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Risk of anxiety and depressive disorders in patients with myocardial infarction

A nationwide population-based cohort study

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Abstract

Anxiety and depressive symptoms are associated with adverse cardiovascular events after an acute myocardial infarction (MI). However, most studies focusing on anxiety or depression have used rating scales or self-report methods rather than clinical diagnosis. This study aimed to investigate the association between psychiatrist-diagnosed psychiatric disorders and cardiovascular prognosis.

We sampled data from the National Health Insurance Research Database; 1396 patients with MI were recruited as the study cohort and 13,960 patients without MI were recruited as the comparison cohort. Cox proportional hazard regression models were used to examine the effect of MI on the risk of anxiety and depressive disorders.

During the first 2 years of follow-up, patients with MI exhibited a significantly higher risk of anxiety disorders (adjusted hazard ratio [HR] = 5.06, 95% confidence interval [CI]: 4.61–5.54) and depressive disorders (adjusted HR = 7.23, 95% CI: 4.88–10.88) than those without MI did. Greater risk for anxiety and depressive disorders was observed among women and patients aged 45 to 64 years following an acute MI. Patients with post-MI anxiety had a 9.37-fold (95% CI: 4.45–19.70) higher risk of recurrent MI than those without MI did after adjustment for age, sex, socioeconomic status, and comorbidities.

This nationwide population-based cohort study provides evidence that MI increases the risk of anxiety and depressive disorders during the first 2 years post-MI, and post-MI anxiety disorders are associated with a higher risk of recurrent MI.

Abbreviations: BMI = body mass index, CI = confidence interval, CRF = corticotropin-releasing factor, HADS = Hospital Anxiety and Depression Scale, HPA = hypothalamic–pituitary–adrenal, HR = hazard ratio, ICD-9-CM = International Classification of Diseases, Ninth Revision, Clinical Modification, LHID2005 = The Longitudinal Health Insurance Database 2005, MI = myocardial infarction, NHI = National Health Insurance, NHIRD = National Health Insurance Research Database, SES = socioeconomic status.

Keywords: adverse cardiovascular event, anxiety, coronary heart disease, depression, mental disorder, myocardial infarction, risk factor

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1. Introduction

Acute myocardial infarction (MI) occurs when reduced coronary blood flow caused by thrombosis leads to a diminished supply of blood, myocardial oxygen, and nutrients, resulting in irreversible myocardial cell damage or death.[1] During an acute MI, most people typically experience sudden chest pain or discomfort, shortness of breath, cold sweating, nausea/vomiting, or light-headedness.[2] After an MI, patients experience anxiety, fear of dying, helplessness, or pain.[3] Some patients are likely to develop mental disorders after an acute MI.[4–8] Moreover, post-MI anxiety or depressive symptoms are associated with an increased risk of adverse cardiac outcomes including fatal and nonfatal cardiac events, hospital readmissions, all-cause mortality, and cardiac mortality.[9,10] Hence, early recognition and prevention of risk factors for anxiety or depression can reduce the years of life lost or disability resulting from an acute MI.

The occurrence of a life-threatening disease leads to the secretion of corticotropin-releasing factor (CRF) and arginine-vasopressin by the hypothalamus for activating the hypothalamic–pituitary–adrenal (HPA) axis.[11,12] Other neurotransmitter systems, such as serotonin, dopamine, and gamma-aminobutyric acid, are also involved in the activation of the HPA axis.[13] However, HPA axis dysregulation may trigger the onset of depression or anxiety.[13,14] Moreover, both anxiety and depression can affect cardiac prognosis by activating the HPA axis and renin–angiotensin–aldosterone system, increasing the risk of reduced heart rate variability[15] and baroreflex cardiac control,[16] and increasing the inflammatory response,[17] platelet

reactivity,[18] and endothelial function.[19] Because anxiety and depression share pathophysiological mechanisms with cardiac events, the possible relationship among anxiety, depression, and post-MI should be investigated.

