristics of participants are summarized in **Table 1**. Of the total number of participants (N = 31,536), 51.7% were female. The age distribution was 13.3% between the ages of 18-25, 40.1% between the ages of 26-49, 24.7% between 50-64, and 21.8% of adults over the ages of 65 years old. The median age was 55 years. The distribution of race was: 63.7% White, 17% Latino/Hispanic, 12% Black, 6% Asian, 7% multiracial, 8% Native American. Regarding education attainment, 70.6% of respondents' highest level of education was associate degree, 26.7% master, and 2.7% professional or doctorate. Fifty-two

Table 2. The association between selected characteristics of participants and self-reported depression

Variables	Depression		No depression		p-value
	N	Weighted: % ± SE	N	Weighted: % ± SE	
Sex					
Male	509	3.5 ± 0.2	14,012	96.5 ± 0.2	<.001
Female	867	5.2 ± 0.2	16,178	94.8 ± 0.2	
Age groups					
Up to 25	127	5.4 ± 0.6	1,935	94.6 ± 0.6	
26-49	463	4.2 ± 0.3	10,588	95.8 ± 0.3	<.001
50-64	446	5.0 ± 0.3	7,913	95.0 ± 0.3	
65+	340	3.3 ± 0.2	9,755	96.7 ± 0.2	
Race					
Hispanic	166	3.7 ± 0.4	3,667	96.3 ± 0.4	
White	959	4.5 ± 0.2	21,131	95.5 ± 0.2	
Black	158	5.0 ± 0.6	3,043	95.0 ± 0.6	<.001
Asian	32	1.9 ± 0.4	1,650	98.1 ± 0.1	
AIAN	22	10.1 ± 2.7	167	89.1 ± 2.7	
Multiple races	25	10.7 ± 2.6	219	89.3 ± 2.6	
Education					
Up to associate	1,017	5.1 ± 0.2	18,037	94.9 ± 0.2	
Baccalaureate-master	318	2.6 ± 0.2	10,811	97.4 ± 0.2	<.001
Professional & doctorate	32	2.1 ± 0.4	1,204	97.9 ± 0.4	
Marital status					
Single	381	6.1 ± 0.4	5,646	93.9 ± 0.4	
Married	407	2.9 ± 0.2	14,259	97.1 ± 0.2	<.001
Divorced	459	6.6 ± 0.4	7,487	93.4 ± 0.4	
Living with partners	100	5.0 ± 0.6	1,787	95.0 ± 0.6	
Ever had diabetes					
Yes	238	5.3 ± 0.4	3,118	94.7 ± 0.4	<.001
No	1,136	3.7 ± 0.2	27,044	96.3 ± 0.2	
Smoker					
Yes	730	6.6 ± 0.3	11,031	93.4 ± 0.3	<.001
No	630	3.2 ± 0.2	18,599	96.8 ± 0.2	
Health insurance					
Yes	1,257	4.3 ± 0.2	28,291	95.7 ± 0.2	0.43
No	119	4.8 ± 0.6	1,865	95.2 ± 0.6	
Social activities					
Yes	1,048	3.4 ± 0.1	29,213	96.7 ± 0.1	<.001
No	328	26.7 ± 1.7	951	73.3 ± 1.7	
BMI category					
Underweight	26	6.7 ± 1.6	435	93.3 ± 1.6	
Healthy	312	3.2 ± 0.2	9,443	96.8 ± 0.2	<.001
Overweight	394	3.7 ± 0.3	10,354	96.3 ± 0.3	
Obese	616	6.2 ± 0.3	9,259	93.8 ± 0.3	
Region					
Northeast	233	4.2 ± 0.4	5,386	95.8 ± 0.4	
Midwest	336	4.9 ± 0.4	6,839	95.1 ± 0.4	<.123
South	499	4.5 ± 0.3	10,409	95.5 ± 0.3	
West	308	3.8 ± 0.3	7,558	96.2 ± 0.3	
Alcohol					
Yes	350	5.3 ± 0.4	6,334	94.7 ± 0.4	<.001
No	519	3.7 ± 0.2	14,210	96.3 ± 0.2	

(52.0) percent of the participants reported being married. In terms of place of residence, 37.9% lived in the South and 23.6% lived in the West. Among the participants, 33% were obese, 34.0% were overweight while 31.4% were normal weight, and only 1.6% were underweight. Furthermore, 35.2% of the participants reported ever smoking more than 100 cigarettes and 33.8% consumed alcohol. An estimated 90.9% reported being covered by health insurance. The prevalence of depressive disorders in this population was 4.4%. Among people who had depression, 9.3% reported ever having diabetes.

