

Association of Poor Mental Health and Cardiovascular Events Among Middle-Aged and older people's: A population-based case control study

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Abstract

Introduction:

Cardiovascular diseases (CVDs) remain the leading cause of death worldwide, and growing evidence suggests that poor mental health may play an important role in their onset. However, the association between mental disorders and cardiovascular events (CVE) among middle-aged and older adults in Iran has not been well explored.

Methods:

This population based case control study using data from the Sina Electronic Health Record (SinaEHR®) system between 2017 and 2024. A total of 14,674 individuals aged ≥ 50 years were included, comprising 7,337 patients with confirmed CVE and 7,337 frequency-matched controls by age and sex without CVE. Mental disorders were identified based on ICD-10 codes (F00–F99), and cardiovascular outcomes included ischemic heart disease and stroke events. Logistic regression was applied to estimate crude and adjusted odds ratios (OR, AOR) with 95% confidence intervals (CI) controlling for sociodemographic lifestyle and clinical variables.

Results:

Mental disorders were significantly more common among CVE cases (60.8%) compared to controls (39.2%, $p_{\text{value}} < 0.001$). After adjustment, mental disorders remained independently associated with CVE (AOR = 1.69, 95% CI: 1.52–1.88). Depression (AOR = 1.53, 95% CI: 1.22–1.92) and anxiety (AOR = 1.94, 95% CI: 1.56–2.40) were particularly strong predictors. Traditional risk factors also showed significant associations like advanced age (≥ 70 years, AOR = 3.39 compared to 50–59), overweight and obesity (AOR: 2.99–3.10 compared to healthy weight), hypertension (AOR = 2.12), hypercholesterolemia (AOR = 1.86), diabetes (AOR = 1.17), smoking (AOR = 1.72), and drug abuse (AOR = 2.30).

Conclusion:

Poor mental health especially depression and anxiety is an independent risk factor for cardiovascular events in middle-aged and older adults. Integrating mental health assessment and care into cardiovascular prevention strategies could reduce CVE burden in this vulnerable population.

Introduction

Cardiovascular disease (CVDs), a group of disorders affecting the heart and blood vessels including coronary heart disease, cerebrovascular disease, rheumatic heart disease and others, are among the leading causes of mortality worldwide.(1) It is estimated that the overall number of deaths caused by CVDs will increase to 20 million by 2030.(2) According to the Global Burden of Disease study, coronary heart disease (CHD), the most common type of CVD, accounts for 20% of overall mortality in Europe.(3) Similarly, a high prevalence of CVD and CHD has been reported in the Middle East.(4) In Iran, CVDs are responsible for 46% of all deaths and 20–23% of the disease burden.(5) With an estimated 2 billion people expected to be over 60 years old by 2050,5 and considering that about 75% of deaths in individuals older than 65 years in developed countries are

caused by CVDs and cancers, prevention of cardiovascular outcomes in the elderly seems a global necessity. (6)

There are several risk factors for CVDs, generally divided into two categories: non-modifiable (age, sex, race, and family history) and modifiable (diabetes, lipid profile, hypertension, alcohol consumption, smoking, inadequate physical activity, inappropriate diet, and obesity). Behavioral, environmental, and social factors are other risk factors for CVDs. (6) Global evidence suggests that by controlling and managing the modifiable risk factors, up to 90% of CVD cases can be reduced. (7)

By 2050, the population of individuals over 60 years old is projected to reach 2.1 billion, up from 900 million in 2015. (8) It is estimated that 20% of this cohort will have a neurological or mental health disorder, and this proportion is expected to rise in line with changing population demographics. (9) Anxiety, substance abuse disorders, schizophrenia, and bipolar disorder are also commonly seen in older people. (10) Mental disorders is a term used to group several common psychiatric disorders (schizophrenia, bipolar affective disorder, and major depressive disorder) that significantly affect functional abilities. (11)

Mental disorder is an rising nontraditional risk factor for CVD and a leading cause of disability among middle-aged and older individuals in the United States. (12) A expansive meta-analysis of observational studies found higher rates of all CVD subtypes among those with mental illness. (13) Prior literature has established a high comorbidity of depression and CVD, suggesting a bidirectional relationship between the two factors. (14) The relationship is indeed bidirectional, and those with CVD are also at higher risk of adverse mental wellbeing outcomes. (15)

However, data on the association between mental disorders and cardiovascular events (CVE) among Iranian middle-aged and older individuals are limited. Therefore, this study aimed to investigate the relationship between mental disorders and other factors associated with CVD among individuals aged 50 years and older in northeastern Iran, using a population-based sample.

