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Incidence and risk of mood disorders in patients with breast cancers in Taiwan: a nationwide population-based study

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Abstract

***Objective*: The objective of this study is to assess the incidence and risk of mood disorders, including major depression, anxiety, and bipolar disorders, in Taiwanese patients after the diagnosis of breast cancer compared with a matched cohort.**

***Methods*: From January 2000 to December 2005, 26,629 newly diagnosed breast cancer patients were enrolled by the Taiwan National Health Insurance program database. The control cohort was selected randomly from 1,000,000 National Health Insurance beneficiaries from a population of 21,400,826 enrolled throughout Taiwan. Each patient was matched with one subject without breast cancer by age, sex, and presence of comorbidities with the same diagnosis index date. The diagnosis of mood disorders was defined by compatible International Classification of Diseases, 9th revision, clinical modification codes plus the prescription of antidepressants for at least 30 days.**

***Results*: The overall incidence rate ratio of mood disorders was 1.33 (95% CI 1.28–1.39, $p < 0.001$) in the breast cancer cohort compared with the matched cohort. The incidence rate ratios for specific mood disorders were 2.06 for bipolar disorder (95% CI 1.37–3.15 $p = 0.0003$), 1.94 for major depressive disorder (95% CI 1.76–2.13 $p < 0.001$), and 1.22 for anxiety (95% CI 1.16–1.27 $p < 0.001$). Independent risk factors for developing mood disorders included breast cancer, as well as age, hypertension, chronic obstructive pulmonary disease, autoimmune disease, ischemic heart disease, and cerebrovascular disease.**

***Conclusions*: Breast cancer is a prominent risk factor for mood disorders, including major depressive disorder, anxiety, and bipolar disorder. The impact is most potent in the first year after diagnosis. Psychological support is a critical issue in these patients.**

Introduction

Cancer is a risk factor for developing mood disorders, especially anxiety and depression [1–9]. Among all cancers, breast cancer is the most commonly diagnosed cancer among women in Taiwan, and the incidence rate is increasing every year. In 2008, there were 8136 new breast cancer cases, and the life-time risk for women was 1/19. (http://www.bhp.doh.gov.tw/BHPnet/Portal/StatisticsShow.aspx?No=201105200001). Among the causes of cancer-related mortality, breast cancer is also the second most common cause of death in women in Taiwan. Previous studies reported that there was an increased risk of mood disorders in breast cancer patients. The causes of mood disorders might be the profound physical and mental impact upon the patients because of the surgery, changes in body image, and side effects following radiotherapy, hormone therapy, and chemotherapy [10–14]. However, the prevalence of mood disorders in breast cancer patients is diverse in different countries and according to different study designs. In UK, a national multicenter clinical trial of 2208 postoperative breast cancer patients reported that the prevalence of anxiety was 12.6–14.4% and the prevalence of depression was 3.1–3.3% in the 60 months following surgery [15]. Another nationwide study in Denmark showed a depressive disorder prevalence rate of 13.7% in a breast cancer cohort of 4917 patients [16]. Bower *et al*. recruited 1957 breast cancer survivors from two large metropolitan cities in the USA and observed 25% of prevalent depression [17]. In Asia, several single-institute studies reported the prevalence of anxiety was 21.1% and the prevalence of depression was 12.6–34.4% [18,19].

All of these studies demonstrate an increased risk of mood disorders in patients with breast cancer. Mood disturbances may influence treatment compliance and reduce quality of life, and they may influence treatment outcomes [15–18]. Lower depression symptoms have been reported to be associated with improved long-term survival in patients with metastatic breast cancer [19]. To date, there have been no nationwide studies on this topic in Asia, and most of the previous studies focused on major depression and anxiety disorder.

