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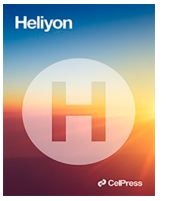

Research article

Change in mental health service utilization from pre- to post-COVID-19 period in the United States

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ABSTRACT

Objectives: This study aimed to explore the change in mental health service utilization before and after the COVID-19 pandemic as well as determine the association of various sociodemographic characteristics and comorbidities on the utilization pattern.

Methods: Data from the National Health Interview Survey (NHIS) 2019 and 2022 were explored in this study. Along with the univariate analysis, bivariate analysis was conducted using the Chi-square and Cochran-Armitage trend tests. Stepwise binary logistic regression was implemented to find the best-fitted model and examine the effects of different factors on mental healthcare utilization. We also conducted a subgroup analysis for the variables that showed heterogeneous changes in utilization from 2019 to 2022.

Results: Analysis of a total of 53,856 complete cases showed that the percentage of mental healthcare utilization changed from 20% in 2019 to 23.31% in 2022. Logistic regression results showed that the odds of mental health service utilization in the post-COVID period is 1.41 times of the pre-COVID [95% CI odds ratio (OR) = (1.26, 1.58)]. Sex, age, race, education, income group, insurance coverage, birth country, marital status, limitations of social functioning, having a place for healthcare, symptoms and history of depression/anxiety, diabetes, and hypertension had significant effects on the odds of receiving mental healthcare. Subgroup analysis revealed that the utilization changed significantly from 2019 to 2022 for age group "18–34" [OR = 1.41, 95% CI = (1.26, 1.58)], "35–49" [OR = 1.35, 95% CI = (1.21, 1.50)], and "50–64" [OR = 1.12, 95% CI = (1.01, 1.24)], while for the age group "above 64" was not significant.

Conclusion: Pre- and post-COVID periods were found to be significantly different in terms of the utilization of mental healthcare utilization. Changes in the utilization was also found to differ in terms of different age groups.

1. Introduction

Depression and anxiety are two major parts of mental illness, which inherently influences social impairment and physical illness, as well as contributes to suicide in adults. Despite being two different terms, depression and anxiety are usually treated concurrently since

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they often occur together in individuals with mental disorders [1,2]. According to the 2023 Mental Health America (MHA) report, 20.78% of adults in the US experienced mental illness in the period of 2019–2020 and almost one-third of them were unable to receive the necessary treatment, which is very concerning [3]. This implies that, although depression and anxiety disorders can lead to many adverse health issues, the prioritization of these disorders, as well as the tendency to seek treatment is often unseen.

Depression has been diagnosed in men half as in women, and married or divorced as well as separated men are more likely to seek treatment compared to unmarried men [4,5]. Previous studies have found that among adults, the percentage of individuals utilizing mental healthcare decreases as age increases [1]. Young adults tend not to accept the diagnosis of depression in an easy manner and face the fear of social humiliation [6]. On the contrary, elderly people, with lower levels of education and income are more reluctant to seek mental health treatment [4]. Economic condition is a key determinant that contributes to healthcare-seeking behavior for depression and anxiety. Investing in mental health care along with physical care and taking insurance coverage for mental treatment becomes quite impossible for lower-income populations [7,8]. According to a report from NIMH, patients often do not receive the proper treatment for depression and anxiety, and they are more likely to receive treatment when the problem reaches a severe point [9]. According to the results of several studies, diabetes and hypertension are two important comorbidities that are associated with depression and anxiety [10–12], and depressive people having these two comorbidities were found to be more likely to use mental healthcare services [13,14].

Mental health is also associated with the epidemic since it can largely disrupt people's social and economic lives, and as a consequence, the affected people are exposed to mental illness [15]. During the COVID-19 pandemic, changes in daily routine, acquisition of unhealthy habits, and fear of infection resulted in mental health related problems [16]. Literature suggests both direct and indirect impacts of the COVID-19 pandemic on mental health, with significant increases in depression and anxiety [17]. A review by Bueno-Notivol et al. found that the prevalence of depression during the pandemic reached 25%, which is seven times higher than the levels reported in 2017 [18]. Anxiety levels were also found to be severe in several studies [19,20]. Another study demonstrated that psychological well-being was negatively affected by the pandemic [21].

According to recent studies, COVID-19 had a significant impact on the delivery of mental healthcare services, and it was a major factor in increasing the prevalence of mental health disorders in the general population [22–24]. Due to this pandemic, people were severely affected economically as a result of being unemployed, socially due to limited social interactions, and physically for decreased physical exercises, and all of these factors ultimately contributed to their psychological distress [25–28]. Pandemic can greatly disrupt the accessibility of health services, and according to WHO, 93% of countries in the world have faced challenges in providing mental care support during the COVID-19 pandemic [29]. Due to the lockdown situation and mitigating the risk of spread, the health system promoted telemental health services [25]. While 50% of adults with behavioral health conditions utilized telehealth services during the early period of the pandemic, in-person mental health service utilization was found to decrease largely [25,30]. For previous large-scale disasters like the 2008 Hurricane, it was observed that due to posttraumatic stress disorder, depression and other mental illnesses persisted over long periods [31]. Therefore, it appears likely that COVID-19 will have a large post-pandemic effect on mental health, and the change in mental health service utilization before and after the outbreak can reflect the effect of the pandemic as well as provide insight into how well the health services were able to engage people.

Although several studies have explored the change in mental health service utilization among US people during the COVID-19 pandemic compared to the pre-pandemic period [25,32], it remains unclear how the utilization has changed at a national level after the pandemic. We aim to explore this by analyzing healthcare utilization for mental health using publicly available National Health Interview Survey (NHIS) datasets from 2019 to 2022 [33,34]. The primary objective of our study is to understand how people's mental health service usage changed before and after the COVID-19 pandemic by comparing data from two years, along with exploring the influence of various sociodemographic features and related diseases on this utilization pattern. We also examined the change in utilization in the two pre-post pandemic years for each category of the variables that were found to have heterogeneous effects on mental health care service utilization.