A population-based longitudinal study confirmed that post-MI depressive symptoms are associated with an increased risk of new cardiovascular events and death,[9] particularly within 2 years after an MI.[4] Moreover, post-MI depression predicts poor quality of life.[20] A meta-analysis of 5750 patients with MI also demonstrated that patients with anxiety are at risk of adverse cardiac events and all-cause mortality.[10] However, most studies focusing on depression or anxiety have used rating scales or self-report methods rather than clinical diagnostic interviews to identify depression or anxiety following an MI. To date, no study has assessed clinical diagnosis of anxiety and depressive disorders after an acute MI in comparison with patients without MI. We hypothesize that (1) MI is associated with an increased risk of anxiety and depressive disorders; (2) during the first 2 years of follow-up, MI patients are at a higher risk of anxiety and depressive disorders; and (3) post-MI anxiety and depressive disorders increase the risk of subsequent cardiac events. Therefore, in the present cohort study, we used a nationwide population database to clarify the association between post-MI and the risks of anxiety or depressive disorders over a 5-year follow-up period.]

2. Materials and methods

2.1. Data source

Data were obtained from the National Health Insurance Research Database (NHIRD) of the National Health Insurance (NHI) program of Taiwan. This program, which was established in 1995, provides health insurance to >99% of the 23 million residents of Taiwan. The NHIRD contains information on clinical visits, including prescription details and diagnostic codes based on the International Classification of Diseases, Ninth Revision, Clinical Modification (ICD-9-CM). To improve diagnostic validity, all ICD-9-CM codes are given by board-certificated physicians. The Longitudinal Health Insurance Database 2005 (LHID2005) is a subset of the NHIRD, containing data of a representative population of 1 million individuals randomly selected from 22,717,053 insurants in 2005. No significant difference exists in the distribution of sex, age, and the average insured payroll-related amount between the LHID2005 and original NHIRD (http://nhird.nhri.org.tw/date_01_en.html). In the present study, we used inpatient expenditures per admission and ambulatory care expenditure per visit from the LHID2005 to evaluate the risk of anxiety and depressive disorders in post-MI patients. The variables provided in the database include the patient's sex, date of birth, disease diagnoses, and medication prescriptions. All patient identification numbers in the database are encrypted to ensure patient privacy. Several studies have demonstrated the accuracy and validity of the diagnoses in the NHIRD.[14,21,22] Therefore, the NHIRD is a suitable tool for this study. This study was approved by the Institutional Review Board of Tri-Service General Hospital, Taiwan (approval number: 2-102-05-045).

2.2. Study population

This cohort study examined the association between post-MI and the risk of anxiety disorders and depressive disorders. Patients aged ≥18 years who received a new diagnosis of acute MI (ICD-9-CM code 410.X) from a cardiologist between January 1 and December 31, 2005, were included in the study cohort. The index date was the date of MI diagnosis. The comparison cohort comprised patients with no history of MI, ischemia heart diseases, or mental disorders who were frequency matched by age and sex with the study cohort at a 1:10 ratio. In both cohorts, patients with a history of ischemia heart diseases or mental disorders before the index date were excluded. Ischemic heart diseases were defined as follows: acute MI (ICD-9-CM code410), other acute and subacute forms of ischemic heart disease (ICD-9-CM code411), old myocardial infarction (ICD-9-CM code412), angina pectoris (ICD-9-CM code413), and other forms of chronic ischemic heart disease (ICD-9-CM code414). Mental disorders were defined as follows: organic psychotic conditions (ICD-9-CM codes 290-294); other psychoses (ICD-9-CM codes 295-299); neurotic disorders, personality disorders, and other nonpsychotic mental disorders (ICD-9-CM codes 300-316); and mental retardation (ICD-9-CM codes 317-319).