In Taiwan, the National Health Insurance (NHI) program covers most of the population. A majority of medical institutions (93%) have been contracted to the Bureau of the NHI, and more than 96% of the population covered by the NHI has utilized health services through contracted medical institutions. Therefore, information from the NHI database is representative and can be considered as a population-based source for estimating the prevalence of disease. This database can be used to find a patient's date of diagnosis, treatment options, chemotherapy treatment received, and antidepressant use if depression developed. Therefore, we performed a nationwide, population-based study using data obtained from the NHI database. The aim of this study was to assess the incidence and risk of mood disorders, including major depression, anxiety, and bipolar disorders, in Taiwanese patients after the diagnosis of early and advanced stage breast cancer in comparison with a matched cohort.

Patients and methods

Data sources

The Taiwan NHI program, which the government initiated in 1995, provides comprehensive health care for all of its citizens. Enrollment in this program is mandatory, and the proportion of the population insured reached 98.29% in 2006 [20,21]. The NHI program provides comprehensive medical care, including outpatient, inpatient, emergency, dental, prescription drug, and traditional Chinese medicine services. Multiple NHI databases (e.g., NHI enrollment files, claims data, and prescription drug registry) are managed and publicly released by the National Health Research Institute, Taiwan. These databases provide comprehensive utilization and enrollment information for all patients with catastrophic illnesses who are exempted from copayments under the NHI program. Patients with breast cancer and control subjects were identified from the NHI database. All information that may potentially identify any individual patient was encrypted. The confidentiality of the patient's data stored in the registry is guaranteed by the data regulations of the Bureau of NHI and the National Health Research Institute.

Study population

Using the discharge codes (174.X) of the International Classification of Diseases, 9th revision, clinical modification (ICD-9-CM) in the Registry of Catastrophic Illness, we identified 36,255 women who were newly diagnosed with breast cancer between January 1, 2000 and December 31, 2005, and followed to December 31, 2006. Patients who had antecedent mood disorders prior to cancer diagnosis were excluded ($n = 9626$). Mood disorders were defined by compatible ICD-9-CM codes (bipolar: 296.0X–296.1X, 296.4X–296.8X; depressive disorder: 296.2X–296.3X, 300.4, 311.X; anxiety: 300–300.3, 300.5, 300.7–300.9) [22–24]. Development of mood disorders was defined by compatible ICD-9-CM codes and the prescription of psychotropic agents for at least 30 days. [24–26]. Information on comorbidities, operations, and medications were collected for analysis.

Control cohort

Subjects without breast cancer were used as the matched cohort (nonexposed subjects) and were randomly selected from 1,000,000 NHI beneficiaries out of a population of 21,400,826 enrollees throughout Taiwan. Each patient with breast cancer was matched with one nonexposed subject by age, sex, and presence of comorbidities with the same diagnosis index date. The selection of comorbidities was according to the Charlson comorbidity index [27]. This index could predict outcome and mortality quite well and had been applied broadly [28,29]. Therefore, these comorbidities are representative to the chronic medical condition of the patients. The same exclusion criteria were applied to the control cohort. A total of 26,629 subjects served as the matched control cohort for comparison.

Statistical analyses

The main dependent variable was the incidence of mood disorders. The two cohorts were followed until the development of mood disorders, death, or the end of the study period (2006). Each subject was followed for a maximum of 7 years. Incidence rates (per 1000 person-years) and incidence rate ratios (IRRs) were analyzed. Formal comparisons between groups were made using the χ^2 test for categorical variables. The Kaplan–Meier method was employed for estimation of cumulative incidence and overall survival rate. A Cox proportional hazard model was used to identify risk factors for mood disorders. Control variables, such as age, sex, comorbidities, operations, and prescription drug administration, were included in the model. Extraction and computation of data were performed using the Perl programming language (version 5.12.2). Microsoft SQL Server 2005 (Microsoft Corp., Redmond, WA, USA) was used for data linkage, processing, and sampling. All statistical analyses were performed using IBM SPSS statistical software (version 19.0 for Windows; IBM Corp., New York, NY, USA). $p < 0.05$ was considered to be statistically significant.