Materials and Methods

Study Design and Data Source

Using the Sina Health Information System (SINAEHR) in Mashhad, Iran, we carried out a population-based case-control study from March 1, 2017, to December 20, 2024. The SinaEHR system supports primary care delivery across various regions of Iran, covering a population of over 5 million people. It captures standardized clinical data, including diagnoses coded using the International Classification of Diseases, version 10 (ICD-10), and integrates laboratory results through a laboratory information system to facilitate real-time clinical decision-making.

Study Participants

Patients aged ≥ 50 years with a verified cardiovascular disease diagnosis made by a specialist at a university-affiliated hospital were included in the case group.

Controls were randomly selected from the same source population as the cases and had no history of cardiovascular disease. Frequency matching was used to ensure a similar distribution of age and sex between the case and control groups. Individuals with a history of cardiovascular disease were excluded from the control group. The association between mental disorders and cardiovascular events was assessed using logistic regression models, with age and sex included as covariates in the multivariable analysis to account for any residual imbalance and potential confounding.

Study Variables

Outcome Measures

The primary outcome was the presence of cardiovascular events, as recorded in SinaEHR® using the ICD-10 coding system. CVE was defined using the following ICD-10 codes: I20 (Angina pectoris), I21 (Acute myocardial infarction), I24 (Other acute ischemic heart diseases), I25 (Chronic ischemic heart disease), I63 (Cerebral infarction), and I70 (Atherosclerosis).

Exposure Variables

1. Mental disorders: Identified using ICD-10 codes F00-F99
2. Sociodemographic factors: Age, gender, educational level, marital status, employment status, residence (urban/rural)
3. Lifestyle factors: Smoking status, drug abuse
4. Anthropometric measures: Body Mass Index (BMI)
5. Medical history: Diabetes, hypercholesterolemia, hypertension
6. Clinical measures: Glomerular Filtration Rate (GFR)

Measurement Tools and Data Collection

All data were extracted from the SinaEHR® system. Diseases were registered using the ICD-10 coding system by trained healthcare professionals during routine clinical visits. The following ICD-10 codes were used for key comorbidities: Diabetes: E10 (Type 1 diabetes mellitus), E11 (Type 2 diabetes mellitus). Hypertension: I10 (Essential (primary) hypertension), I15 (Secondary hypertension). Hypercholesterolemia: E78 (Disorders of lipoprotein metabolism and other lipidemias). Mental disorders: F00-F99 (Mental, Behavioral and Neurodevelopmental disorders).

BMI was calculated from height and weight measurements recorded during clinical visits. GFR was estimated using the CKD-EPI (Chronic Kidney Disease Epidemiology Collaboration) equation based on serum creatinine levels.

The Kessler Psychological Distress Scale (K6) was used to assess psychological distress. The K6 consists of six items assessing feelings of restlessness, depression, hopelessness, worthlessness, exhaustion, and anxiety. Participants responded to each item using a five-point scale ranging from never (0) to always. The total score was calculated by summing the individual item scores, ranging from 0 to 24. Participants with a total score of 12 or higher were classified as positive for psychological distress.

Smoking status and drug abuse were self-reported and documented by healthcare providers during patient interviews. Educational level, marital status, employment status, and residence were also self-reported and recorded in the SinaEHR® system.

Statistical Analysis

Data were extracted from SinaEHR®, coded, and analyzed using Stata version 14. Descriptive statistics were computed for all study variables. Continuous variables were presented as means and standard deviations, while categorical variables were presented as frequencies and percentages. Univariate logistic regression analyses were performed to examine the association between each predictor variable and the presence of CVE. Variables with a p-value < 0.25 in the univariate analysis were included in the multivariate logistic regression model, following the recommendation by Hosmer and Lemeshow (2000) for variable selection in logistic regression.

