Frequent mental distress among adults in the United States and its association with socio-demographic characteristics, lifestyle, and chronic health condition

Mamunur Rashid[1], M. Mazharul Islam[2], Aiping Li[3] and Naima Shifa[1]

[1]Department of Mathematics, DePuaw University, Greencastle, IN 46135, USA
[2]Department of Statistics, College of Science, Sultan Qaboos University, Muscat, Oman
[3]Department of Psychology and Neuroscience, DePauw University, Greencastle, IN 46135, USA

Corresponding Author: M. Mazharul Islam **Email:** mmazhar.islam@yahoo.com

ABSTRACT

Frequent mental distress (FMD) is a measure of poor mental health days for at least 14 days out of 30 days. It is one of the important dimensions of the health-related quality of life. The underlying causes of FMD are diverse. However, the issue has not been explored extensively due to the lack of reliable data on mental health. The aim of this study was to examine the level and trends of FMD among the adults of the United States (US) and identify the socio-demographic, lifestyles, and chronic health outcomes related correlates of FMD. The data for the study was obtained from the publicly available 2019 Behavioral Risk Factor Surveillance System (BRFSS) in the US, covering a large sample of 418,268 adult respondents from all the 50 states and participating territories. Respondents from each state and territory were identified by selecting the telephone number from the telephone directory following a systematic sampling design. To examine the trends in the prevalence of FMD, data from the 2010-2018 BRFSS were also utilized. Both descriptive and inferential statistical techniques, including multiple logistic regression models were employed to analyze the data. Results indicated that about 12% of the adults in the US experienced FMD, and the prevalence of FMD is increasing over time. Females, students, adults aged below 35 years, multiracial, less educated, single, low income, and underweight individuals were found to have a higher risk of FMD. FMD was found to be significantly associated with unhealthy lifestyles and chronic health conditions. This study findings highlight the importance of interventions for mental health promotion and mental illness prevention, substance use prevention, screening and treatment services of FMD, and increased provision of resources to address social and economic determinants of FMD.

Key words: mental health, frequent mental distress, life style, BRFSS, United States

INTRODUCTION

Mental health refers to an individual's emotional, social, and psychological well-being. Mental distress is a mental health problem. It is one of the leading causes of disability worldwide, and major contributor of disability adjusted life years (DALYs).[1,2] Frequent mental distress (FMD) refers to a mental health state when a person feels stressed, sad or depressed, anxious, or has problems with his/her emotions for at least 14 out of 30 days.[3,4] The World Health Organization (WHO) recognizes mental health as an integral part of health and well-being by defining health as "a state of complete physical, mental and social well-being and not merely the absence of disease or infirmity" in its constitution.[5] About one in five people across the world is suffering from a current mental disorder.[6,7] As modern societies are more stressful, mental disorders are becoming more prevalent among adults.[8] The upward trend in mental illness diagnosis emphasized the need for increased public awareness of individuals' mental health. "There is no health without mental health" as argued by Prince et al.[9]

As important as physical health, mental illnesses influence an individual's daily activities, such as work productivity, relationship building, and ability to adapt, at a different level.[8] Individuals who experience mental illnesses are at greater risk of having poor physical health, decreased quality of life, educational difficulties, lowered productivity and poverty, social problems, vulnerability to abuse, and additional health problems.[10] Individuals with a psychological disorder were found to be significantly less likely to complete high school, or receive a college degree, compared to their peers without mental illness.[11] Mental illness reduce earnings and employment opportunity, which in turn increase the risk of poverty.[12,13] Thus mental illness and poverty "interact in a vicious cycle". Poverty acts as a risk factor for mental illness, and mental illness increases the risk, by which individuals will "drift into or remain in poverty". Mental disorders can also contribute to other health problems such as cancer, diabetes, obesity, etc. For example, people diagnosed with mental depression were 40% more likely to develop cardiovascular and metabolic diseases than those who did not have depression.[10,14] Mentally ill individuals and their families also experience significant social stigma and discrimination.[15]

Mental disorders and their underlying causes are diverse, consisting of an interconnected causality network of socio-economic (SES), behavioral, environmental, comorbidity and genetic factors. SES has been found to play an important role in depression.[16-18] A meta-analysis of population-based surveys indicated a negative association between socio-economic status and the prevalence of mental distress.[19] Similarly, recent studies indicated that low levels of SES and unhealthy lifestyle factors were significantly associated with mental health conditions.[20,21] One recent research reported that individuals who had mental illnesses were more likely to report a higher unemployment rate compared to the general population.[3] Both smoking and drinking negatively impact on individuals' stress levels and depressive symptoms.[21] Previous research also indicated that regular physical activity correlated with lower stress levels and less depression experience.[21, 22] A cross-sectional study in the United States showed that participants who engaged in different forms of exercise experienced lower mental health burden.[23]

Individuals who lived in an adverse environment with low SES were more likely to develop comorbidities than their

counterparts, and they were more likely to be accompanied by negative life outcomes, such as suffering from poor health conditions, premature death, human rights violations, and global and national economic loss.[24, 25] The prevalence of common mental disorders were found to be higher among people suffering from physical ill health, especially for certain chronic conditions including diabetes, chronic obstructive pulmonary disease (COPD), arthritis, stroke, and cardiovascular disease.[21, 26,27]

Despite the fact that mental health has profound effects on an individual's physical and social well-being, quality of life, and economic productivity, it is often overlooked as a public health issue because of historical focus on communicable and other life-threatening diseases, such as COVID-19, HIV/AIDS, cancer, diabetes and so on. Understanding the effects of mental illness on individual patients and social systems is necessary for the improvement of mental health care systems and the development of effective mental health care delivery programs. Although physical health and its risk factors have been frequently studied; the epidemiology of self-rated mental health and its risk factors has not been explored as extensively. This is partly because of the lack of reliable data on mental health. Behavioral Risk Factor Surveillance System (BRFSS) collects comprehensive data on both mental and physical health of adults from all over the United States (US) routinely, and thus provides an opportunity to conduct studies on mental health and its risk factors. In this study, an attempt has been made to investigate the recent level and trends of self-rated FMD status among the adults in the US, and to examine its association with socio-demographic factors, lifestyle, and chronic health conditions, using the latest data from the 2019 BRFSS.