2.3. Outcome measures

In this study, the primary endpoint was the diagnosis of anxiety or depressive disorder by a psychiatrist. Anxiety was defined as neurotic disorders (ICD-9-CM code 300), and depression was defined as major depressive disorder, single episode (ICD-9-CM code 296.2); major depressive disorder, recurrent episode (ICD-9-CM code 296.3); and depressive disorder, not elsewhere classified (ICD-9-CM code 311). Both cohorts were followed up from the index date until the diagnosis of anxiety or depressive disorder, death, withdrawal from the NHI program, or the end of 2010. In both cohorts, MI recurrence was defined as MI events occurring after a diagnosis of anxiety or depressive disorder. Baseline comorbidities identified from a literature review were listed as coexisting subsequent complications. Thus, the following conditions diagnosed before the index date were considered comorbidities: diabetes (ICD-9-CM code 250), hypertension (ICD-9-CM codes 401-405), hyperlipidemia (ICD-9-CM code 272), and cerebrovascular disease (ICD-9-CM codes 430-438). All medical diagnoses were given by physicians.

2.4. Statistical analyses

The distributions of the sociodemographic characteristics (such as age, sex, and socioeconomic status [SES]) and comorbidities were compared between the MI and non-MI cohorts. The chi-square test was used for categorical variables, and the Student's *t* test was used for continuous variables. The sex-, age-, SES-, and comorbidity-specific incidence rates of anxiety and depressive disorders per 1000 person-years of follow-up were calculated for each cohort. Cox proportional hazard regression models were used to estimate the hazard ratios of the risk of anxiety and depressive disorders in patients with MI compared with those without MI, as well as the risk of subsequent myocardial infarction associated with the synergistic interaction effects between myocardial infarction and anxiety and depressive disorder, after adjustment for age, sex, SES, and comorbidities. The Kaplan–Meier method was used with the log-rank test to compare the differences in the cumulative incidence curves between the patients with and without MI. Data management and statistical analyses were performed using SPSS (Version 18.0, SPSS Inc., Chicago, IL). Statistical significance was defined as $P < 0.05$.

3. Results

3.1. Baseline differences between 2 cohorts

Figure 1 displays a flowchart of the enrollment process. Overall, 1396 patients with MI and 13,960 patients without MI were identified in the NHIRD (Table 1). In both cohorts, 63.25% were men, and 59.81% were ≥65 years old. The distributions of sex and age did not differ significantly between the 2 cohorts. A higher proportion of patients with MI had hyperlipidemia (6.23% vs 2.41%; $P<0.001$), and a higher proportion of patients without MI had diabetes (14.11% vs 18.12, $P<0.001$), hypertension (18.98% vs 23.76%, $P<0.001$), and cerebrovascular disease (4.30 vs 10.30, $P<0.001$).

3.2. Incidence rates of anxiety and depressive disorders

During the entire follow-up period, 256 (18.34%) patients with MI and 2574 (18.44%) patients without MI received a diagnosis for anxiety or depressive disorders. The mean time to the occurrence of anxiety or depressive disorders in the study and comparison cohorts was 3.35 ± 2.07 and 3.36 ± 2.04 years, respectively. No significant difference was observed in the risk of overall anxiety or depression between the 2 cohorts after adjustment for age, sex, SES, and comorbidities (Table 2; $P=0.289$). However, the cumulative incidence of anxiety and depressive disorders was significantly higher in the study cohort than in the comparison cohort (log rank: 6.29, $P=0.012$) (Fig. 2). Moreover, after stratification by the follow-up period, the study cohort had a significantly higher risk of anxiety disorders (adjusted hazard ratio [HR] = 5.06, 95% confidence interval [CI]: 4.61–5.54) and depressive disorders (adjusted HR = 7.23, 95% CI: 4.88–10.88) during the first 2 years of follow-up than the comparison cohort. Sex-stratified analysis showed that women with MI had a higher risk of anxiety and depressive disorders compared with those without MI (adjusted HR = 1.56, 95% CI: 1.43–1.71). In the age-stratified analysis, patients with MI aged 45 to 64 years had a significantly higher risk of anxiety and depressive disorders than those without MI (adjusted HR = 1.29, 95% CI: 1.08–1.55).