The multivariate logistic regression model was used to identify factors independently associated with CVE, adjusting for potential confounders. Adjusted odds ratios (AORs) with 95% confidence intervals (CIs) were calculated. A p-value < 0.05 was considered statistically significant for all analyses.

Table 1
Comparison of Demographic and Clinical Characteristics Between Case and Control Groups

Variables	Case(n = 7337) Freq(%)	Control(n = 7337) Freq(%)	P value*
Mental Disorders			
No	4835(45.8)	5722(54.2)	< 0.001
Yes	2502(60.8)	1615(39.2)	
Age			
50–59	1327(30.0)	3089(70.0)	< 0.001
60–69	2773(52.2)	2537(47.8)	
≥70	2942(66.5)	1483(33.5)	
Sex			
Female	3002(52.4)	2729(47.6)	< 0.001
Male	4335(48.5)	4608(51.5)	
Marital status			
Single	1751(58.1)	1263(41.9)	< 0.001
Married	5586(47.9)	6074(52.1)	
Employment status			
Unemployed	5484(50.4)	5402(49.6)	0.12
Employed	1853(48.9)	1935(51.1)	
Education level			
Illiterate	3222(56.4)	2489(43.6)	< 0.001
Elementary	2778(44.0)	3537(56.0)	
High school	926(43.6)	1199(56.4)	
College graduate	411(78.6)	112(21.4)	
BMI			
Underweight	165(55.9)	130(44.1)	< 0.001
Healthy Weight	3084(62.5)	1847(37.5)	
Overweight	1990(43.9)	2546(56.1)	
Obesity1	1545(43.3)	2027(56.7)	
* Chi-squared test			

Variables	Case(n = 7337) Freq(%)	Control(n = 7337) Freq(%)	P value*
Mental Disorders			
Obesity2	436(41.9)	605(58.1)	
Obesity3	117(39.1)	182(60.9)	
GFR			
≥90	4778(44.7)	5901(55.3)	< 0.001
60–89	2404(65.4)	1274(34.6)	
<60	155(48.9)	162(51.1)	
Diabetes			
No	3884(45.1)	4724(54.9)	< 0.001
Yes	3453(56.9)	2613(43.1)	
Residence			
Village	1196(38.4)	1918(61.6)	< 0.001
Suburban	800(28.8)	1974(71.2)	
Under one million habitant	1282(78.9)	343(21.1)	
Metropolitan	40.59(56.7)	3102(43.3)	
Smoking			
No	6090(48.5)	6477(51.5)	< 0.001
Yes	1247(59.2)	860(40.8)	
Hypercholesterolemia			
No	3029(41.8)	4218(58.2)	< 0.001
Yes	4308(58.0)	3119(42.0)	
Hypertension			
No	1297(29.9)	3048(70.1)	< 0.001
Yes	6040(58.5)	4289(41.5)	
Drug abuse			
No	6484(48.8)	6805(51.2)	< 0.001
Yes	853(61.6)	532(38.4)	
* Chi-squared test			

Table 2
Multivariable and Univariate Logistic Regression Analysis of Clinical Predictors of CVE

Variable		Crude Odds Ratio			Adjusted Odds Ratio		
		OR	95% Confidence interval	P- value	OR	95% Confidence interval	P- value
Mental disorder	No	Reference	-	-	-	-	-
	Yes	1.83	1.70–1.97	< 0.001	1.69	1.52–1.88	< 0.001
Depression	No	Reference	-	-	-	-	-
	Yes	2.06	1.89–2.24	< 0.001	1.53	1.22–1.92	< 0.001
Anxiety	No	Reference	-	-	-	-	-
	Yes	1.63	1.47–1.80	< 0.001	1.94	1.56–2.40	< 0.001
Gender	Female	Reference	-	-	-	-	-
	Male	1.16	1.09–1.25	< 0.001	0.62	0.56–0.69	< 0.001
Age	50–59	Reference	-	-	-	-	-
	60–69	2.54	2.34–2.76	< 0.001	2.32	2.09–2.57	< 0.001
	≥ 70	4.61	4.22–5.05	< 0.001	3.39	2.97–3.86	< 0.001
Marital status	Single	Reference	-	-	-	-	-
	married	0.66	0.61–0.71	< 0.001	0.94	0.84–1.04	0.26
Resident	Village	Reference	-	-	-	-	-
	Suburban	0.65	0.58–0.72	< 0.001	0.57	0.51–0.65	< 0.001
	Under one million habitant	5.99	5.21–6.89	< 0.001	4.32	3.67–5.07	< 0.001
	Metropolitan	2.09	1.92–2.28	< 0.001	1.99	1.79–2.21	< 0.001
Education level	Illiterate	Reference	-	-	-	-	-
	Elementary	0.60	0.56–0.65	< 0.001	0.84	0.77–0.92	< 0.001
	High school	0.59	0.54–0.66	< 0.001	1.06	0.92–1.21	0.41