METHODS AND MATERIALS

Data source and the sample

This study utilized publicly available data from the 2019 Behavioral Risk Factor Surveillance System (BRFSS), conducted in all the 50 states and four US territories. BRFSS is a collaborative project between states in the US and participating US territories and the Centers for Disease Control and Prevention (CDC). Since 1984, BRFSS is a nationwide routine population based and computer-assisted telephone interview (CATI) survey conducted by the CDC, which collects information on health-related risk behaviors, chronic health conditions, health care access, and the use of preventive services related to the leading causes of death and disability from the non-institutionalized adult population aged ≥18 years in the US. It is the largest random-digit dialed telephone health survey in the world. According to the 2018 American Community Survey (ACS), 98.5% of all occupied housing units in the US had active telephone service available[28]. The BRFSS field operations are managed by state health departments that follow protocols adopted by the states, with technical assistance provided by CDC. State health departments collaborate during survey development and conduct the interviews themselves or use contractors. The data are transmitted to CDC for editing, processing, weighting, and analysis. All the responses in the BRFSS are self-reported.

BRFSS respondents are identified through telephone-based methods. The sampling frame was obtained from the Telecordia database of telephone exchanges (e.g., 617-492-0000 to 617-492-9999). The BRFSS select a telephone number to systematically create the listing frame by forming an interval—K—by dividing the population count of telephone numbers in the frame—N—by the desired sample size— n for each state and participating territory. The BRFSS divides the frame of telephone numbers into n

intervals of size K telephone numbers. From each interval, the BRFSS draws one 10-digit telephone number at random. In 2019, BRFSS collected data from a sample of 418,268 respondents from 50 states and 4 territories, which constituted our study subjects. To examine the time trends in the prevalence of FMD, we have also used the data from the past nine (2010-2018) BRFSS surveys. The BRFSS methods, including sample selection and weighting procedures, questionnaires, data, and reports are available at http://www.cdc.gov/brfss/index.html.

Description of the variables

The outcome variable for the study was self-reported poor mental health days in the past 30 days.

When a person feels stressed, sad or depressed, anxious, or has problems with his/her emotions for at least 14 out of 30 days, the person is considered as having frequent mental distress (FMD).[3] In the BRFSS, participants were asked the question: "Now thinking about your mental health, which includes stress, depression and problems with emotions, for how many days during the past 30 days was your mental health not good?" Participants who reported 14 or more days of not good mental health were classified as having "frequent mental distress" and those with less than 14 days of not good mental health were classified as having "less frequent mental distress". Many prior studies also used similar definitions of FMD.[29-32]

The study considered several domains of factors affecting FMD. These domains included socio-demographic, lifestyle and chronic health conditions. All these variables are categorical, and the details of their categories can be found in Table 1. The socio-demographic domain included: age, sex, education level, race, marital status, employment status, income, and urban/rural place of residence.

The lifestyle domain variables included: physical activity, smoking status, drinking status and obesity. To measure physical activity status, respondents were asked whether, other than their regular job, they participated in any physical activities or exercises such as running, calisthenics, golf, gardening, or walking for exercise, during the past 30 days with the response of either Yes or No. In the survey, the smoking habit was determined by asking the question, "Do you now smoke cigarettes every day, some days, or not at all?", which we categorized as currently smoking or not. To know the drinking status, respondents were asked "During the past 30 days, did you have at least one drink of any alcoholic beverage such as beer, wine, a malt beverage or liquor?" Here, one drink is equivalent to a 12-ounce beer, a 5-ounce glass of wine, or a drink with one shot of liquor. Using the height and weight data, the BMI was calculated by dividing the weight in kilograms (kgs) by the height in meters squared (m^2) and then using the standard cut points, BMI was categorized into underweight (BMI < 18.5), normal (BMI 18.5 – 24.9), overweight (BMI 25.0 – 29.9) and obese (BMI≥30.0).

The chronic health status domain included: asthma, diabetes, coronary heart disease/ myocardial infarction, cancer, rheumatoid arthritis, chronic obstetric pulmonary disease (COPD), depressive disorders, stroke, and kidney disease. In the survey, respondents were asked, "Has a doctor, nurse, or any other health professional ever told you that you had any of the following?", such as asthma, cancer and so on. For each, respondents reported either Yes or No. To check the reliability of the tools, Cronbach's alpha (α) reliability coefficient was used. The reliability coefficient (α) was found to be 0.83 (95% CI 0.81–0.85), suggesting that the items have relatively high internal consistency.

Statistical analyses

Both descriptive and inferential statistical methods were used for data analysis. Frequency distribution was used for analyzing the background characteristics of the respondents and the prevalence of FMD. Bivariate analysis and Chi-square test were employed for analyzing the association between FMD and the characteristics of respondents. A p-value of <0.05 was considered as statistically significant. To identify the socio-demographic characteristics, lifestyle, and chronic health conditions related predictors of FMD, multiple logistic regression model was used considering FMD as a binary variable with value 1, if the adults suffered 14 or more days out of 30 days from mental distress, and 0 other wise.[33]

RESULTS

Table 1 presents participants' socio-demographic, lifestyle, and comorbidity characteristics as well as the prevalence of FMD by their characteristics. Majority of the respondents were aged 45 years and above (71%), with white race (76%) and living in urban metropolitan areas (69%). There were more female (55%) respondents than male respondents (45%). Adults who received college education made up the largest percentage in the survey (65.9%). About half of the respondents were married (51%) and employed (50%). About one-fourth (24.7%) of the respondents reported that they were smoking currently, while 10% reported doing regular physical activities, 11% used to have at least 1 drink of alcohol in the past 30 days, and 25% were over-weight or obese. Chronic health problems among adults vary from as low as 3.9% for kidney diseases to as high as 33% for arthritis.