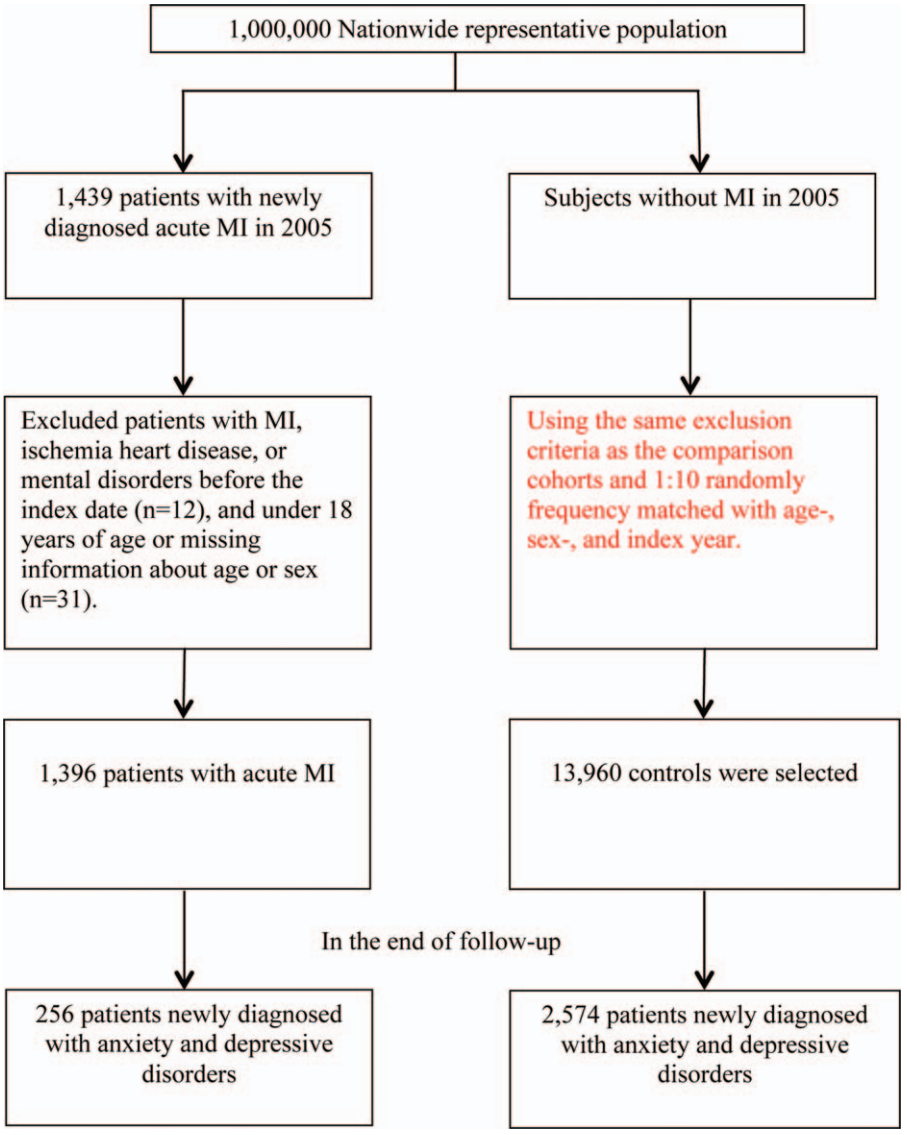

Figure 1. Flowchart of the selection method for the study and comparison cohorts.

Table 1

Characteristics and comorbidities in patients with and without myocardial infarction.