Results

Clinical characteristics of the study population

During the study period, a total of 26,629 patients with breast cancer were enrolled. The patients ranged in age from 20 to 96 years and had a median age of 44 years. The most common underlying diseases were hypertension (23%), diabetes mellitus (13.9%), and chronic pulmonary disease (10.8%). The demographic data and comorbidities of the patients with breast cancer and the matched group are shown in Table 1. Age, gender, economic income, geographic region, income-related insured amount, and all of the listed comorbid diseases were matched. The median follow-up period for the matched group was 3.22 years, significantly longer than the 2.70 years for the breast cancer cohort ($p < 0.001$ by Mann–Whitney test).

Incidence rates of mood disorders

Of the total 53,258 patients, 9671 patients (18.2%) were diagnosed with mood disorders, 5223 were from the breast cancer group (incidence 65.04 per 1000 person-years) and

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Table 1. Baseline characteristics of patients with breast cancer and matched cohort

	Patients with breast cancer, $n = 26,629$		Matched cohort, $n = 26,629$		
Characteristics	**No.**	**%**	**No.**	**%**	***p***
Median age, (range)	49 (20–96)		49 (20–96)		
<40	4209	15.8	4209	15.8	1
40–59	16,543	62.1	16,543	62.1	
≥60	5877	22.1	5877	22.1	
Sex					
Female	26,629	100	26,629	100	1
Comorbidities					
Diabetes mellitus	3700	13.9	3700	13.9	1
Hypertension	6125	23.0	6125	23.0	1
Congestive heart failure	815	3.1	856	3.2	0.308
Chronic obstructive pulmonary disease	2873	10.8	2873	10.8	1
Chronic kidney disease	1295	4.9	1295	4.9	1
Liver cirrhosis	250	0.9	250	0.9	1
Autoimmune diseases	1269	4.8	1269	4.8	1
Cerebrovascular accident	1463	5.5	1463	5.5	1
Ischemic heart disease	2641	9.9	2641	9.9	1
Geographic region					1
Urban	18,149	68.2	18,150	68.2	
Suburban	6800	25.5	6799	25.5	
Rural	1680	6.3	1680	6.3	
Income-related insured amount					
<20,000 NTD/month	6838	25.7	6838	25.7	1
20,000–39,999 NTD/month	12,119	45.5	12,119	45.5	1
≥40,000 NTD/month	7672	28.8	7672	28.8	1
Follow-up years (median range)	2.70		3.21		<0.001

NTD, new Taiwan dollars.

4448 were from the matched cohort (48.74 per 1000 person-years, $p < 0.001$). Kaplan–Meier estimates of the cumulative incidence of mood disorders in the breast cancer patients and matched cohort are shown in Figure 1. The cumulative incidence of mood disorders in the breast cancer patients was significantly higher than that in the matched cohort ($p < 0.001$). The IRR was 1.33 (95% CI 1.28–1.39, $p < 0.001$) in the breast cancer cohort compared with the matched cohort. As shown in Table 2, there were differences in the IRR of mood disorders in patients stratified by age, geographic region, and income-related insured amount. Younger patients (<40 years old) had a higher IRR than older patients (IRR 1.51, 95% CI 1.34–1.69, $p < 0.001$). When the population was divided by geographic region, the IRR was higher in the urban patients (IRR 1.34, 95% CI 1.27–1.40, $p < 0.001$) than in the rural patients. When considering income, the IRR was higher in the group with an income <20,000 New Taiwan Dollars (NTD)/month (IRR 1.40, 95% CI 1.30–1.52) than in patients with a higher income. When considering comorbidities, there were significantly higher IRRs in the patients with diabetes mellitus (IRR 1.18, 95% CI 1.06–1.31, $p = 0.002$), hypertension (IRR 1.09, 95% CI 1.01–1.18, $p = 0.0027$), and chronic obstructive pulmonary disease (COPD; IRR 1.16, 95% CI 1.03–1.30, $p = 0.012$). In contrast, patients with congestive heart failure, chronic kidney disease, liver cirrhosis, autoimmune disease, ischemic heart disease, and cerebrovascular disease did not show higher IRRs. Patients with breast cancer that were diagnosed within 1 year had higher incidence rate of developing mood disorders than the matched cohort (IRR 2.07, 95% CI 1.94–2.12, $p < 0.001$). In contrast, there was no significant difference in the IRR between the two groups when the patients had a follow-up of more than 1 year.