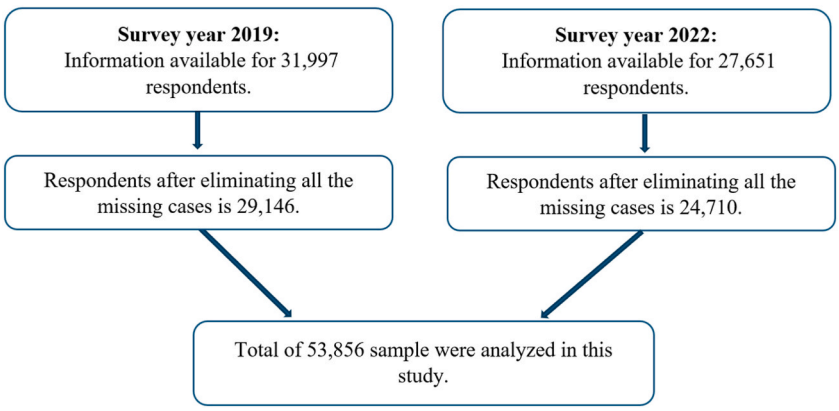

Fig. 1. Flowchart showing the steps to select final study sample. Respondents with missing information for any of the considered variables are defined as missing.

2. Methods

2.1. Dataset and variables

The study subjects were extracted from the NHIS data which were obtained by cross-sectional interview survey from thousands of households in the USA [35,36]. The 2019 NHIS dataset was used as the most recent data prior to the COVID-19 pandemic and the 2022 NHIS data was used for representing the situation after the pandemic. There were 31,997 and 27,651 observations respectively in the 2019 and 2022 survey datasets and after removing observations with missing values we obtained 29,146 and 24,710 observations respectively with a total sample size of 53,856 (see Fig. 1).

2.2. Response variable

The response variable in our study is *Health service utilization for mental health* with two possible outcomes (yes, or no). Following the categorization done by Lee et al. [1], we labeled a subject's health service utilization status as "yes" if they had a record of at least one of the following: (1) taking medication for worried/nervous/anxious feelings (2) Taking medication for depression and (3) Received counseling/therapy from mental health professional in the past 12 months of the interview.

2.3. Covariates

2.3.1. Sociodemographic features

The sociodemographic features that were considered in this study are *Age* (Grouped into categories of *18–34*, *35–49*, *50–64*, and *64+* years old), *Sex* (*Female* and *Male*), *Race* (grouped into *White* or *non-White* from various race group), *Education* (grouped into *less than high school*, *high school or GED (general equivalency diploma)*, and *some college or associate degree or above*), *Marital status* (grouped into *married or living with a partner* or *neither*), *Country of birth* (*USA* or *non-USA*), *Insurance coverage* (*not covered* or *covered*), *Social functioning limitation* (grouped into "*limited activity*" and "*no limit*"), and having a usual *Place to go for healthcare* (grouped into "*some*

Table 1
Univariate analysis with Frequency and Percentage of the levels of variables.

Variable	Levels	Frequency	Percent
Year	Year 2019	29146	54.12
	Year 2022	24710	45.88
Mental health service utilization	Yes	11613	21.56
	No	42243	78.44
Symptoms of depression/anxiety	Have Symptoms	13013	24.16
	No Symptoms	40843	75.84
Age	18–34	11217	20.83
	35–49	11919	22.13
	50–64	13864	25.74
	64+	16856	31.30
Sex	Female	24601	45.68
	Male	29255	54.32
Race	White	42743	79.37
	Non-White	11113	20.63
Education	Less than High school	4222	7.84
	High school or GED	13555	25.17
	Some college/associate degree or above	36079	66.99
Limitation of social functioning	Limited activity	48102	89.32
	No limit	5754	10.68
Insurance	Not covered	3963	7.36
	Covered	49893	92.64
Place to go for healthcare	Some Place	49196	91.35
	None	4660	8.65
Marital Status	Married or living with partner	28953	53.76
	Neither	24903	46.24
Country of birth	USA	46395	86.15
	Non-USA	7461	13.85
History of anxiety and/or depression	Yes	9791	18.18
	No	44065	81.82
Diabetes	Yes	5714	10.61
	No	48142	89.39
Hypertension	Yes	19890	36.93
	No	33966	63.07
Income group	Under 100%	5363	9.96
	100–199%	9246	17.17
	200–399%	15809	29.35
	400% and above	23438	43.52

place" and "*none*").

As mentioned earlier, we considered the patients from all income groups, the subjects were grouped into 4 *Income groups* in terms of family poverty ratio. The four groups relative to the family poverty ratio are "Under 100%", "100%–199%", "200%–399%", and "above 400%" as categorized by Hoge et al. [37].

2.3.2. Related diseases

Our study considered the comorbidities such as *Diabetes* (*Yes* or *No*), *Hypertension* (*Yes* or *no*), and having *History of depression and/or anxiety* (Grouped into *Yes* and *No*).

In the dataset, the severity of anxiety symptoms was determined using the GAD-7 (7-item Generalized Anxiety Disorder scale) that categorized the level of anxiety using the response of seven specific questions [38]. Similarly, for the severity of depression, PHQ-8 (8-item Patient Health Questionnaire depression scale) was used which considered the response of 8 depression-related questions [39]. In our research, a subject was categorized as having symptoms of anxiety/depression if they were diagnosed to have mild or greater severity of symptoms in either GAD-7 or PHQ-8 similarly as Lee et al. [1].

3. Data analysis

Univariate analyses were done to show frequencies and percentages of categories of each variable of interest. The chi-square test of independence was utilized to examine the association between Health service usage for mental health and each covariate with two levels (nominal variables). On the other hand, Cochran-Armitage Trend test was used to test the association between Health service utilization and ordinal variables (*Age group*, *Education*, *Income group*). Stepwise logistic regression was conducted to find the best-fitted model. In the first step, only the main effects of the independent variables were considered. Secondly, all selected main effects were taken alongside their interaction with *"Year"* and stepwise regression was implemented again for the final model selection. A subgroup analysis was conducted for the variable that showed significant interaction with *"Year"* in mental health service utilization. SAS 9.4 programming was used to do all analyses [40]. And ggplot package [41] of R programming [42] was utilized for creating the plots.

Table 2
Bivariate Analysis: Chi-square test of independence and Cochran-Armitage Trend Test.