	College graduate	2.83	2.28–3.51	< 0.001	4.24	3.23–5.58	< 0.001
BMI	Healthy weight	Reference	-	-	-	-	-
	Underweight	1.31	1.03–1.66	0.02	1.09	0.82–1.44	0.54
	Over weight	2.13	1.96–2.31	< 0.001	3.10	2.80–3.44	< 0.001
	Obesity1	2.19	2.00–2.39	< 0.001	3.04	2.73–3.40	< 0.001
	Obesity2	2.31	2.02–2.65	< 0.001	2.99	2.52–3.54	< 0.001
	Obesity3	2.59	2.04–3.30	< 0.001	2.99	2.23–4.00	< 0.001
GFR	≥90	Reference	-	-	-	-	-
	60–89	1.18	0.94–1.47	0.14	1.13	0.85–1.50	0.37
	<60	2.33	2.15–2.51	< 0.001	1.73	1.53–2.17	< 0.001
Diabetes	No	Reference	-	-	-	-	-
	Yes	1.60	1.50–1.71	< 0.001	1.17	1.08–1.27	< 0.001
Hypertension	No	Reference	-	-	-	-	-
	Yes	3.30	3.06–3.57	< 0.001	2.12	1.93–2.33	< 0.001
Hypercholesterolemia	No	Reference	-	-	-	-	-
	Yes	1.92	1.80–2.05	< 0.001	1.86	1.71–2.01	< 0.001
Drug abuse	No	Reference	-	-	-	-	-
	Yes	1.68	1.50–1.88	< 0.001	2.30	1.96–2.69	< 0.001
Employment status	Unemployed	Reference	-	-	-	-	-
	Employed	0.94	0.87–1.01	0.12	0.80	0.72–0.89	
Smoking	No	Reference	-	-	-	-	-
	Yes	1.54	1.40–1.69	< 0.001	1.72	1.51–1.95	< 0.001

Results

The total number of participants for the study was 14674 individuals, which included 7337 cases and 7337 controls. Of those participants, cases reported a diagnosis of mental disorders in 60.8% of participants, compared with 39.2% of controls ($p_{\text{value}} = < 0.001$). Participants with CVE also were older than participants with controls, with participants age ≥ 70 years residing in 66.5% of cases vs 33.5% of controls ($p_{\text{value}} = < 0.001$). The proportion of male participants with CVE was 48.5%, compared to 51.5% in controls ($p_{\text{value}} < 0.001$). There were differences observed in education including levels of illiteracy with cases at 56.4% in cases, compared to 43.6% of controls ($p_{\text{value}} = < 0.001$). Additionally, the number of college graduates for cases was significantly less than controls at 21.4% in cases compared to 78.6% in controls ($p_{\text{value}} = < 0.001$). In terms of clinical characteristics, cases demonstrated higher BMI and more comorbidities, clearly diabetes 56.9% cases compared to 43.1% controls ($p_{\text{value}} = < 0.001$), hypertension 58.5% cases vs 43.1% controls ($p_{\text{value}} = < 0.001$), and hypercholesterolemia 58.0% cases vs. 42.0% controls ($p_{\text{value}} = < 0.001$). Lifestyle choices were observed to be more prevalent in this population with lifestyle factors with smoking found in 59.2%, compared to 40.8% in controls ($p_{\text{value}} < 0.001$); and drug abuse 73, 61.6% compared to controls 38.4% ($p_{\text{value}} = < 0.001$). Reduced kidney function for the variables of $\text{GFR} < 60 \text{ mL/min/1.73 m}^2$ for the participants were higher for cases at 51.1% vs 48.9% for controls ($p_{\text{value}} = < 0.001$) (See Table 1).