Incidence of specific types of mood disorders

Table 3 shows the incidence of different types of mood disorders among patients with breast cancer and the matched cohort. The IRR of all mood disorder was 1.33 (95% CI 1.28–1.39, $p < 0.001$). In the subclassification of mood disorders in the breast cancer cohort, the IRR of bipolar disorder was 2.06 (95% CI 1.37–3.15 $p = 0.0003$), for depressive disorder was 1.94 (95% CI 1.76–2.13 $p < 0.001$), and for anxiety was 1.22 (95% CI 1.16–1.27 $p < 0.001$).

Risks factors for mood disorders in the cohort

The Cox regression analysis was performed on the two groups. The Cox univariate proportional hazards analysis showed that patients with breast cancer, older age, diabetes mellitus, hypertension, congestive heart failure, COPD, chronic kidney disease, liver cirrhosis, autoimmune disease, ischemic heart disease, cerebrovascular disease, those living in urban regions (compared with rural regions), and the high income group had higher risks of mood disorders. In the Cox multivariate proportional hazards analysis, breast cancer (hazard ratio (HR) 1.31, 95% CI 1.26–1.36, $p < 0.001$), age (HR 1.003, 95% CI 1.001–1.005, $p = 0.001$), hypertension (HR 1.16 95% CI 1.10–1.25, $p < 0.001$), COPD (HR 1.18, 95% CI 1.10–1.25, $p < 0.001$), autoimmune disease (HR 1.30, 95% CI 1.20–1.42, $p < 0.001$), ischemic heart disease (HR 1.22, 95% CI 1.14–1.31, $p = 0.001$), and cerebrovascular disease (HR 1.11, 95% CI 1.02–1.21 $p = 0.016$) were independent risk factors for developing mood disorders (Table 4).