Variable	Levels	Mental health service utilization		p-value
		Yes (%)	No (%)	
Year	2019	20.08	79.92	<0.0001
	2022	23.31	76.69	
Symptoms of depression/anxiety	Have Symptoms	49.50	50.50	<0.0001
	No Symptoms	12.66	87.34	
Age	18–34	22.39	77.61	<0.0001[a]
	35–49	23.51	76.49	
	50–64	22.49	77.51	
	64+	18.88	81.12	
Sex	Female	15.24	84.76	<0.0001
	Male	26.88	73.12	
Race	White	23.31	76.69	<0.0001
	Non-White	14.83	85.17	
Education	less than High school	20.23	79.77	<0.0001[a]
	High school or GED	19.41	80.59	
	Some college/associate degree or above	22.53	77.47	
Limitation of social functioning	Limited activity	17.98	82.02	<0.0001
	No limit	51.53	48.47	
Insurance	Not covered	12.52	87.48	<0.0001
	Covered	22.28	77.72	
Place to go for healthcare	Some Place	22.53	77.47	<0.0001
	None	11.33	88.67	
Marital Status	Married or living with partner	19.11	80.89	<0.0001
	Neither	24.41	75.59	
Country of birth	USA	23.28	76.72	<0.0001
	Non-USA	10.90	89.10	
History of anxiety and/or depression	Yes	71.41	28.59	<0.0001
	No	10.49	89.51	
Diabetes	Yes	27.41	72.59	<0.0001
	No	20.87	79.13	
Hypertension	Yes	24.72	75.28	<0.0001
	No	19.71	80.29	
Income group (in terms of family poverty ratio)	Under 100%	29.26	70.74	<0.0001[a]
	100–199%	23.99	76.01	
	200–399%	20.62	79.38	
	400% and above	19.48	80.52	

[a] Two-sided p-value for Cochran-Armitage Trend Test.

4. Results

4.1. Univariate analysis (frequency and percentages)

Table 1 shows the frequency and percentage of different categories of the variables of interest in this study. As the table presents, only around 22 percent of the participants utilized health services for mental health reasons. Female and male represent around 45 and 55 percent of the sample respectively. About 31 percent of participants were more than 64 years old and 53.8 percent were married or living with partner. Most of the respondents were White (79.4 percent), were born in the USA (86.2 percent), and had at least some college/associate degree (67 percent). In terms of anxiety/depression symptoms and related diseases, 24.2 percent of the respondents had some symptoms of depression/anxiety, 18.2 percent had history of those mental illnesses, 10.6 percent had diabetes, and 36.9 percent had hypertension. Health insurance coverage was reported by 92.6 percent of the participants, and 91.4 percent had some place to go for healthcare. Approximately 10 percent had family poverty ratio under 100% whereas 43.5 percent had the ratio of at least 400%, and 89.3 percent of respondents had limited social functioning.

4.2. Bivariate analysis

In Table 2, a bivariate association between mental health service utilization and each of the other variables of interest has been presented. All variables including *Year* showed strong association with health service utilization for mental health. It implies that mental healthcare usage was significantly different for the categories of those variables. Cochran-Armitage Trend Test suggests that utilization of mental healthcare has a trend association with the categories of *Age*, *Education*, and *Income group*. The visual representation of both year-wise and age-wise differences in mental health service utilization between 2019 and 2022 has been provided in Fig. 2.

4.3. Multivariable analysis

In the first step, we fit a stepwise logistic regression to select the best-fitted model with the main effects of the 15 independent variables, and all of them were selected (Supplemental file: Table-1). Then stepwise regression with the main effects of those 15 variables and their interaction with "*Year*" were performed. Finally, all the 15 main effects and interactions between *Age* and *Year* (total 16 covariates) were selected in the final logistic regression model.

The result of logistic regression has been presented in Table 3. The odds of mental health service utilization have increased by 41.2% in 2022 from 2019 (95% CI of OR = [1.260, 1.583]). Male respondents utilized the service more than female (OR = 1.684, 95% CI = [1.595, 1.778]). People who are married or living with a partner are less likely to get mental health service (OR = 0.893, 95% CI = [0.845, 0.944]). *Non-white* people are less likely to utilize the service than *White* people (OR = 0.59, 95% CI = [0.548, 0.635]) and people born in the USA are more likely to utilize the service than who did not born in the USA (OR = 1.587, 95% CI = [1.446, 1.742]). The odds of utilization is 2.76 times (95% CI = [2.602, 2.929]) for the people with the symptoms of depression/anxiety compared to the people with no symptoms, whereas the odds are more than 12 times for the people with history of depression and/or anxiety compared to the people with no such history (OR = 12.594, 95% CI = [11.870, 13.362]). Although people with *Education* "*High school or GED*" do not get the service significantly different from people with *Education* "*less than High school*", people with "*Some college/associate degree or above*" are more likely to use mental health service than people with "*less than High school*" (OR = 1.423, 95% CI =

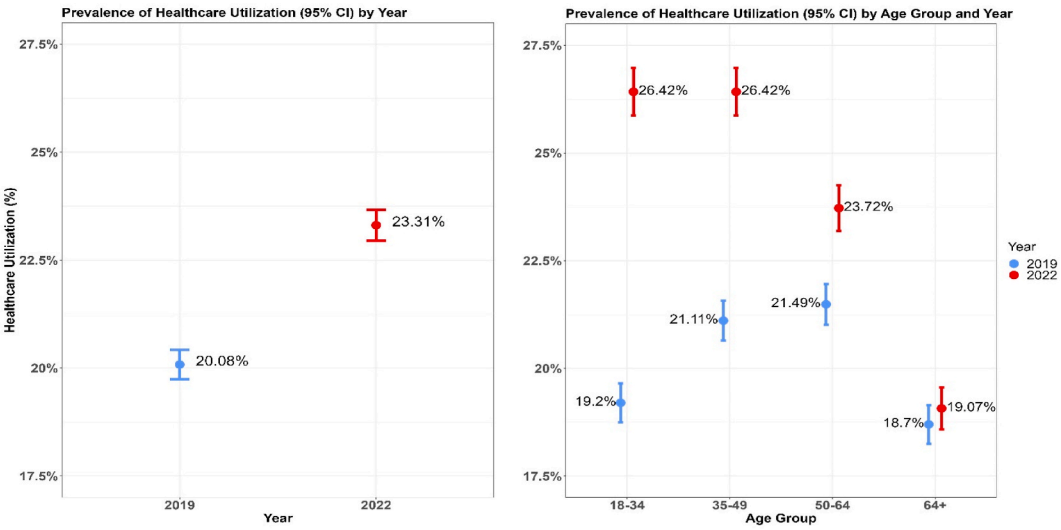

Fig. 2. Prevalence of healthcare utilization by *Year* (left), and by both *Age Group* and *Year* (right).