Variable	Myocardial infarction		*P*
	No N = 13,960	Yes 1396	
Sex*	n (%)	n (%)	1.000
Women	5130 (36.75)	513 (36.75)	
Men	8830 (63.25)	883 (63.25)	
Age, mean, SD†	65.33 (15.75)	65.99 (15.20)	0.134
Age categories*			1.000
< 45	1410 (10.10)	141 (10.10)	
45–64	4200 (30.09)	420 (30.09)	
≥ 65	8350 (59.81)	835 (59.81)	
Low-income households*			0.226
No	13,731 (98.36)	1367 (97.92)	
Yes	229 (1.64)	29 (2.08)	
Comorbidity*			
Diabetes	2529 (18.12)	197 (14.11)	<0.001
Hypertension	3317 (23.76)	265 (18.98)	<0.001
Hyperlipidemia	337 (2.41)	87 (6.23)	<0.001
CVA	1438 (10.30)	60 (4.30)	<0.001

CVA = cerebrovascular accident.
* Chi-squared test.
† Student's *t* test.

3.3. Risk of adverse cardiac events

Further analysis revealed that 155 (11.10%) patients died during the entire follow-up period, but none were associated with anxiety or depressive disorders in both cohorts. A total of 508 (36.39%) patients had recurrent MI in the study cohort and 1696 (12.15%) patients in the comparison cohort had a newly diagnosed MI. Overall, patients with an index MI had an increased risk of MI recurrence compared with those without MI (adjusted HR = 3.45, 95% CI: 2.11–5.65) (Table 3). Moreover, after adjustment for sex, age, low-income household, and comorbidities, the prevalence of recurrent MI was higher in the patients with post-MI anxiety disorders than in those without

Table 2

Incidence and hazard ratio of anxiety and depressive disorders stratified by sex, age, socioeconomic status, and comorbidities between patients with and without myocardial infarction.

Variable	Myocardial infarction						Crude HR (95% CI)	*P*	Adjusted HR† (95% CI)	*P*
	No			Yes						
	Event	PY	Rate*	Event	PY	Rate*				
Total	2574	41,014	62.76	256	3766	67.99	1.084 (0.953–1.232)	0.220	1.088 (0.931–1.273)	0.289
Anxiety	2463	41,014	60.05	241	3766	64	1.080 (0.930–1.254)	0.311	1.066 (0.909–1.249)	0.499
< 2‡	1583	3828	413.55	177	373	474.00	4.965 (4.538–5.432)	<0.001	5.056 (4.613–5.541)	<0.001
2–5‡	880	37,186	23.66	64	3392	18.87	0.201 (0.184–0.220)	<0.001	0.198 (0.180–0.217)	<0.001
Depression	128	41,014	3.12	16	3766	4.25	1.359 (0.808–2.285)	0.248	1.301 (0.767–2.208)	0.329
< 2‡	98	3828	25.60	14	373	37.49	6.646 (4.480–9.861)	<0.001	7.228 (4.881–10.883)	<0.001
2–5‡	30	37,186	0.81	2	3392	0.59	0.150 (0.101–0.2223)	<0.001	0.137 (0.092–0.205)	<0.001
Sex										
Women	1190	14,703	80.93	105	1193	88.04	1.509 (1.402–1.625)	<0.001	1.564 (1.428–1.713)	<0.001
Men	1384	26,310	52.60	151	2573	58.69	0.663 (0.615–0.714)	<0.001	0.639 (0.584–0.700)	<0.001
Age										
< 45	171	4,426	38.63	29	329	88.03	0.664 (0.575–0.767)	<0.001	1.135 (0.954–1.349)	0.152
45–64	805	12,872	62.54	84	1263	66.52	1.475 (1.266–1.719)	<0.001	1.291 (1.078–1.546)	0.005
≥ 65	1598	23,715	67.38	143	2173	65.80	1.523 (1.315–1.763)	<0.001	0.881 (0.741–1.048)	0.152
Low-income households										
No	2535	40,526	62.55	246	3702	66.45	0.744 (0.561–0.987)	0.040	1.236 (0.881–1.735)	0.220
Yes	39	488	79.91	10	63	158.08	1.345 (1.014–1.783)	0.040	0.809 (0.576–1.135)	0.220
Comorbidities										
No	1938	31,514	61.50	194	2635	73.61	0.944 (0.866–1.028)	0.183	0.965 (0.869–1.071)	0.503
Yes	636	9500	66.95	62	1131	54.82	1.060 (0.973–1.154)	0.183	1.036 (0.933–1.151)	0.503