According to the 2019 BRFSS survey, about one in every eight adults reported suffering from FMD in the United States, i.e., about 12% of the total adults reported that their mental health was not good for 14 or more days in the past 30 days (Table 1).

Table 1 Percentage distribution of adults and the prevalence of frequent mental distress among the adults according to their socio-demographic characteristics, lifestyle, and chronic health status, BRFSS 2019.

Characteristics	% (n)	Bivariate analysis	
		Prevalence (%) of frequent mental distress	P-value
Total	100.0 (418,268)	12.1	
Socio-demographic characteristics			
Age (in years)			<0.001
18-24	6.0 (25,104)	19.7	
25-34	10.5 (43,903)	16.8	
35-44	11.8 (49,470)	14.5	
45-64	34.7 (145,090)	13.3	
65+	37.0 (154,701)	7.7	
Respondent Sex			<0.001
Male	45.4 (189,835)	10.2	
Female	54.6 (228,433)	13.7	
Education Level			<0.001
Less than high school	7.2 (30,065)	18.0	
High school graduates	26.9 (111,890)	14.3	
College education	65.9 (274,478)	10.7	

Characteristics	% (n)	Bivariate analysis	
		Prevalence (%) of frequent mental distress	P-value
Race			<0.001
White, Non-Hispanic	75.9 (310,750)	11.7	
Black, Non-Hispanic	7.7 (31,423)	13.3	
Hispanic	9.1 (37,410)	12.7	
Asian	2.2 (9,179)	7.8	
Others	5.0 (20,571)	18.2	
Marital Status			<0.001
Married	51.4 (213,324)	8.3	
Divorced/widowed/separated	27.9 (115,827)	15.2	
Single	20.6 (85,633)	17.6	
Employment Status			<0.001
Employed	49.9 (205,630)	10.1	
Not employed	8.9 (36,525)	17.5	
Not in workforce	38.6 (158,761)	13.1	
Student	2.6 (10,845)	18.8	
Income range (in dollars)			<0.001
< 15,000	9.4 (31,982)	26.0	
15,000 – 25,000	15.8 (53,392)	18.7	
25,000 – 35,000	10.2 (34,496)	13.8	
35,000 – 50,000	13.8 (46,572)	11.9	
≥50,000	50.8 (172,045)	7.6	
Metropolitan status			0.453
Urban	69.0 (282,652)	12.1	
Rural	31.0 (127,158)	12.2	
Lifestyle status			
Physical Activity			<0.001
Yes	72.8 (288,516)	10.2	
No	27.2 (107,745)	17.4	
Currently Smoke			<0.001
Yes	14.1 (56,422)	24.7	
No	85.9 (342,918)	10.1	
Drink (at least 1 drink of alcohol in the past 30 days)		11.0	<0.001
Yes	50.6 (199,788)	13.4	
No	49.4 (195,326)		
Body Mass index (BMI, kg/m^2)			<0.001
Underweight (BMI<18.5)		19.0	
Normal weight (BMI 18.5-24.9)	1.7 (6,564)	11.3	
Overweight (BMI 25.0- 29.9)	30.3 (115,886)	10.3	
Obese (BMI≥30.0)	35.7 (136,399)	15.1	
	32.3 (123,216)		
Comorbidity/Chronic physical health			
Asthma			<0.001
Yes	14.1 (58,921)	20.8	
No	85.9 (357,838)	10.7	
Diabetes			<0.001
Yes	13.8 (57,401)	15.8	
No	86.2 (360,022)	11.6	

Characteristics	%	(*n*)	Bivariate analysis	
			Prevalence (%) of frequent mental distress	P-value
Coronary heart disease /myocardial infarction (CHD/MI)			17.4	<0.001
Yes	8.8	(36,756)	11.6	
No	91.2	(381,512)		
Cancer				<0.001
Yes	17.9	(74,486)	11.6	
No	82.1	(341,481)	12.2	
Arthritis				<0.001
Yes	33.4	(139,703)	16.2	
No	66.6	(278,565)	10.2	
Chronic obstructive pulmonary disease (COPD)				<0.001
Yes	8.5	(35,427)	25.1	
No	91.5	(380,565)	10.9	
Depressive disorder				<0.001
Yes	19.0	(79,181)	37.8	
No	81.0	(336,804)	6.1	
Stroke				<0.001
Yes	4.5	(18,745)	20.8	
No	95.5	(398,213)	11.7	
Kidney disease				<0.001
Yes	3.9	(16,276)	18.8	
No	96.1	(400,385)	11.8	