[1.273, 1.589]). People who have limitations in social functioning are less likely to take mental health service compared to people with such no limitation (OR = 0.646, 95% CI = [0.596, 0.700]). The odds are nearly double for those with health insurance coverage compared to those with no health insurance (OR = 2.028, 95% CI = [1.787, 2.301]) and for those who have some place to go for healthcare services compared to those who do not have a place to go (OR = 2.179, 95% CI = [1.936, 2.453]). People suffering from *Diabetes* (OR = 1.166, 95% CI = [1.070, 1.270]) and *Hypertension* (OR = 1.205, 95% CI = [1.133, 1.281]) are slightly more likely to get mental health services. Compared to the *Income group* "400% and above" the odds of utilization is not significantly different in group "Under 100%" and decreased by 13.5% for *Income group* "100–199%" (OR = 0.865, 95% CI = [0.797, 0.938]) and by 14.9% for "200–399%" (OR = 0.851, 95% CI = [0.798, 0.909]).

For the model diagnosis, we plot the ROC curve (Fig. 3) and found that the area under the curve (AUC) = 0.85. It indicates that our model fits the data well and it has good predictive power [43].

4.4. Sub-group analysis

We found a significant interaction between "*Year*" and *"Age"*, which implies the heterogeneous change in healthcare utilization before and after COVID-19 for different groups of age [44]. Therefore, a subgroup analysis was conducted to determine the effect size in different age groups. The results of the subgroup analysis are presented in Fig. 4. We found that for the sub-group of *"18 – 34"*, *"35 – 49"*, and *"50 – 64"* years of age, the odds of utilization have significantly increased by 41%, 35%, and 12% respectively in 2022 compared to 2019. However, no significant effect was found for the age group greater than 64.

5. Discussion

This study aimed to examine the change in mental health service utilization before and after the COVID-19 pandemic. In our study, we have found an increase in the use of mental health care services in 2022 compared to 2019, implying the pandemic's effects on people's utilization of health services for mental health issues. A study based on a large sample of commercially insured people showed that overall mental health services increased during the first year of the COVID-19 pandemic [25]. However, they concluded that the rapid expansion of telehealth services played a vital role here, since they found a dramatic increase (1495.2%–1925.0%) in telehealth and a decrease (52%–57%) in in-person service utilization from pre-pandemic to after 10 months of the declaration of COVID-19 national emergency [25]. Another study reported similar findings, where they also showed that low-income people exhibited lower utilization of telemedicine compared to the pre-pandemic period [45]. An important factor for increased health service utilization in the post-pandemic period could be due to the recent expansion of telehealth services at US mental health treatment facilities. A recent study revealed that the percentage of mental health treatment facilities offering telehealth services has more than doubled after the pandemic, rising from 39.4% in 2019 to 88.1% in 2022 [46]. Another study showed that while telehealth represented less than 1% of outpatient care for mental health treatment before the pandemic, it surged to 40% at its peak during the pandemic and remained at 36% in the later stage of the pandemic [47]. Moreover, despite spiking the prevalence of depression, the COVID-19 pandemic also increased awareness and knowledge of psychological problem management across population, and normalized help-seeking behavior from families or professional mental healthcare providers [48].

Table 3
Results of multiple logistic regression.

Variable	Levels	Estimate	p-value	Odds Ratio (95% CI)
Intercept		−4.170	<0.0001	0.02 (0.01, 0.02)
Year	Year 2022 vs Year 2019	0.345	<0.0001	1.41 (1.26, 1.58)
Age	35–49 vs 18–34	0.120	0.033	1.13 (1.01, 1.26)
Age	50–64 vs 18–34	−0.057	0.307	0.95 (0.85, 1.05)
Age	64+ vs 18–34	−0.291	<0.0001	0.75 (0.67, 0.84)
Age * Year	35–49 * Year 2022	−0.048	0.554	0.95 (0.82, 1.12)
Age * Year	50–64 * Year 2022	−0.234	0.003	0.79 (0.68, 0.92)
Age * Year	64+ * Year 2022	−0.345	<0.0001	0.71 (0.61, 0.82)
Sex	Male vs Female	0.521	<0.0001	1.68 (1.60, 1.78)
Symptoms of depression/anxiety	Have Symptoms vs No Symptoms	1.015	<0.0001	2.76 (2.60, 2.93)
Race	Non-White vs White	−0.528	<0.0001	0.59 (0.55, 0.64)
Education	High school or GED vs less than High school	0.054	0.363	1.06 (0.94, 1.18)
Education	Some college/associate degree or above vs less than High school	0.352	<0.0001	1.42 (1.27, 1.59)
Limitation of social functioning	Limited activity vs No limit	−0.437	<0.0001	0.65 (0.60, 0.70)
Insurance	Covered vs not covered	0.707	<0.0001	2.03 (1.79, 2.30)
Place to go for healthcare	Some Place vs no place	0.779	<0.0001	2.18 (1.94, 2.45)
Marital Status	Married or living with partner vs Neither	−0.113	<0.0001	0.89 (0.85, 0.94)
Country of birth	USA vs Non-USA	0.462	<0.0001	1.59 (1.45, 1.74)
History of anxiety and/or depression	Yes vs No	2.533	<0.0001	12.59 (11.87, 13.36)
Diabetes	Yes vs No	0.153	0.001	1.17 (1.07, 1.27)
Hypertension	Yes vs No	0.186	<0.0001	1.21 (1.13, 1.28)
Income group	100–199% vs 400% and above	−0.146	0.001	0.87 (0.80, 0.94)
Income group	200–399% vs 400% and above	−0.161	<0.0001	0.85 (0.80, 0.91)
Income group	Under 100% vs 400% and above	−0.088	0.085	0.92 (0.83, 1.01)