The univariate logistic regression analysis indicated that mental disorders were linked to more than double the probability of cardiovascular events ($\text{OR} = 1.83$, 95% CI: 1.70–1.97, $p_{\text{value}} = < 0.001$) than those who did not have such disorders. The association remained significant ($\text{AOR} = 1.69$, 95% CI: 1.52–1.88, $p_{\text{value}} = < 0.001$) even after adjustment. Indeed, depression ($\text{AOR} = 1.53$, 95% CI: 1.22–1.92, $p_{\text{value}} = < 0.001$) and anxiety ($\text{AOR} = 1.94$, 95% CI: 1.56–2.40, $p_{\text{value}} = < 0.001$) specifically were pointed out as risk factors that increased the likelihood of cardiovascular events compared to individuals who were free of these conditions.

Age was the most important factor that determined the CVE risk. The risk of those aged 60–69 was 2.32 times greater than that of the 50–59 age group, and the risk of the ≥ 70 years old group was 3.39 times greater than that of the 50–59 group ($p_{\text{value}} = < 0.001$). Men were less likely to have a cardiovascular event than women ($\text{AOR} = 0.62$, 95% CI: 0.56–0.69, $p_{\text{value}} = < 0.001$).

Economic factors had an effect on the risk of CVE as well. Elementary-educated people had marginally higher odds ($\text{AOR} = 0.84$, 95% CI: 0.77–0.92, $p_{\text{value}} = < 0.001$) than illiterate individuals, while college graduates had dramatically higher odds ($\text{AOR} = 4.24$, 95% CI: 3.23–5.58, $p_{\text{value}} = < 0.001$) of CVE compared with the illiterate group. Suburban residents had lower odds ($\text{AOR} = 0.57$, 95% CI: 0.51–0.65) in comparison to villagers, while the women who live in metropolitan had higher odds ($\text{AOR} = 1.99$, 95% CI: 1.79–2.21). The highest risk was found in towns with less than one million inhabitants ($\text{AOR} = 4.32$, 95% CI: 3.67–5.07) when compared to rural areas.

The clinical predictors were also statistically significant. Overweight individuals had 3.10 higher odds for risk compared to normal BMI, while Obesity class I ($\text{AOR} = 3.04$, 95% CI: 2.73–3.40), obesity class II ($\text{AOR} = 2.99$, 95% CI: 2.52–3.54), and obesity class III ($\text{AOR} = 2.99$, 95% CI: 2.23–4.00) had higher progressive risk compared to healthy weight individuals.

Hypertension was reported by participants who identified as overweight ($\text{AOR} = 2.12$, 95% CI: 1.93–2.331), hypercholesterolemia ($\text{AOR} = 1.86$, 95% CI: 1.71–2.01, $p_{\text{value}}: < 0.001$) and diabetes ($\text{AOR} = 1.17$, 95% CI: 1.08–1.27, $p_{\text{value}}: < 0.001$) were all statistically significant risk factors compared to individuals without them. Lower GFR (< 60) was also associated with a higher risk compared to healthy kidney function ($\text{AOR} = 1.73$, 95%

CI: 1.53–2.17, p_value: <0.001). Smoking (AOR = 1.72, 95% CI: 1.51–1.95, p_value: <0.001) and illicit drug abuse (AOR = 2.30, 95% CI: 1.96–2.69, p_value: <0.001) were also identified as risk factors compared with non-users. Employment was considered to be protective against CVE, was also identified as the only protective factor, AOR = 0.80, 95% CI: 0.72–0.89. (Refer to Table 2.)

Discussion

This case control analysis of middle aged and elderly individuals in Iran identified a significant independent correlation between mental health disorders and cardiovascular events. The research emphasizes various key risk elements that contribute to the onset of CVE, including male sex, advanced age, elevated BMI, reduced eGFR, diabetes, hyperlipidemia, hypertension, and mental disorders. Additionally, socioeconomic components, such as educational attainment and residential location, are influential in shaping cardiovascular health outcomes. Our findings stress the necessity of all encompassing public health initiatives aimed at minimizing modifiable risk elements, including tobacco use, excessive weight, and substance dependence. Particular emphasis should be placed on mental health, recognizing it as a standalone risk determinant for cardiovascular disease, highlighting the urgency of integrated medical approaches. These results furnish essential insights for health policymakers, medical practitioners, and scholars to craft targeted prevention and intervention programs that tackle the multifactorial origins of CVE.