To gain insight into the time trends in the prevalence of FMD, we have calculated the prevalence of overall FMD and FMD by gender, using the data extracted from the past nine consecutive BRFSS surveys (2010 – 2018) and the 2019 BRFSS. The results are presented in line diagram (Figure 1). The results indicated overall increasing trends in the prevalence of FMD over the recent decade. More specifically, there was a 1.8 percentage point increase or increase of 17.5% in FMD of U.S. adults from 10.3% in 2010 to 12.1% in 2019. Females had a consistently higher prevalence of FMD than males over the period (Figure 1).
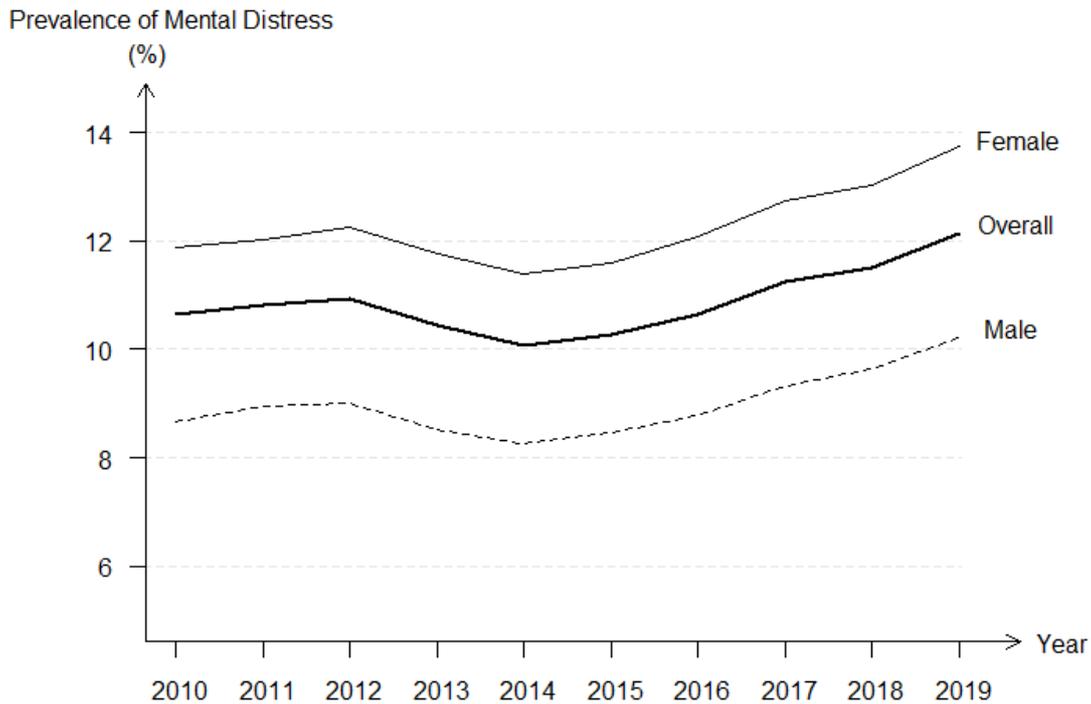
Figure 1 Trend in prevalence of FMD by gender over the years 2010-2019: BRFSS data

Table 1 also presents the differentials of FMD across the background characteristics of the adults. FMD was found to have a negative association with age, as the age increased, the percentage of FMD decreased. For example, elderly people (aged 65 and above) reported less mental health problems (7.7%) compared to adults aged 18-24 years (19.7%). Females were more likely to report FMD compared to their male counterparts (13.7% vs. 10.2%). The prevalence of FMD decreases with the educational levels. Adults with education lower than high school reported higher rate of FMD (18%) compared to high school graduates (14.3%) and those with college education (10.7%). White people reported having a lower prevalence of FMD (11.7%) compared to Blacks (13.3%) and Hispanics (12.7%). Ethnic Asians reported the lowest level of FMD (7.8%). Single adults were reported to have had higher FMD than their married counterparts (17.6% vs. 8.3%). Students reported the highest percentage (18.8%) of FMD compared to respondents with

another employment status. Adults with higher level of income (say > 50K) reported less FMD compared to those with lower level of income (say <15K) (7.6% vs 26%). Also, adults with a normal weight or engaged in physical activities reported less mental health problems (11.3% and 10.2% respectively) compared to their counterparts. Adults who did not smoke had less FMD problems (10.1%) compared to those who did (24.7%). The prevalence of FMD was higher among adults with asthma (20.8% vs 10.7%), diabetes, coronary heart disease, arthritis, COPD (25.1% vs 10.9%), depressive disorder (37.8% vs 6.1%), stroke and kidney disease.

The results of bivariate analysis presented in Table 1 indicated that except for metropolitan status all other socio-demographic, life style and chronic health condition factors have statistically significant association with FMD. However, these associations are unadjusted as the effects of the confounders could not be controlled in bivariate analysis. To obtain the adjusted or net effect of a factor

on FMD, we employed a multiple logistic regression model, after controlling the effects of all other confounders. The results are presented in Table 2. It was found that except for education, all other factors appeared as significant predictors of FMD.

Table 2 Multiple logistic regression analysis showing the adjusted odds ratios (AORs) and the confidence intervals (CIs) of odds of mental distressed, BRFSS 2019.

Characteristics	AOR	95% CI
Age (in years)		--
18-24	(Ref.)	0.76 - 0.86
25-34	0.81**	0.61 – 0.69
35-44	0.65**	0.41 – 0.46
45-64	0.43**	0.19 – 0.22
65+	0.20**	
Respondent Sex		
Male	(Ref.)	--
Female	1.09**	1.07 – 1.12
Education Level		
Less than high school	(Ref.)	--
High school graduates	1.02	0.97 - 1.08
College education	0.97	0.92 - 1.02
Race		
White, Non-Hispanic	(Ref.)	-
Black, Non-Hispanic	0.95	0.90 - 1.00
Hispanic	0.97	0.92 - 1.01
Asian	0.89*	0.80 - 0.98
Others	1.21**	1.15 - 1.28
Marital Status		
Married	(Ref.)	--
Divorced/widowed/separated	1.28**	1.24 - 1.33
Single	1.22**	1.18 - 1.27
Employment Status		
Employed	(Ref.)	-
Not employed	1.35**	1.30 - 1.42
Not in workforce	1.35**	1.30 - 1.40
Student	1.16**	1.07 -1.25
Income range (in dollars)		
< 15,000	(Ref.)	--
15,000 – 25,000	0.91**	0.87 - 0.95
25,000 – 35,000	0.80**	0.76 - 0.84
35,000 – 50,000	0.74**	0.70 - 0.78
≥50,000	0.57**	0.54 - 0.60
Metropolitan status		
Urban	(Ref.)	-
Rural	0.93**	0.90 - 0.95
Physical Activity		
Yes	0.68**	0.66 - 0.70
No	(Ref.)	--
Currently Smoke		
Yes	1.55**	1.50 - 1.60
No	(Ref.)	-