CI = confidence interval, HR = hazard ratio, PY = person-years.
* Rate is defined as the incidence rate, per 1000 PY.
† Adjusted for sex, age, low-income households, and comorbidities.
‡ Cumulative incidence of years.

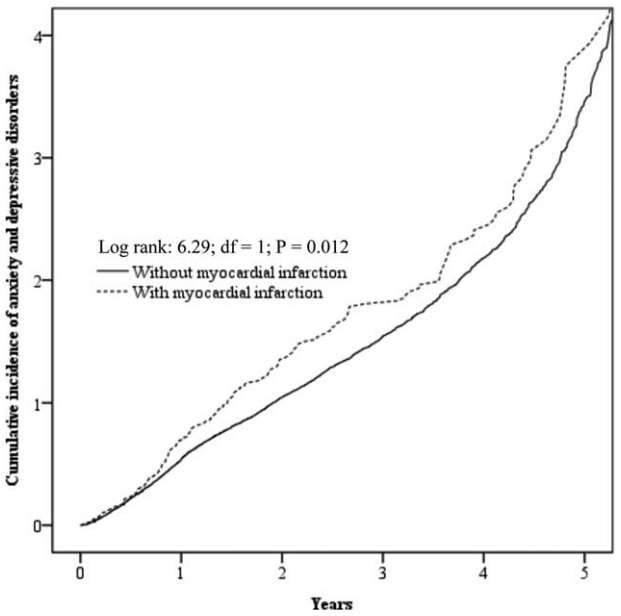

Figure 2. Cumulative incidence of anxiety and depressive disorders in patients with (dashed line) and without (solid line) myocardial infarction.

MI (adjusted HR = 9.37, 95% CI: 4.45–19.70). After additional adjustment for post-MI depression, anxiety disorders remained an independent predictor of recurrent MI (adjusted HR = 8.91, 95% CI: 4.23–18.74).

4. Discussion

This nationwide cohort study investigated the risk of clinical anxiety and depressive disorders requiring psychiatric treatment and adverse cardiac events in post-MI patients. The major finding of this study is that patients with MI had a higher risk of being newly diagnosed with anxiety and depressive disorders compared with those without MI during the first 2 years of follow-up. Specifically, patients with post-MI anxiety disorders had a higher risk of recurrent MI after adjustment for sex, age, SES, and comorbidities. Sex- and age-stratified analyses show that women and patients aged 45 to 64 years had a higher risk of anxiety and depressive disorders in the study cohort.

Our results indicate that the incidence rate of newly diagnosed anxiety and depressive disorders following an acute MI was 18.34% (anxiety disorders: 17.26%; depressive disorders: 1.15%). In a cohort study, Walters et al[23] reported that an incidence rate of 18.56% in 803 primary patients with MI in the United Kingdom, consistent with our finding. However, in a 10-year follow-up study, Roestt et al[24] found that 5.5% of 438 patients with acute MI were diagnosed with generalized anxiety disorder in the Netherlands. A cohort study revealed that 19.4% of 173 patients who had a paid job received a diagnosis of a major depressive episode, and 11.9% received a diagnosis of an anxiety disorder during the first 3 months following an MI.[25] A 2-year follow-up study found that of 804 patients, 7.1% and 5.3% met the criteria for major depressive disorder and generalized anxiety disorders, respectively.[26] The discrepancy between these findings is likely attributable to the following reasons.