On bivariate analysis, sex, age, race, education attainment, marital status, diabetes status smoking, alcohol consumption and social activities were significantly associated with depression at the 0.05 level of significance. Health insurance coverage and region of residence were not associated with depression at 0.05 level of significance (**Table 2**).

Factors associated with depression in the multivariate Logistic Regression are summarized in **Table 3**. The odds of having depression were three times higher among AIAN (AOR = 3.40, 95% CI 1.40-8.11) as well as participants who

Table 3. Logistic regression analysis

Variables	AOR	95% confidence interval	
		Low	High
Sex			
Male	1		
Female	1.92	1.57	2.34
Age groups			
Up to 25	1		
26-49	0.79	0.56	.1.09
50-64	0.76	0.52	1.10
65+	0.42	0.28	0.63
Race			
Hispanic	1		
White	1.26	0.93	1.71
Black	1.16	0.73	1.85
Asian	0.72	0.68	1.40
AIAN	3.40	1.43	8.11
Multiple races	2.59	1.57	2.34
Education			
Up to associate	1.84	1.08	3.13
Baccalaureate-master	1.16	0.68	1.97
Professional & doctorate	1		
Marital status			
Single	1		
Married	0.43	0.33	0.56
Divorced	0.89	0.67	1.17
Living with partners	0.59	0.42	0.82
Ever had diabetes			
Yes	2.22	1.68	2.94
No	1		
Smoker			
Yes	1.92	1.57	2.43
No	1		
Social activities			
Yes	1,048	3.4 ± 0.1	29,213
No	328	26.7 ± 1.7	951
BMI category			
Underweight	1.24	0.56	2.75
Overweight	1.15	0.87	1.51
Obese	1.68	1.30	2.16
Normal	1		
Alcohol			
Yes	1.22	0.99	1.51
No	1		

reported multiple races (AOR = 2.59, 95% CI 1.57-2.34) as compared to participants from Hispanic descent. Whites (AOR: 1.26, 95% CI 0.93-1.71) and African Americans (AOR: 1.16, 95% CI 0.73-1.85) were 1.2 and 1.7 times more likely to have depression than Hispanics, but the difference was not statistically significant. Similarly, the odds of having depression were two times more likely among participants who had diabetes (AOR = 2.22, 95% CI 1.68-2.94) compared to those who did not have diabetes. Women (AOR = 1.92, 95% CI 1.57-2.39) were 1.9 times more likely than men to have depression. Participants who had a low level of education (up to an associate degree) (AOR: 1.84, 95% CI 1.08-3.18) were 1.8 times more likely to have depression than those with a postgraduate degree. Participants who smoked cigarettes (AOR: 1.92, 95% CI 1.57-2.43) were 1.92 times more likely than those who did not smoke to develop depression. Finally, participants who consumed alcohol (AOR=1.22 95% CI 0.99-1.51) were 1.2 times more likely to have depression than those who did not

consume alcohol, but the difference was not statistically significant.

Conversely, participants who reported being married (AOR: 0.43, 95% CI 0.33-0.56) and those who were 65 years or older (OR: 0.42, 95% CI 0.28-0.63) had nearly a 60% lower chance of having depression than those who were single or young. Participants from Asian descent (AOR: 0.72, 95% CI 0.68-1.40) had a 30% lower change of having depression than Hispanics.

DISCUSSION

The objective of this study was two folds: examine the trends of depression and identify the covariates of depression among adults in the USA.

The study showed a decrease in the prevalence of depression during the onset of COVID19, from 4.7% in 2019 to 4.5% in 2020. The low prevalence rate of depression (4.5% in 2020) reported, along with the decrease observed at the onset of COVID-19, contrasts with most community-based studies, which indicate an increased prevalence of up to 25% due to sudden worsening of living circumstances, including social isolation, economic instability, and uncertainty [24, 38]. Could the initial decrease in the prevalence of depression be attributed to the immediate social support and sense of solidarity experienced during the early stages of the COVID-19 pandemic, as communities and governments rallied to respond to the crisis. The authors do not have a clear explanation for this initial decrease. More community-based studies are needed to assess the true mental impact of COVID-19.

Regarding the risk factors of depression, we found that females were more likely than men to develop depression. The gender disparity in depression rates has been well documented in the literature, with adult women experiencing depression at twice the rate of men [39-41]. The relationship between gender and depression is a complex issue. Hyde, Mezulis and Abramson's model suggests that convergence of affective, biological, and cognitive vulnerabilities during early adolescence creates a susceptiveness to depression in females. It was warned against the risk of overlooking male depression due the socialization process. The more men adhered to masculine norms, the more likely they are to exhibit symptoms consistent with "male depression," and the less likely to disclose mental health difficulties to their physicians [42].