Characteristics	AOR	95% CI
Drink (at least 1 drink of alcohol in the past 30 days)		
Yes	1.02**	0.99 - 1.05
No	(Ref.)	-
Body Mass index (BMI, kg/m^2)		
Underweight (BMI<18.5)	--	-
Normal weight (BMI 18.5- 24.9)	0.78**	0.72 - 0.86
Overweight (BMI 25.0- 29.9)	0.75**	0.69 - 0.82
Obese (BMI $\geq$30.0)	0.84**	0.77 - 0.92
Asthma		
Yes	1.15**	1.12 - 1.19
No	(Ref.)	-
Diabetes		
Yes	1.17**	1.13 - 1.22
No	(Ref.)	-
Coronary heart disease /myocardial Infarction (CHD/MI)		
Yes	1.22**	1.17 - 1.27
No	(Ref.)	--
Cancer		
Yes	1.10**	1.06-1.14
No	(Ref.)	-
Arthritis		
Yes	1.38**	1.34-1.43
No	(Ref.)	-
Chronic obstructive pulmonary disease (COPD)		
Yes	1.26**	1.21-1.31
No	(Ref.)	-
Depressive disorder		
Yes	6.23**	6.07-6.40
No	(Ref.)	-
Stroke		
Yes	1.30**	1.23-1.37
No	(Ref.)	-
Kidney disease		
Yes	1.14**	1.08-1.21
No	(Ref.)	-

Age of the respondents was found to be a significant predictor of FMD, and the risk of FMD decreased with the increase of age. For example, elderly people (aged 65+ years) had 80% lower odds of FMD than the young adults of age 18-24 years old (AOR=0.20; 95%CI: 0.19-0.22). Females had 1.1 times higher odds of FMD than males (AOR=1.09; 95%CI: 1.07-1.12). Educational levels showed no significant association with FMD. Race appeared as a significant predictor of FMD. Asian-Americans had 11% lower risk of having FMD than the White Americans (AOR=0.89; 95%CI: 0.80-0.98).

Compared to married adults, never-married adults had 1.2 times higher odds of FMD (AOR=1.22, 95%CI: 1.18-1.27). Adults who were not employed or not in the workforce had 1.4 times higher odds of

FMD compared to those who were currently employed (AOR=1.35; 95%CI: 1.30-1.40). Adults earning more than 50K had 43% lower odds of FMD compared to those earning less than 15K (AOR=0.57; 95%CI: 0.54-0.60). Adults living in the rural areas had lower risk of having FMD compared to those living in urban areas (AOR= 0.93; 95%CI: 0.90-0.95).

The results also indicated that the adults, who were not engaged in physical activity, did not smoke or drink had higher odds of FMD than their counterparts. Chronic health conditions of adults also appeared as the significant predictors of FMD. Adults with asthma, diabetes, coronary heart disease, cancer, arthritis, COPD, depressive disorder, stroke, and kidney disease had higher odds of FMD compared to those who had none of those diseases. Notably, adults suffering from depressive disorder had about six times higher odds of FMD compared to those who had no depressive disorder (AOR=6.23; 95%CI: 6.07-6.40).

DISCUSSION

Frequent mental distress (FMD) is one of the important dimensions of the health-related quality of life. The goal of the present study was to investigate the levels and trends of FMD among the adults in the US, and examine the association between FMD and socio-demographic characteristics, unhealthy lifestyle (such as smoking, drinking etc.), and chronic physical health condition of adults using the 2019 BRFSS dataset. Our analysis indicated that overall, about 12.0% of adults of the United States reported that they had FMD. There is an increasing trend in the prevalence of FMD among adults in the United States. The prevalence of FMD has increased from 10.3% in 2010 to 12.1% in 2019, an increase of 1.8 percentage points or 17.5% over the past decade. While analyzing the geographic patterns of FMD, Moriarty et al.[34] also observed that the

prevalence of FMD increased by at least 1 percentage point in 27 states and more than 4 percentage points in other states from 1993 to 2006. Several studies found that FMD is increasing over time due to consequences of recessions and non-employment, high financial debt relative to assets, reduced health care access, housing insecurity, physical inactivity, depressive disorder, food insecurity, and insufficient sleep.[35-38]

Our analysis revealed some critical factors in the domains of demographic, socio-demographic characteristics, unhealthy lifestyle, and chronic physical health conditions that were significantly correlated with FMD. According to the sociological model for mental health consequences, there is a strong relationship between social placements such as age, gender, class etc. and disorders.[39] Consistent with the sociological model for frequent mental health consequences, young adults and women were found to be at greater risk of FMD in the US. The findings of this study revealed that FMD decreased with age. The decreased level of FMD in older adults can be attributed to the reorientation of lifestyle and value for those at a mid-age and the transition to retirement for those in the older-age group.[40] A review study showed that young people in Australia, Brazil, Ethiopia, Switzerland, and South Africa all reported a high prevalence of mental health disorders.[41]

Our finding that women had 10% higher risk of FMD than men is consistent with findings of the large cross-national face-to-face world mental health survey of WHO, which was conducted in five developing and 10 developed countries across Africa, the Americas, Asia, Europe, the Middle East, and the Pacific.[42] The underlying reasons might be that females are more concerned about their success in a future career, physical appearance, and peer pressure. Also, females are more likely to undergo negative social changes that were

brought by social media, consumer culture,[43] and cultural expectations.[44]

The present study found that married individuals had a relatively lower risk of FMD compared to single, divorced/separated or widowed, which is in support of the findings of the previous studies that regardless of gender, individuals who were married reported better mental health status than unmarried individuals.[45-47]

The findings of this study demonstrated that unemployment, and low income were significantly associated with FMD among US adults. A cross sectional study in Chile also documented similar findings that socioeconomic factors like low education level, low income, and poor housing were accompanied by higher levels of mental disorders.[48] Low income and unemployment were often found to be co-occurring with low education levels. There is a multifactorial and bidirectional causal relationship between low socio-economic status and high mental health problems.[19,24,49]

Results of the present study also indicated disparities in respondents' FMD that were relevant to their race. After controlling the other factors, Asians were found to be less likely to suffer from FMD than their White counterparts, while adults from 'other category' had significantly higher odds of FMD than the Whites. Although it is a long standing issue that American Blacks were more likely to report social discriminations than the Whites,[50,51] the finding of this study demonstrates no significant difference in FMD between the Black and the White race.