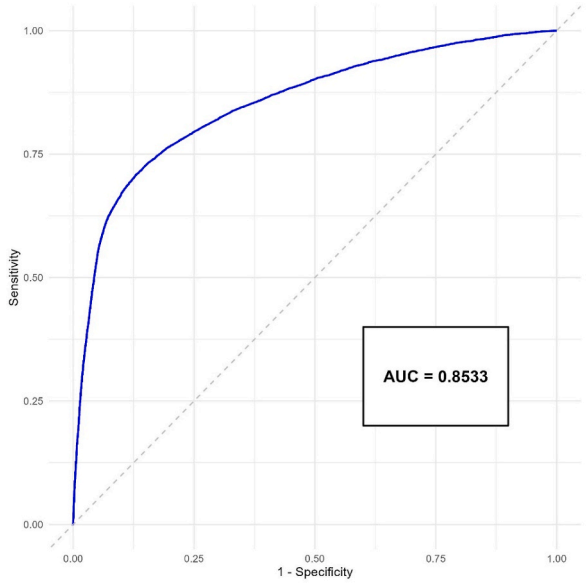

Fig. 3. ROC Curve for diagnostic of the multiple logistic regression model.

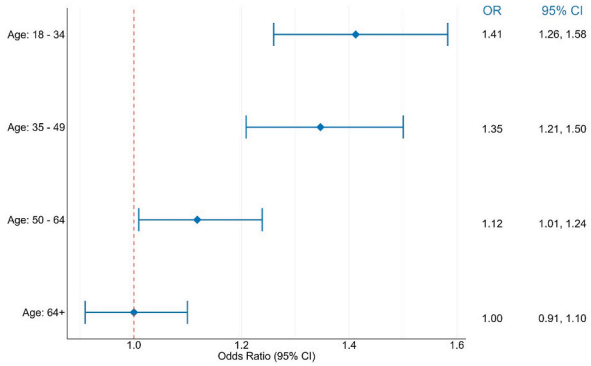

Fig. 4. Sub-group analysis and the estimates of the change in mental healthcare utilization from pre-to post-COVID-19 period for different Age groups.

Our study showed that age group has a significant association with the use of mental healthcare, and the utilization of mental healthcare services significantly decreases with age, which implies that as people get older they become more reluctant to take mental health services. Similar findings were reported in a study which showed that the younger generation was the most prominent user of health care services, followed by middle-aged and elderly people [49,50]. Our results of the subgroup analysis for different age groups highlight the change in mental healthcare utilization between 2019 and 2022. Except for the oldest age group of 64 years and older, all other age groups were found to have significantly increased mental healthcare utilization in the post-COVID period compared to the pre-COVID. A previous study found that during the pandemic, younger adults experienced higher levels of depression and anxiety than older individuals which could be a potential reason for the increased healthcare utilization for them in the post-pandemic period [51]. Moreover, a recent study based on the impact of COVID-19 pandemic showed that older adults faced more difficulties in accessing mental health care resources during the pandemic and couldn't seek mental health services due to mass quarantine, having limited knowledge of modern technology like smartphones and internet, and restrictions to use transportation [52]. As telehealth services have gained popularity since the pandemic, promoting digital literacy among older adults can improve their access to these facilities and increase their utilization of mental health services [53].

The health service utilization for male participants was found to be significantly higher compared to females, with an increase of 68%. However, many of the research showed that women suffer more from depression compared to males in general and also during the pandemic [54–56]. Previous studies have identified several common reasons for reduced healthcare utilization among women, such as the belief that they can manage without medical help, lack of time, and concerns about the embarrassment or shame associated with receiving a mental health diagnosis [57]. Non-white people were found to utilize less mental healthcare services compared to white people, which is also supported by previous studies [58,59]. This disparity is linked to several factors such as White respondents

are more prone to have higher income with better insurance coverage and experience less discrimination from mental health care professionals, allowing them greater access to mental health care services compared to non-white people [59,60]. Moreover, non-USA people, along with those who are living with a partner and have limitations of social functioning were found to utilize less mental healthcare services compared to their counterparts. These factors were also found to be among the major barriers to health service utilization in previous studies [61–66]. Furthermore, the utilization of mental healthcare has been found to have an upward trend with the level of education, and similar results were found in a study conducted in the USA [59].

According to our study, people who have insurance coverage as well as those who have a place to seek healthcare, both are twice as prone to their counterparts in utilizing healthcare services, which is also supported by a study conducted with NHIS data from 1997 to 2002 [67]. A previous study showed that the most commonly reported structural barrier to receiving mental health treatment is the inability to afford the cost, indicating that the high expenses of medications and treatment make uninsured individuals less likely to seek mental healthcare services [68]. Moreover, apart from insurance coverage, *Income* itself is considered a crucial factor in healthcare utilization for depression and anxiety. People with higher income reflected lower barriers to address their mental care needs, whereas low-income people, especially those from the USA have reported facing barriers to getting in touch with mental health care [69,70]. In our study, compared to the people with the topmost group of income, other income groups were found to have a significantly lower tendency to receive mental health care. However, for the lowest income group, it was not found statistically significant.

There exists a two-way connection between diabetes and depression [71]. Depression and anxiety were found to be more prevalent in diabetic patients compared to non-diabetic people [10,72,73]. On the contrary, a high risk of diabetes has been observed in depressed people too [74]. Furthermore, hypertension is one of the comorbidities that has been found to be associated with anxiety and depression in previous studies [75]. High healthcare usage has been discerned in people with both hypertension and depression [12, 14,76]. Hence, in light of the previous studies, it is expected that individuals who have comorbidities like diabetes or hypertension should utilize higher mental health care services, and our findings are completely consistent with this presumption. Our results also revealed that people with symptoms and history of depression and anxiety show higher inclination to employ mental health care, and the odds are 12 times for those who have a previous history of suffering from anxiety-depression. The knowledge of the proper place and person to seek help, along with the previous experience of getting mental issue-related treatment might play a vital role here, since these factors have been found to be connected to the better use of mental health care utilization in previous studies [1,77]. With the aim of suicide prevention, patients with symptoms and history of depression-anxiety are often kept in follow-ups, which can also result in receiving more mental care for them [78].