Consistent with prior investigations across various regions, our study revealed that individuals experiencing psychological distress exhibit an elevated likelihood of developing CVE. As per Harshfield et al., the occurrence of CVD in older populations was linked to established depressive symptoms within an aggregated cohort spanning over 30 nations. (17). Research conducted in low- and middle-income countries identified that individuals without a history of CVD yet presenting four or more depressive indicators exhibited a 14% greater risk of developing cardiovascular disease and all-cause mortality (18). Furthermore, an investigation among individuals of European descent demonstrated a relationship between depressive episode frequency and the onset of atrial fibrillation, type 2 diabetes, and coronary artery disease. (19)

Within the United States, a single-center study involving participants determined that moderate-to-severe depression was negatively associated with cardiovascular health scores (20), a trend mirrored in moderately sized population-based research. (22,21)

The CVE-mental disorder relationship has been acknowledged as bidirectional, with depression recognized as a standalone risk contributor to CVD. (17, 23, 24) The heightened probability of CVE among individuals experiencing depression might originate from unhealthy behavioral patterns frequently associated with depressive states, including physical inactivity, inadequate nutrition, and cigarette consumption. (25–28) There exist various physiological mechanisms, such as disruptions in glucose and lipid metabolism, alongside coagulation cascade irregularities induced by chronic stress, through which mental well-being influences cardiovascular health and CVD susceptibility. It is equally essential to acknowledge that CVD itself can precipitate mental disorders. Studies have documented elevated rates of psychiatric conditions among patients diagnosed with CVD. (31, 32) Reports indicate that 15% of individuals who have undergone myocardial infarction or coronary artery bypass surgery experience major depressive disorder, a prevalence that surpasses 20% in patients with heart failure and is even higher in severe heart failure cases. (31, 33, 34)

Our analysis suggests that men are at a greater risk of experiencing the CVE mental disorder association, aligning with previous research findings that identified a stronger connection between psychiatric disorders and CVE, CVE related mortality, and overall mortality in males. (35, 36) Men tend to underreport mental health issues and are less inclined to pursue treatment, potentially exacerbating their perceived risk. (37, 38) Meanwhile, some studies have reported a stronger link between mental disorders and the emergence of coronary artery disease among women, demonstrating substantial variability in the gender specific associations noted in the literature. (19)

Findings regarding the impact of urbanization on mental disorder risk have been inconsistent across different geographical regions. While some studies suggest a higher prevalence of psychiatric disorders in urban residents, others have identified either protective effects or no association at all. (39, 40) A meta analysis revealed that in developed nations, individuals residing in urban settings had 44% greater odds of developing mental disorders compared to those in rural areas. Potential contributing factors include poor dietary habits, decreased physical activity, high stress levels, unsafe living conditions, social isolation, and limited access to green spaces. (41, 42) Our study similarly found that the association between mental disorders and CVE was stronger among urban populations, suggesting a potential interaction between urban living conditions, psychological health, and cardiovascular risk.

This research further demonstrated that reduced glomerular filtration rate, indicative of impaired kidney function, was significantly correlated with CVE incidence. Multiple epidemiological investigations have repeatedly established that individuals with chronic kidney disease or those experiencing progressive kidney dysfunction face heightened susceptibility to CVE events including heart attacks, strokes, and heart failure regardless of traditional CVE risk factors, corroborating previous findings. (46, 45)

These findings hold crucial clinical and public health implications. This study underscores the importance of recognizing CVE risk in patients suffering from depression and poor mental health. Implementing targeted interventions aimed at enhancing mental wellbeing and mitigating mood disorders could be instrumental in reducing CVE risks. Cardiac rehabilitation programs already incorporate stress management and mindfulness techniques, yet mental health integration within these programs could be further strengthened, particularly for psychiatric patients. Strategies to address mood disorders in older populations should include interventions that tackle CVE risk factors such as physical activity, weight control, and smoking cessation. (50)