Besides socio-demographic factors, individuals' lifestyle is also highly relevant to their FMD. Prior research also indicated that the individuals who experienced mental disorders were more likely to be heavy smokers and more addicted to nicotine.[51,52] One possible explanation was

that patients with mental health issues found tobacco and nicotine consumption as an effective way of self-medication.[53] Drinking is another critical factor adversely related to mental health wellbeing. In the present study, respondents who had at least one drink of alcohol in the past 30 days were 1.02 times more likely to experience mental health distress than those who did not. Previous research indicated a strong correlation between alcohol use and mental health distress, such as depression, anxiety, and conduct disorders.[54,55]

This study identified students as the group that experienced an outstanding level of FMD problems among all age groups and employment statuses. A recent study done by American College Health Association revealed that, among 108 U.S. undergrad institutions, 10% of the student participants identified with depression and anxiety, 24.3% with suicidal ideation, and nearly 20% with self-injury.[56] Mossakowski[50] observed that young students are at a pivotal stage of their life, where they undergo major life changes that make them more prone to chronic stress and symptoms of depression. Byrd and Mckinney[57] argued that students' mental health can be attributed to a series of factors that ranged from individual, interpersonal, and institutional levels. On the individual level, students' low self-esteem and lack of coping abilities were correlated with higher levels of depression and even suicide.[57,58] On the institutional level, academic curriculum, campus climate, and faculty interaction largely determined students' experiences at school, which were potential factors that correlated with their mental health.[59]

The results of this study implied a significant correlation between individuals' chronic physical health and FMD. With more research emerging in recent years, researchers have identified great overlaps between individuals' physical and mental

health.[16,17,60,61] Adverse physical health conditions, such as cardiovascular disease, hypertension, diabetes, dyslipidemia, and other morbidity were found to lead to poor mental health problems, like depression, bipolar disorders, schizophrenia, and anxiety disorders.[56-58] Individuals with depression experienced 150% greater risk of a cardiovascular event, and higher risk of arthritis compared to the general population.[62,63] However, the relationship between mental and physical health was rather complex. From the standpoint of physical illnesses, results showed that patients with poor physical health were also at greater risk of mental health distress.

CONCLUSION

The results of this study indicated that one in eight US adults suffer from FMD and there is an increasing trend in FMD. FMD was found to be significantly higher among females, students, aged below 35 years, multiracial, less educated, unmarried, low income, living in urban areas, and underweight individuals. Unhealthy life style, such as no physical exercise, smoking, and drinking activity, was found to be significantly associated with FMD. The study also found that adults with chronic health conditions like asthma, diabetes, coronary heart disease, arthritis, COPD, depressive disorder, stroke, and kidney disease had higher prevalence of FMD. It is worth noting that oftentimes individuals undergo severe mental health problems due to the combined effect of multiple factors. The findings in this study stressed the need for raising public awareness on the issue of mental health in general, and targeted intervention should be undertaken to promote mental health of the vulnerable groups of people who are at higher risk of FMD. To promote better mental health, health care providers and public health professionals can focus on promoting healthy lifestyles, such as

maintaining a healthy weight, doing regular physical exercise, quitting smoking, and avoiding drinking alcohol, given that the findings indicated that unhealthy lifestyles are associated with mental distress.

DISCLOSURE STATEMENT

The authors declare that they have no competing interests.

FUNDING

The study involved no funding from any source.

AVAILABILITY OF DATA AND MATERIALS

The data sets analyzed in this study can be found at: https://www.cdc.gov/brfss/index.html.

ETHICS APPROVAL AND CONSENT TO PARTICIPATE

Ethical approval was not applicable for this study, because the study is based on secondary analysis of the publicly available BRFSS dataset. Informed consent was obtained in the survey from all the respondents before conducting the interview.

REFERENCES

1. Lopez AD, Murray CC. The global burden of disease, 1990–2020. Nat Med. 1998;4:1241-3.
2. Rehm J, Shield KD. 6Global Burden of Disease and the Impact of Mental and Addictive Disorders. Current Psychiatry Reports. 2019;21(10):2-7. doi: https://doi.org/10.1007/s11920-019-0997-0.
3. Centers for Disease Control and Prevention (CDC). Measuring Healthy

Days: Population Assessment of Health-related Quality of Life [Internet]. USA: CDC. 2000. Available from: http://www.cdc.gov/hrqol/pdfs/mhd.pdf.

4. Center for Behavioral Health Statistics and Quality. Key substance use and mental health indicators in the United States: Results from the 2019 National Survey on Drug Use and Health (HHS Publication No. PEP20-07-01-001, NSDUH Series H-55) [Internet]. Rockville, MD; 2020. Available from: https://www.samhsa.gov/data/.

5. Constitution of the World Health Organization. In: World Health Organization: Basic documents. 45th ed. Geneva: World Health Organization. 2005.

6. Steel Z, Marnane C, Iranpour C, Chey T, Jackson JW, Patel V, et al. The global prevalence of common mental disorders: a systematic review and meta-analysis 1980-2013. Int J Epidemiol. 2014;43(2):476-93.

7. OECD. Health at a Glance: Europe 2018: State of Health in the EU Cycle. Paris, France: OECD Publishing; 2018. doi: https://doi.org/10.1787/health_glance_eur-2018-en.

8. World Health Organization. Promoting mental health: concepts, emerging evidence, practice (Summary Report). Geneva: World Health Organization. 2004.