First, most previous studies have identified depressive or anxiety symptoms and depressive or anxiety disorders by using rating scales, such as the Hospital Anxiety and Depression Scale (HADS), rather than clinical diagnosis by psychiatrists. Second, cultural differences may affect the reporting of anxiety and depressive disorders. The Chinese concept of the "heart" (*xin*), an organ of emotions, differs from the anatomical heart in English.[27] In addition to being an internal organ, *xin* is used by Chinese people as the center of the phraseological cluster to describe their emotions following an acute MI. Cardiologists may be unable to differentiate between somatic and psychological complaints when patients describe their illness experiences, limiting referrals for psychiatrists. Third, anxiety and depression exhibit a moderate-to-strong correlation.[28] In the present study, we included only patients with psychiatrist-diagnosed anxiety and depressive disorders; those who were not prescribed antianxiety agents or antidepressants were excluded. However,

Table 3

Cox proportional hazard regression models of the risk of subsequent myocardial infarction with the synergistic interaction effects between myocardial infarction and anxiety and depressive disorders.

Variables		Event*	PY	Rate†	Adjusted HR‡ (95% CI)	*P*
Index MI	Anxiety and depressive disorders					
No	No	1685	25,908.68	65.04	Reference	
No	Yes	11	282.08	39.00	0.679 (0.511–0.903)	0.008
Yes	No	501	2457.05	203.90	3.201 (2.891–3.543)	<0.0001
Yes	Yes	7	16.86	415.18	3.447 (2.105–5.645)	<0.0001
Index MI	Anxiety disorders					
No	No	1687	26,008	64.86	Reference	
No	Yes	9	183	49.22	0.727 (0.378–1.400)	0.340
Yes	No	501	2457	203.90	3.209 (2.902–3.548)	<0.0001
Yes	Yes	7	17	415.18	9.366 (4.452–19.701)	<0.0001
Index MI	Depressive disorders					
No	No	1694	26,091.39	64.93	Reference	
No	Yes	2	99.37	20.13	0.327 (0.082–1.309)	0.114
Yes	No	508	2473.91	205.34	3.237 (2.929–3.577)	<0.0001
Yes	Yes	0	–	–	–	–

CI = confidence interval, HR = hazard ration, PY = person year.

* Event is defined as subsequent myocardial infarction.

† Rate is defined as the incidence rate, per 1000 PY.

‡ Adjusted for sex, age, low-income households, and comorbidities.

compared with other countries, Taiwan exhibits lower prevalence and incidence rates for anxiety and depressive disorders.[29,30] Therefore, our study may reflect the overall conditions of psychiatrist-diagnosed anxiety and depressive disorders in Taiwan.

Several studies have demonstrated that anxiety and depression are the most common psychological symptoms in patients with MI.[31–34] Our findings reveal that MI is a risk factor for clinical anxiety and depressive disorders during the first 2 years, and post-MI anxiety increases the risk of recurrent MI. The association may be attributed to the following reasons. First, when an individual is faced with challenges or dangers, such as acute MI, the sympathetic nervous system and HPA axis are activated to regain homeostasis. However, stressful life events lead to alterations in the stress response of the HPA axis, predisposing individuals to developing psychopathologies such as anxiety and depressive disorders.[23,24] Second, anxiety and depressive disorders increase the vulnerability to cardiac reactivity by weakening the immune system, enhancing proinflammatory activity, impairing endothelial function, and increasing platelet activity and aggregation; all these factors exacerbate cardiovascular diseases.[35,36] Third, patients with post-MI anxiety and depressive disorders are less likely to engage in healthy lifestyles, including smoking cessation, weight reduction, regular exercise, maintaining a healthy diet, medication adherence, and stress reduction.[24,35] Therefore, our cohort study extends knowledge on post-MI by showing that recurrent MI is associated with a significantly higher risk of anxiety and depressive disorders. Because our study is observational rather than experimental in design, additional studies should identify the bidirectional causal relationship between MI and anxiety or depressive disorders.