Being married significantly reduced the likelihood of developing depression. Marriage frequently offers a sense of support as partners provide comfort, motivation and companionship, all of which can help protect against the development of depression [43]. Marriages thrive on conversations, empathy, shared financial duties and mutual understanding. These elements nurture closeness and help couples withstand challenges that could lead to depression [44]. Finally, married people might embrace lifestyle choices, like physical activity, a well-rounded diet and cutting back on substances following the encouragement and support of their partner [44].

Lower level of education was associated with a higher likelihood to have depression. This finding corroborates with

previous studies [45]. This association could be explained, in part, by the fact that individuals with lower educational levels often face a variety of psychosocial stressors, including job insecurity, low income, and substandard living conditions, which can exacerbate the onset and severity of depression. Furthermore, educational attainment impacts health literacy, influencing how individuals manage their health, recognize early symptoms of mental disorders, and access appropriate care. Consequently, those with higher education are more likely to adopt healthy behaviors and access preventative health information [46].

Furthermore, smoking was associated with a higher odd of developing depression. The relationship between smoking and depression has been extensively studied [47]. Smoking often serves as a coping mechanism for stress, yet it can lead to dependency and withdrawal symptoms that may exacerbate mood issues upon quitting. Additionally, smokers frequently face heightened psychological and social stress due to health complications and societal stigma, further aggravating depressive symptoms. Genetic predispositions may also play a role, linking smoking and depression, with some individuals using smoking as a form of self-medication to manage their depressive symptoms. More research is needed to deepen our understanding of how smoking and depression interconnect and to develop targeted interventions for those affected by both issues.

Racial disparity related to depression has been well established in the literature. Hispanics, Whites, AIAN, and participants who reported multiple races were significantly more likely to report ever being diagnosed with depression, whereas those from Asian descents were significantly less likely to report ever being diagnosed with depression. Researchers contend that the diagnostic instruments used to assess depression symptoms and severity may not be culturally appropriate, potentially resulting in the underreporting of depression in certain racial or ethnic groups [48]. The deep-rooted mistrust can deter ethnic minority members from acknowledging the symptoms of depression or seeking mental health services, leading to higher rates of undiagnosed cases of depression. Underestimation of depression in these communities may lead to missed opportunities for treatment and unaddressed suffering.

The relationship between the education level and depression remains controversial. While our study found that people aged 60 years and younger were more likely to develop depression compared to those aged 60 years and older [49, 50], other studies have reported more depressive symptoms with increasing age [51, 52]. As individuals age, they are at increased risk of suffering from chronic illnesses, decreased functional ability, and reduced mobility. These conditions increase feelings of helplessness and depression. Older adults also face additional stressors including loneliness and bereavement that further exacerbate the risk of depression [53]. Further studies are needed to better understand these dynamics and to tailor interventions that address the specific needs of different age groups effectively.

Both low as well as high body mass index have been linked to increased feelings of depression . This association may be attributed to shared processes like increased cytokine levels, impaired neurotransmitter functioning due to insulin issues and overactivity of the pituitary adrenal (HPA) axis [55]. Additionally, stigma, discrimination and low self-esteem often associated with obesity can contribute to depressive symptoms [56]. The health complications related to obesity such as heart disease and diabetes can also increase stress levels. Furthermore, obesity can limit activity and social interactions potentially intensifying feelings of isolation and depression.

Utilization of the large NHIS data set, which is representative of nearly the entire US population, is the main strength of this study. However, it does have several limitations. First, the cross-sectional design of the study impeded the assessment of the cause-and-effect relationship between the outcome and explanatory variables. Second. since depressive symptoms occur more frequently among those in residential care, prevalence rates of depression are probably underestimated. Third, data collection through questionnaire interview might be subject to recall bias.

CONCLUSION

The counterintuitive trends as well as the low prevalence of depression observed during the onset of COVID-19 underscores the needs for further study. The factors associated with depression included being female, obese, lower level of education, and smoking. Protective factors such as being married, and older age were associated with a reduced likelihood of depression. These findings highlight the critical need for integrated healthcare strategies that incorporate routine depression screening, patient education on lifestyle changes, and improved access to mental health services. Collaborative efforts among healthcare providers, policymakers, and communities are essential to address the multifaceted nature of depression and improve mental health outcomes across diverse populations. This study's insights are crucial for designing effective prevention and treatment programs tailored to the specific needs of different demographic groups.

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