9. Prince M, Patel V, Saxena S, Maj M, Maselko J, Phillips MR, et al. No health without mental health. Lancet. 2007;370(9590):859-77.

10. World Health Organization. Investing in Mental Health [Internet]. 2003. Available from: https://apps.who.int/iris/bitstream/handle/10665/42823/9241562579.pdf.

11. Kessler RC, Foster CL, Saunders WB, Stang PE. Social consequences of psychiatric disorders, I: Educational attainment. American Journal of Psychiatry. 1995;152(7):1026-32.

12. Marcotte DE, Wilcox-Gök V. Estimating the employment and earnings costs of mental illness: recent developments in the United States. Soc Sci Med. 2001;53(1):21-7.

13. Lund C, De Silva M, Plagerson S, Cooper S, Chisholm D, Das J, et al. Poverty and mental disorders: breaking the cycle in low-income and middle-income countries. Lancet. 2011; 378(9801):1502-14.

14. Firth J, Siddiqi N, Koyanagi A, Siskind D, Rosenbaum S, Galletly C, et al. The Lancet Psychiatry Commission: a blueprint for protecting physical health in people with mental illness. Lancet Psychiatry. 2019;6(8):675-712.

15. Seloilwe ES. Experiences and demands of families with mentally ill people at home in Botswana. J Nurs Scholarsh. 2006;38(3):262-8.

16. Jones E, Gupta S, Murphy A, Norris F. Inequality, socioeconomic status, and social support in post-disaster mental health in Mexico. Soc App Anthr. 2011;70(1):33–43.

17. Sareen J, Afifi TO, McMillan KA, Asmundson GJ. Relationship between household income and mental disorders: findings from a population-based longitudinal study. Arch Gen Psychiatry. 2011;68(4):419-27.

18. Ibrahim AK, Kelly SJ, Adams CE, Glazebrook C. A systematic review of studies of depression prevalence in university students. J Psychiatr Res. 2013;47(3):391-400. doi: 10.1016/j.jpsychires.2012.11.015.

19. Nagasu M, Kogi K, Yamamoto I. Association of socioeconomic and lifestyle-related risk factors with mental health conditions: a cross-sectional study. BMC Public Health. 2019; 19(1):1759. doi: 10.1186/s12889-019-8022-4.

20. Reiss F. Socioeconomic inequalities and mental health problems in children and adolescents: a systematic review. Soc Sci Med. 2013;90:24-31. doi: 10.1016/j.socscimed.2013.04.026.

21. Kim J, Kim H. Demographic and Environmental Factors Associated with Mental Health: A Cross-Sectional Study. Int J Environ Res Public Health. 2017;14(4).

22. Paluska SA, Schwenk TL. Physical activity and mental health: current concepts. Sports Med. 2000;29(3):167-80. doi: 10.2165/00007256-200029030-00003.

23. Chekroud SR, Gueorguieva R, Zheutlin AB, Paulus M, Krumholz HM, Krystal JH, et al. Association between physical exercise and mental health in 1·2 million individuals in the USA between 2011 and 2015: a cross-sectional study. Lancet Psychiatry. 2018;5(9):739-46. doi: 10.1016/S2215-0366(18)30227-X.

24. Costello EJ, Angold A, Burns BJ, Erkanli A, Stangl DK, Tweed DL. The Great Smoky Mountains Study of Youth. Functional impairment and serious emotional disturbance. Arch Gen Psychiatry. 1996;53(12):1137-43. doi: 10.1001/archpsyc.1996.01830120077013.

25. World Health Organization. The WHO Special Initiative for Mental Health (2019-2023): Universal Health Coverage for Mental Health. Geneva: World Health Organization. 2019.

26. Moussavi S, Chatterji S, Verdes E, Tandon A, Patel V, Ustun B. Depression, chronic diseases, and decrements in health: results from the World Health Surveys. Lancet. 2007;370(9590):851-8. doi: 10.1016/S0140-6736(07)61415-9.

27. Herbst A, Kordonouri O, Schwab KO, Schmidt F, Holl RW. Impact of physical activity on cardiovascular risk factors in children with type 1 diabetes: a multicenter study of 23,251 patients.

Diabetes Care. 2007;30(8):2098-100. doi: 10.2337/dc06-2636.

28. Federal Communications Commission USA. Universal Service Monitoring Report. 2019. Available from: https://docs.fcc.gov/public/attachments/DOC-362272A1.pdf

29. Rohrer JE, Pierce JR, Blackburn CR. Lifestyle and mental health. Preventive Medicine. 2005;40:438-43.

30. Slabaugh SL, Shah M, Zack M, Happe L, Cordier T, Havens E, et al. Leveraging Health-Related Quality of Life in Population Health Management: The Case for Healthy Days. Popul Health Manag. 2017;20(1):13-22. doi: 10.1089/pop.2015.0162.

31. Stellefson M, Wang MQ, Balanay JAG, Wu R, Paige SR. Latent Health Risk Classes Associated with Poor Physical and Mental Outcomes in Workers with COPD from Central Appalachian U.S. States. Int J Environ Res Public Health. 2020;17(18). doi: 10.3390/ijerph17186798.

32. Cree RA, Okoro CA, Zack MM, Carbone E. Frequent Mental Distress Among Adults, by Disability Status, Disability Type, and Selected Characteristics - United States, 2018. MMWR Morb Mortal Wkly Rep. 2020;69(36):1238-43. doi: 10.15585/mmwr.mm6936a2.

33. Hosmer Jr. DW, Lemeshow S, Sturdivant RX. Applied Logistic Regression. 3rd ed. John Wiley & Sons, Hoboken, NJ; 2013.

34. Moriarty DG, Zack MM, Holt JB, Chapman DP, Safran MA. Geographic patterns of frequent mental distress: U.S. adults, 1993-2001 and 2003-2006. Am J Prev Med. 2009;36(6):497-505. doi: 10.1016/j.amepre.2009.01.038.