As discussed above, our findings indicate significantly lower mental healthcare utilization among several groups, particularly older adults, women, low-income groups, and uninsured individuals, compared to their counterparts. To improve overall mental well-being, initiatives should prioritize increasing mental health service usage among these groups. In addition to promoting awareness, policymakers should investigate the reasons behind lower healthcare utilization in these groups and take necessary steps to increase their usage. Expanding access to telemedicine could be an effective solution. To encourage greater use of telemedicine among providers and patients during the COVID-19 pandemic, federal regulators temporarily waived or reduced cost sharing for patients with Medicaid and Medicare insurance [79]. Policymakers could consider extending insurance coverage of telemedicine services over the long term to make telehealth and telemedicine more affordable for marginalized groups. Furthermore, to enhance utilization among non-white and non-U.S. populations, intervention using a model of integrated care can help reduce ethnic and racial disparities in mental health services [80].

Besides several strengths, this study also has some limitations. Since our study was based on cross-sectional data, we cannot make any cause-and-effect relationship between the outcome variable and the other factors. Future research could use a longitudinal study design to explore trends in mental health service utilization over time and assess the potential long-term effects of the pandemic on mental health services. The study is also subject to recall bias since respondents were interviewed and asked about their past experiences. Future studies can reduce recall bias by regularly contacting respondents through in-person visits or phone calls to help them better recall the events they need to report accurately [81].

6. Conclusion

The findings showed that the utilization of mental health services increased after the COVID-19 pandemic compared to the pre-pandemic period. Despite the notable surge in the prevalence of mental illness caused by the pandemic, it is also likely that the implementation of several policies and state regulations including the expansion of telehealth services and raised social awareness might play a vital role in increasing mental healthcare utilization. Although the pandemic is over and usage of health services has increased significantly, still it is equally imperative to carry on with health policies to mitigate the aftereffects of COVID-19. The sociodemographic variables that were found to be associated with the utilization can be taken into account while implementing the post-pandemic plans for mental health if needed.

CRediT authorship contribution statement

Md Rezaul Kader: Writing – review & editing, Writing – original draft, Visualization, Validation, Software, Resources, Project administration, Methodology, Investigation, Funding acquisition, Formal analysis, Data curation. **Mohammod Mahmudur Rahman:** Writing – review & editing, Writing – original draft, Visualization, Validation, Software, Resources, Project administration, Methodology, Investigation, Funding acquisition, Formal analysis. **Piali Dey Bristi:** Writing – review & editing, Writing – original draft,

Validation, Resources, Project administration, Methodology. **Foyez Ahmmed:** Writing – review & editing, Writing – original draft, Visualization, Validation, Supervision, Software, Resources, Project administration, Methodology, Investigation, Funding acquisition, Conceptualization.

Ethical approval

The authors certify that this research is totally based on the data that was collected from the National Health Interview Survey (NHIS), and the survey is approved by the Research Ethics Review Board of the National Center for Health Statistics and the U.S. Office of Management and Budget. All NHIS respondents provided oral consent prior to participation [35,36].

Data accessibility statement

Data used in this study can be accessed from a publicly available source: https://www.cdc.gov/nchs/nhis/2019nhis.htm and https://www.cdc.gov/nchs/nhis/2022nhis.htm.

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Declaration of competing interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

Appendix A. Supplementary data

Supplementary data to this article can be found online at https://doi.org/10.1016/j.heliyon.2024.e40454.

References

[1] Y.J. Lee, et al., Factors influencing the health care utilization among people with depression and/or anxiety symptoms, J. Am. Psychiatr. Nurses Assoc. (2023).
[2] M. Felez-Nobrega, J. Haro, A. Koyanagi, Multimorbidity, depression with anxiety symptoms, and decrements in health in 47 low-and middle-income countries, J. Affect. Disord. 317 (2022) 176–184.
[3] M. Reinert, D. Fritze, T. Nguyen, The State of Mental Health in America 2022, Mental Health America, 2021.
[4] J.L. Kim, et al., Depression symptom and professional mental health service use, BMC Psychiatr. 15 (2015) 1–12.
[5] G. Parker, H. Brotchie, Gender differences in depression, Int. Rev. Psychiatr. 22 (5) (2010) 429–436.
[6] B.W. Van Voorhees, et al., Beliefs and attitudes associated with the intention to not accept the diagnosis of depression among young adults, Ann. Fam. Med. 3 (1) (2005) 38–46.
[7] L.F. Campbell, E.M. Selby-Nelson, *Bringing Psychotherapy to People Living in Poverty*. Bringing Psychotherapy to the Underserved: Challenges and Strategies, 2020, pp. 98–122.
[8] E. Fu, et al., Implementation barriers and experiences of eligible patients who failed to enroll in collaborative care for depression and anxiety, J. Gen. Intern. Med. 38 (2) (2023) 366–374.
[9] K.O. Conner, et al., Mental health treatment seeking among older adults with depression: the impact of stigma and race, Am. J. Geriatr. Psychiatr. 18 (6) (2010) 531–543.
[10] S. Chen, et al., Association of depression with pre-diabetes, undiagnosed diabetes, and previously diagnosed diabetes: a meta-analysis, Endocrine 53 (1) (2016) 35–46.
[11] A.B. Grigsby, et al., Prevalence of anxiety in adults with diabetes: a systematic review, J. Psychosom. Res. 53 (6) (2002) 1053–1060.
[12] A.K. Ho, et al., Association of anxiety and depression with hypertension control: a US multidisciplinary group practice observational study, J. Hypertens. 33 (11) (2015) 2215–2222.
[13] M. Andrews, Diabetes linked to risk of mental health hospitalization in young adults [cited 2024 March 27,]; Available from: https://www.pbs.org/newshour/health/diabetes-linked-risk-mental-health-hospitalization-young-adults, 2016.
[14] H. Shao, et al., Evaluating excessive burden of depression on health status and health care utilization among patients with hypertension in a nationally representative sample from the medial expenditure panel survey (MEPS 2012), J. Nerv. Ment. Dis. 205 (5) (2017) 397–404.
[15] C.K. Ettman, et al., Prevalence of depression symptoms in US adults before and during the COVID-19 pandemic, JAMA Netw. Open 3 (9) (2020) e2019686.
[16] M. Taheri, et al., Effects of home confinement on physical activity, nutrition, and sleep quality during the COVID-19 outbreak in amateur and elite athletes, Front. Nutr. 10 (2023) 1143340.
[17] N. Vindegaard, M.E. Benros, COVID-19 pandemic and mental health consequences: systematic review of the current evidence, Brain Behav. Immun. 89 (2020) 531–542.
[18] J. Bueno-Notivol, et al., Prevalence of depression during the COVID-19 outbreak: a meta-analysis of community-based studies, Int. J. Clin. Health Psychol. 21 (1) (2021) 100196.
[19] M. Taheri, et al., Mental health, eating habits and physical activity levels of elite Iranian athletes during the COVID-19 pandemic, Sci. Sports 38 (5–6) (2023) 527–533.
[20] I. Kupcova, et al., Effects of the COVID-19 pandemic on mental health, anxiety, and depression, BMC psychology 11 (1) (2023) 108.
[21] K.M. Sønderskov, et al., The depressive state of Denmark during the COVID-19 pandemic, Acta Neuropsychiatr. 32 (4) (2020) 226–228.
[22] B.S. Pierce, et al., The COVID-19 telepsychology revolution: a national study of pandemic-based changes in US mental health care delivery, Am. Psychol. 76 (1) (2021) 14.
[23] A. Byrne, R. Barber, C.H. Lim, Impact of the COVID-19 pandemic–a mental health service perspective, Prog. Neurol. Psychiatr. 25 (2) (2021) 27–33b.