Future research should focus on longitudinal studies to clarify the causal relationship between mental disorders and CVE, investigate mediators and moderators influencing this association, assess mental health interventions for CVE prevention, and examine sex specific mechanisms linking mental well-being and cardiovascular risk. Additional studies should integrate validated mental health screening tools within standardized cardiovascular health assessments, address the role of social determinants, and explore health disparities that influence the intersection of mental health and cardiovascular outcomes. (44, 43)

In conclusion, our study provides evidence of an association between mental disorders and cardiovascular events in a population from Iran. These findings highlight the potential importance of integrated approaches to mental and cardiovascular health in clinical practice and public health interventions. Addressing mental health as part of comprehensive cardiovascular care may contribute to improved mental well-being and cardiovascular health outcomes in this population.

The SinaEHR® provided a large population-based dataset from Mashhad and surrounding areas, with data collected over six years. The use of this dataset enabled the assessment of the association between mental disorders and cardiovascular events in a large study population. The study also examined a broad range of sociodemographic and health-related factors, including educational attainment, residence type, diabetes, hypertension, obesity, and other cardiovascular risk factors, providing a comprehensive assessment of factors associated with cardiovascular events.

This study has several limitations that should be considered when interpreting the findings. First, the case-control design limits the ability to establish temporality and causality between mental disorders and cardiovascular events. Therefore, the observed associations should not be interpreted as causal relationships. Second, although cases and controls were selected from the same population and matched on age and sex, the analysis may be affected by residual confounding and potential bias related to the matching procedure. Third, mental disorders were identified primarily from routinely recorded ICD-10 diagnoses in the electronic health records. Consequently, undiagnosed conditions, differences in healthcare-seeking behavior, and variations in diagnostic practices may have resulted in misclassification of mental disorders. Fourth, the study did not have detailed information on the duration, severity, treatment status, or clinical course of individual mental disorders, which may have influenced the observed associations. Fifth, several important potential confounders, including dietary factors, physical activity, socioeconomic characteristics, family history of cardiovascular disease, and medication use, were not available or sufficiently detailed in the database, and residual confounding therefore cannot be excluded. Sixth, cardiovascular events were identified using routinely recorded ICD-10 codes, and although standardized diagnostic coding was used, misclassification of cardiovascular outcomes remains possible. Finally, although the study used data from the SinaEHR system, the study population was derived from Mashhad and the surrounding region; therefore, the findings may not be directly generalizable to all Iranian populations or other settings. Further longitudinal studies with more detailed clinical information are needed to clarify the temporal and potentially causal relationship between mental disorders and cardiovascular events.

Conclusions

This study identified mental Conditions is associated with cardiovascular events (CVE) among middle-aged and elderly individuals. Although this association is likely bidirectional, prioritizing mental health may help reduce CVE risk in middle-aged and elderly individuals.

Declarations

Acknowledgment: This article was the result of a research project approved by Mashhad University of Medical Sciences, Iran. Hereby, we extend our gratitude to the Health Deputy of Mashhad University of Medical Sciences for assisting us in data collection.

Authors' contributions

AM is the principal investigator and research leader. EM designed the Study and drafted the manuscript and analyzed the data. MN contributed to the conception, design, data interpretation, and revising the manuscript. All authors read and approved the final manuscript.

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Availability of data and materials

The data that support the findings of this study are available from the corresponding author upon reasonable request.

Ethics approval and consent to participate

This study was approved by the Ethics Committee of Mashhad University of Medical Sciences (code IR.MUMS.FHMPM.REC.1403.029). The study adhered to the principles of the Declaration of Helsinki and followed the Strengthening the Reporting of Observational Studies in Epidemiology (STROBE) guidelines for reporting observational studies. The STROBE guidelines provided a framework for transparent and consistent reporting of observational studies, ensuring the study's findings were reported in a clear and reproducible manner.

Informed consent was waived by the Research Ethics Committee of the School of Paramedical Sciences and Health School, Mashhad University of Medical Sciences, as secondary data were obtained anonymously from the Sina Electronic Health Record system. All data were de-identified before analysis to ensure patient confidentiality.

Consent for publication

Not Applicable.

Competing interests

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

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