35. Sweet E, Nandi A, Adam EK, McDade TW. The high price of debt: household financial debt and its impact on mental and physical health. Soc Sci Med. 2013;91:94-100. doi: 10.1016/j.socscimed.2013.05.009.

36. Bruning J, Arif AA, Rohrer JE. Medical cost and frequent mental distress among the non-elderly US adult population. J Public Health (Oxf). 2014;36(1):134-9.

37. Liu Y, Njai RS, Greenlund KJ, Chapman DP, Croft JB. Relationships between housing and food insecurity, frequent mental distress, and insufficient sleep among adults in 12 US States, 2009. Prev Chronic Dis. 2014;11:E37.

38. Okoro CA, Hollis ND, Cyrus AC, Griffin-Blake S. Prevalence of Disabilities and Health Care Access by Disability Status and Type Among Adults - United States, 2016. MMWR Morb Mortal Wkly Rep. 2018; 67(32):882-7. doi: 10.15585/mmwr. mm6732a3.

39. Aneshensel CS, Rutter CM, Lachenbruch PA. Social structure, stress, and mental health: competing conceptual and analytic models. American Sociological Review. 1991;56(2):166–78.

40. Williams JS, Cunich M, Byles J. The impact of socioeconomic status on changes in the general and mental health of women over time: evidence from a longitudinal study of Australian women. Int J Equity Health. 2013;12:25. doi: 10.1186/1475-9276-12-25.

41. Patel V, Flisher AJ, Hetrick S, McGorry P. Mental health of young people: a global public-health challenge. Lancet. 2007;369(9569):1302-13. doi: 10.1016/ S0140-6736(07)60368-7.

42. Seedat S, Scott KM, Angermeyer MC, Berglund P, Bromet EJ, Brugha TS, et al. Cross-national associations between gender and mental disorders in the WHO world mental health surveys. Archives of General Psychiatry. 2009;66(7):785–95.

43. Hamilton M. What's happening to our girls? London: Penguin Books; 2008.

44. Eckersley R. Never better or getting worse? The health and wellbeing of young Australians. Canberra: Australia; 2008.

45. Simon RW. Revisiting the relationships among gender, marital status, and mental health. Ajs. 2002;107(4):1065-96.

46. Diener E, Lucas RE, Oishi S. Subjective well being: The science of happiness and life satisfaction. In C. R. Synder, S. J. Lopez, editors. Handbook of positive psychology. Oxford: Oxford University Press; 2002. p. 63-73.

47. Oppenheimer V. The continuing importance of men's economic position in marriage formation. In L. Waite, editor. The ties that bind. New York: Aldine de Gruyter; 2000. p. 283–301.

48. Araya R, Lewis G, Rojas G, Fritsch R. Education and income: which is more important for mental health? Journal of Epidemiology and Community Health. 2003;57(7):501–5.

49. McDonough P, Berglund P. Histories of poverty and self-rated health trajectories. J Health Soc Behav. 2003;44(2):198-214.

50. Mossakowski K. Dissecting the influence of race, ethnicity, and socioeconomic status on mental health in young adulthood. Research on Aging. 2008;30(6):649–71.

51. McNeill A. Smoking and mental health - a review of the literature (Rep.). London:Smoke Free London Programme; 2001.

52. De Leon J, Diaz FJ. A meta-analysis of worldwide studies demonstrates an association between schizophrenia and tobacco smoking behaviors. Schizophr Res. 2005;76(2-3):135-57. doi: 10.1016/j.schres.2005.02.010.

53. Le Houezec J. Nicotine: abused substance and therapeutic agent. J Psychiatry Neurosci. 1998;23(2):95-108.

54. Huang R, Ho SY, Wang MP, Lo WS, Lam TH. Reported alcohol drinking and mental health problems in Hong Kong Chinese adolescents. Drug Alcohol Depend. 2016;164:47-54. doi: 10.1016/j.drugalcdep.2016.04.028.

55. Kessler RC, Chiu WT, Demler O, Merikangas KR, Walters EE. Prevalence, severity, and comorbidity of 12-month DSM-IV disorders in the National Comorbidity Survey Replication. Arch Gen Psychiatry. 2005;62(6):617-27. doi: 10.1001/archpsyc.62.6.617.

56. Liu CH, Stevens C, Wong SHM, Yasui M, Chen JA. The prevalence and predictors of mental health diagnoses and suicide among U.S. college students: Implications for addressing disparities in service use. Depress Anxiety. 2019;36(1):8-17. doi: 10.1002/da.22830.

57. Byrd DR, McKinney KJ. Individual, interpersonal, and institutional level factors associated with the mental health of college students. J Am Coll Health. 2012;60(3):185-93. doi: 10.1080/07448481.2011.584334.

58. Wilburn VR, Smith DE. Stress, self-esteem, and suicidal ideation in late adolescents. Adolescence. 2005; 40(157):33-45.

59. Hunt J, Eisenberg D. Mental health problems and help-seeking behavior among college students. J Adolesc Health. 2010;46(1):3-10.

60. Doherty AM, Gaughran F. The interface of physical and mental health. Soc Psychiatry Psychiatr Epidemiol. 2014;49(5):673-82. doi: 10.1007/s00127-014-0847-7

61. Leucht S, Burkard T, Henderson J, Maj M, Sartorius N. Physical illness and schizophrenia: a review of the literature. Acta Psychiatr Scand. 2007;116(5):317-33.

62. Cuijpers P, Schoevers RA. Increased mortality in depressive disorders: a review. Curr Psychiatry Rep. 2004;6(6):430–7.

63. Carnethon MR, Biggs ML, Barzilay JI, Smith NL, Vaccarino V, Bertoni AG, et al. Longitudinal association between depressive symptoms and incident type 2 diabetes mellitus in older adults: the cardiovascular health study. Arch Intern Med. 2007;167(8):802-7. doi: 10.1001/archinte.167.8.802.