Some studies have indicated that post-MI anxiety and depressive disorders are associated with a higher mortality rate.[5,37,38] However, in our study, 155 (11.1%) post-MI patients who died did not develop a depressive or anxiety disorder during the follow-up period. This difference may be attributable to the mortality rate in the past decade is lower because of improvements in MI treatment and evidence-based secondary prevention following MI. Moreover, the cardiac mortality rate is related to cardiac status. Because of the lack of information on left ventricular ejection fraction, thrombolysis, and other impaired physical conditions in NHIRD, whether the severity of the cardiac disorder is a confounder could not be determined in our study. Although anxiety increases physical symptoms and worsens functional status and quality of life, anxious patients are more likely to seek help from their doctors to improve their medical status.[10,20] Further research on the association between post-MI anxiety disorders and cardiac prognosis is warranted.

In our study, acute MI was more prevalent in men, but women had a higher risk of depression and anxiety disorders. Similar results have been reported in several studies.[39–41] A possible explanation is that women have more comorbidities, including diabetes mellitus, hypertension, atrial fibrillation, and congestive heart failure.[42,43] In this study, among patients with post-MI anxiety or depressive disorders, more comorbidities were observed in women than in men (26.67% vs 22.52%). In addition, sex majorly influences typical stressors, coping resources, and role structures for expressing psychological distress.[44] A cross-sectional study in Norway indicated that more women reported depression, sleep disturbances, and high family stress than men in the year prior to first-time MI.[45] A meta-analysis also revealed that biological factors (e.g., hormones) and psychosocial factors (e.g., role overload) possibly explain the significantly higher burden of emotional distress in women with coronary artery diseases than in men.[40] Therefore, gender roles may majorly influence post-MI recovery.

Another finding of our study is that middle-aged patients (45–64 years) with MI had a higher risk of anxiety and depressive disorders. Previous studies demonstrated that young- and middle-aged patients experienced higher stress after acute MI.[46,47] Age may be a crucial factor influencing the relationship between post-MI conditions and psychological distress, because patients at various life stages experience different stressors (e.g., job strain and parenting), priorities, and physical status.[48] In middle age, post-MI survivors were the main income earners in their families; they also must cope with demands associated with physical changes, which may affect personal and social life, leading to a decline in work performance. Wang and Wang[49] examined the risk factors for psychological distress and the behavioral factors for heart disease separately for different age groups and found that unemployment and serious psychological distress were associated with heart disease patients <65 years. In addition, heart attacks leading to limited physical activity or worse health status may affect survivors' illness perceptions.[50] The illness perceptions of post-MI patients are associated with lower mental and physical health-related quality of life.[51] Therefore, supporting post-MI patients in improving their perception of personal control may affect their personal and social lives, particularly in middle age.

Although our study used population-based NHIRD records rather than self-reported data on anxiety and depression, there are still some limitations. First, we excluded those with a history of any coronary heart disease or psychiatric disorders from 1997 to 2004, which may have eliminated confounding factors, leading to fewer patients with depressive disorder and a lower mortality rate in the post-MI group. Second, we investigated the risk of mortality in post-MI patients by using inpatient expenditures per admission; the mortality rate may have been underestimated because we did not account for people who did not seek medical assistance when they were dying. Third, other than disease-related data, the NHIRD contains limited information on potentially confounding factors (e.g., family medical history, educational level, subjects' lifestyles, body mass index [BMI], and blood levels), limiting the findings of this study. Future studies must be conducted in a clinical setting to overcome these limitations. Additional studies should investigate psychological or self-management interventions to improve the psychological well-being of patients and aid with recovery after an acute MI.

Our results indicate that post-MI patients have a high risk of receiving a new diagnosis of anxiety and depressive disorders during the first 2 years of follow-up. Women and patients aged 45 to 64 years have an increased risk for anxiety and depressive disorders. Furthermore, patients with post-MI anxiety disorders have a higher risk of recurrent MI. To prevent adverse cardiac events, patients with acute MI should be earlier assessed to identify post-MI psychological distress and provide age- and sex-specific care.

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