[24] S. Galea, R.M. Merchant, N. Lurie, The mental health consequences of COVID-19 and physical distancing: the need for prevention and early intervention, JAMA Intern. Med. 180 (6) (2020) 817–818.
[25] R.K. McBain, et al., Mental health service utilization rates among commercially insured adults in the US during the first year of the COVID-19 pandemic, JAMA Health Forum 4 (1) (2023) e224936.
[26] D.M. Feehan, A.S. Mahmud, Quantifying population contact patterns in the United States during the COVID-19 pandemic, Nat. Commun. 12 (1) (2021) 893.
[27] E. Harrison, et al., COVID-19 pandemic-related changes in wellness behavior among older Americans, BMC Publ. Health 21 (1) (2021) 755.
[28] S. Lund, et al., COVID-19 and Jobs: Monitoring the US Impact on People and Places, McKinsey Global Institute, 2020.
[29] World Health Organization, COVID-19 disrupting mental health services in most countries, WHO survey [cited 2024 January 7,]; Available from: https://www.who.int/news/item/05-10-2020-covid-19-disrupting-mental-health-services-in-most-countries-who-survey, 2020.
[30] S.H. Fischer, et al., The transition to telehealth during the first months of the COVID-19 pandemic: evidence from a national sample of patients, J. Gen. Intern. Med. 36 (3) (2021) 849–851.
[31] M. Tracy, F.H. Norris, S. Galea, Differences in the determinants of posttraumatic stress disorder and depression after a mass traumatic event, Depress. Anxiety 28 (8) (2011) 666–675.
[32] J.M. Zhu, et al., Trends in Outpatient Mental Health Services Use before and during the COVID-19 Pandemic: study examines trends in outpatient mental health service using before and during the COVID-19 pandemic, Health Aff. 41 (4) (2022) 573–580.
[33] National health interview survey, Available from: https://www.cdc.gov/nchs/nhis/2019nhis.htm, 2019.
[34] National health interview survey, Available from: https://www.cdc.gov/nchs/nhis/2022nhis.htm, 2022.
[35] National center for health Statistics, survey description, National Health Interview Survey, Maryland, Hyattsville, 2019, 2020.
[36] National Center for Health Statistics, National Health Interview Survey, 2022 Survey Description, 2023.
[37] C. Hoge, et al., Association of poverty income ratio with physical functioning in a cohort of patients with systemic lupus erythematosus, J. Rheumatol. 47 (7) (2020) 983–990.
[38] R.L. Spitzer, et al., A brief measure for assessing generalized anxiety disorder: the GAD-7, Arch. Intern. Med. 166 (10) (2006) 1092–1097.
[39] K. Kroenke, et al., The PHQ-8 as a measure of current depression in the general population, J. Affect. Disord. 114 (1–3) (2009) 163–173.
[40] SAS Institute Inc, SAS Software, SAS Institute Inc, Cary, NC, 2013.
[41] H. Wickham, ggplot2: Elegant Graphics for Data Analysis, Springer, New York, 2009.
[42] R core team, R, A Language and Environment for Statistical Computing, R Foundation for Statistical Computing, Vienna, Austria, 2014.
[43] A.A. de Hond, E.W. Steyerberg, B. van Calster, Interpreting area under the receiver operating characteristic curve, The Lancet Digital Health 4 (12) (2022) e853–e855.
[44] A. Agresti, Categorical Data Analysis, vol. 792, John Wiley & Sons, 2012.
[45] J.H. Cantor, et al., Who is (and is not) receiving telemedicine care during the COVID-19 pandemic, Am. J. Prev. Med. 61 (3) (2021) 434–438.
[46] R.K. McBain, et al., Expansion of telehealth availability for mental health care after state-level policy changes from 2019 to 2022, JAMA Netw. Open 6 (6) (2023) e2318045.
[47] J. Lo, et al., Telehealth has played an outsized role meeting mental health needs during the COVID-19 pandemic, Med. Benefit. 39 (7) (2022) 8–9.
[48] M. Nealon, The pandemic accelerant: how COVID-19 advanced our mental health priorities [cited 2024 January 7,]; Available from: https://www.un.org/en/un-chronicle/pandemic-accelerant-how-covid-19-advanced-our-mental-health-priorities, 2021.
[49] E.A. DiNapoli, et al., Age as a predictive factor of mental health service use among adults with depression and/or anxiety disorder receiving care through the Veterans Health Administration, Int. J. Geriatr. Psychiatr. 31 (6) (2016) 575–582.
[50] R. Crabb, J. Hunsley, Utilization of mental health care services among older adults with depression, J. Clin. Psychol. 62 (3) (2006) 299–312.
[51] S. Collier Villaume, S. Chen, E.K. Adam, Age disparities in prevalence of anxiety and depression among US adults during the COVID-19 pandemic, JAMA Netw. Open 6 (11) (2023) e2345073.
[52] K. Tsamakis, et al., COVID-19 and its consequences on mental health, Exp. Ther. Med. 21 (3) (2021), 1-1.
[53] N.G. Choi, et al., Telehealth use among older adults during COVID-19: associations with sociodemographic and health characteristics, technology device ownership, and technology learning, J. Appl. Gerontol. 41 (3) (2022) 600–609.
[54] K.N. Fountoulakis, et al., Results of the COVID-19 mental health international for the general population (COMET-G) study, Eur. Neuropsychopharmacol 54 (2022) 21–40.
[55] D.F. Santomauro, et al., Global prevalence and burden of depressive and anxiety disorders in 204 countries and territories in 2020 due to the COVID-19 pandemic, Lancet 398 (10312) (2021) 1700–1712.
[56] F. Thibaut, G. Elnahas, Women's mental health and lessons learnt from the COVID-19 pandemic, Psychiatr. Clin. 46 (3) (2023) 415–426.
[57] K.J. Gold, "I would never want to have a mental health diagnosis on my record": a survey of female physicians on mental health diagnosis, treatment, and reporting, Gen. Hosp. Psychiatr. 43 (2016) 51–57.
[58] A.L. Hines, L.A. Cooper, L. Shi, Racial and ethnic differences in mental healthcare utilization consistent with potentially effective care: the role of patient preferences, Gen. Hosp. Psychiatr. 46 (2017) 14–19.
[59] S. Alexander, M.D. Young, M.S. H.S, et al., Persistent depression and anxiety in the United States: prevalence and quality of care, Psychiatr. Serv. 59 (12) (2008) 1391–1398.
[60] N.M. Kormendi, A.D. Brown, Asian American mental health during COVID-19: a call for task-sharing interventions, SSM-Mental Health 1 (2021) 100006.
[61] J.L. Wang, The difference between single andmarried mothers in the 12-month prevalence of major depressivesyndrome, associated factors and mental health serviceutilization, Soc. Psychiatr. Psychiatr. Epidemiol. 39 (1) (2004) 26–32.
[62] J. Cairney, T.J. Wade, Single parent mothers and mental health care service use, Soc. Psychiatr. Psychiatr. Epidemiol. 37 (5) (2002) 236–242.
[63] M. Kahl Joyce, Wellbeing and marriage: does marriage improve mental health? Undergraduate economic review 16 (1) (2019) e16-e16.
[64] M. Mohammadifirouzeh, et al., Factors associated with professional mental help-seeking among U.S. Immigrants: a systematic review, J. Immigr. Minority Health 25 (5) (2023) 1118–1136.
[65] M.B. Thomeer, M.D. Moody, J. Yahirun, Racial and ethnic disparities in mental health and mental health care during the COVID-19 pandemic, Journal of Racial and Ethnic Health Disparities 10 (2) (2023) 961–976.
[66] I.M.J. Saris, et al., Social functioning in patients with depressive and anxiety disorders, Acta Psychiatr. Scand. 136 (4) (2017) 352–361.
[67] R. Mojtabai, Trends in contacts with mental health professionals and cost barriers to mental health care among adults with significant psychological distress in the United States: 1997–2002, Am. J. Publ. Health 95 (11) (2005) 2009–2014.
[68] E.R. Walker, et al., Insurance status, use of mental health services, and unmet need for mental health care in the United States, Psychiatr. Serv. 66 (6) (2015) 578–584.
[69] L. Steele, C. Dewa, K. Lee, Socioeconomic status and self-reported barriers to mental health service use, Can. J. Psychiatr. 52 (3) (2007) 201–206.
[70] J. Sareen, et al., Perceived barriers to mental health service utilization in the United States, Ontario, and The Netherlands, Psychiatr. Serv. 58 (3) (2007) 357–364.
[71] N. Mukherjee, S.K. Chaturvedi, Depressive symptoms and disorders in type 2 diabetes mellitus, Curr. Opin. Psychiatr. 32 (5) (2019) 416–421.
[72] T. Roy, C.E. Lloyd, Epidemiology of depression and diabetes: a systematic review, J. Affect. Disord. 142 (2012) S8–S21.
[73] C.-J. Huang, et al., Prevalence and incidence of anxiety disorders in diabetic patients: a national population-based cohort study, Gen. Hosp. Psychiatr. 33 (1) (2011) 8–15.
[74] A. Deleskog, et al., Severity of depression, anxious distress and the risk of type 2 diabetes – a population-based cohort study in Sweden, BMC Publ. Health 19 (1) (2019) 1174.
[75] M. Mushtaq, N. Najam, Depression, anxiety, stress and demographic determinants of hypertension disease, Pakistan J. Med. Sci. 30 (6) (2014) 1293–1298.

[76] S.S. Rozario, S.W. Masho, The associations between mental health status, hypertension, and hospital inpatient visits in women in the United States, Am. J. Hypertens. 31 (7) (2018) 804–810.
[77] K. Reynolds, et al., Older adults' narratives of seeking mental health treatment: making sense of mental health challenges and "muddling through" to care, Qual. Health Res. 30 (10) (2020) 1517–1528.
[78] S.K. Doupnik, et al., Association of suicide prevention interventions with subsequent suicide attempts, linkage to follow-up care, and depression symptoms for acute care settings: a systematic review and meta-analysis, JAMA Psychiatr. 77 (10) (2020) 1021–1030.
[79] D.P. JoAnn Volk, Madeline O'Brien, Christina L. Goe, States' actions to expand telemedicine access during COVID-19 and future policy considerations, June 23 (2021), https://doi.org/10.26099/r95z-bs17.
[80] S.Y. Lee-Tauler, et al., A systematic review of interventions to improve initiation of mental health care among racial-ethnic minority groups, Psychiatr. Serv. 69 (6) (2018) 628–647.
[81] V. Arthi, et al., Not your average job: measuring farm labor in Tanzania, J. Dev. Econ. 130 (2018) 160–172.