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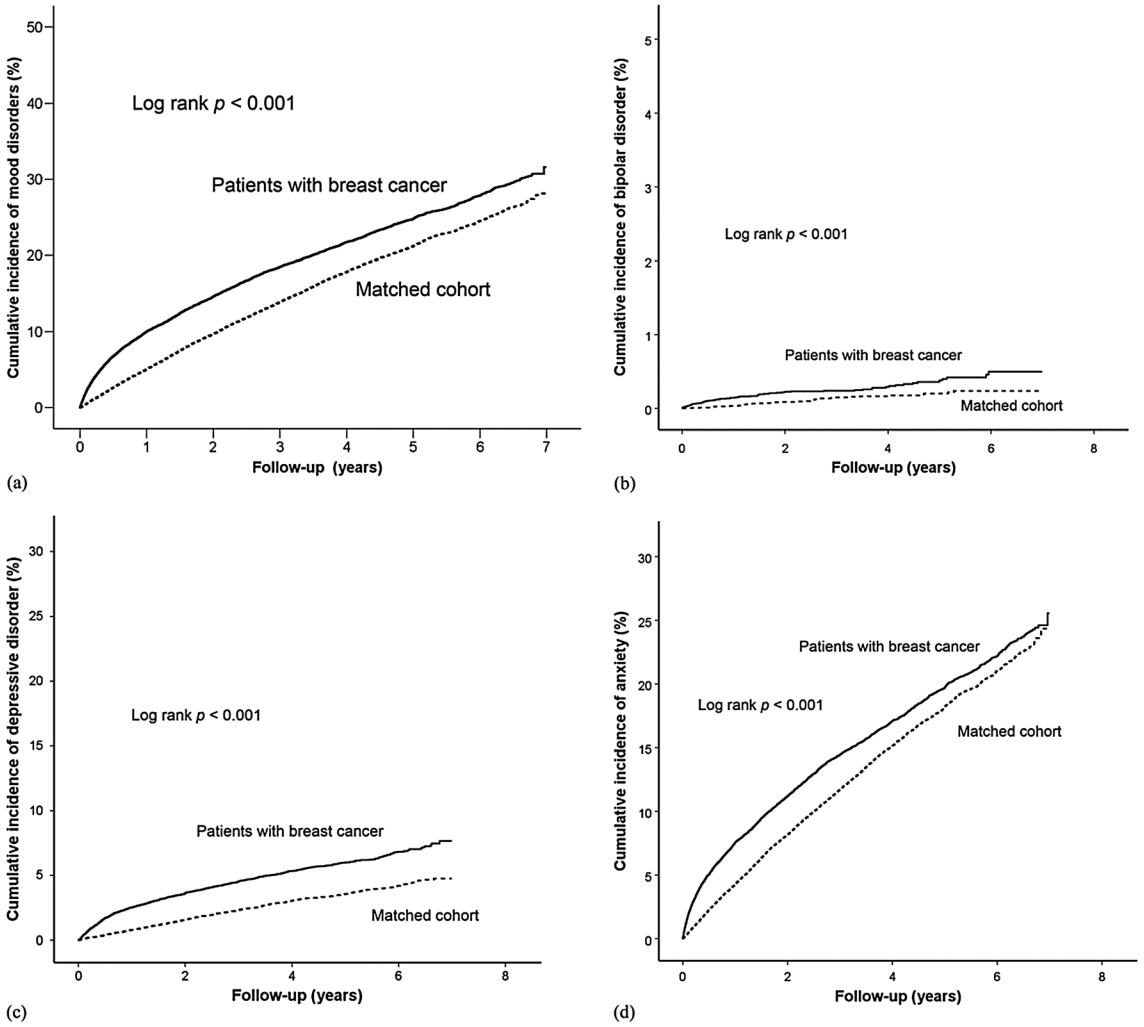

Figure 1. (a) Cumulative incidence of all mood disorders in patients with breast cancer and the matched cohort, (b) cumulative incidence of bipolar disorder in patients with breast cancer and the matched cohort, (c) cumulative incidence of depressive disorder in patients with breast cancer and the matched cohort, and (d) cumulative incidence of anxiety in patients with breast cancer and the matched cohort

Discussion

The results of this nationwide, population-based study demonstrated that the prevalence of mood disorders was 19.6% in the breast cancer cohort and 16.7% in the matched cohort. Our findings in this large-scale study were in accord with the results of previous smaller-scale studies in Asia [30–32]. There was a significantly increased risk of mood disorders (IRR of 1.33) in the breast cancer cohort compared with the matched controls during the follow-up period. The increased risk was universal in every subgroup when the subjects were matched for confounding factors. There are several important findings of the work. Firstly, there was an increased risk of anxiety and depressive disorder in breast cancer patients, and this risk was most distinct for bipolar disorder. Secondly, the increased risk of mood disorders was only present within the first year of breast cancer diagnosis but not in the follow-up period after the first year. Thirdly, we observed a trend showing a higher risk of mood disorders in younger patients.

To the best of our knowledge, this is the largest study to analyze mood disorder risk in breast cancer patients. Our study adopted an age- matched and comorbidity-matched cohort as the control group. We also matched the subjects by geographic region and income-related insurance amount. All of these factors were previously reported to be contributing factors to mood disorders [33]. Using this study design, we obtained the IRR of each subpopulation for mood disorders and developed Kaplan–Meier survival curves with the longitudinal data. In contrast with our study, most of the previous studies were cross-sectional. Furthermore, the present study is based on a claim-based dataset, so the data related to medical charges, such as examinations and medications, are relatively precise. In the NHI system, certification of catastrophic diseases can exempt patients from related medical charges, and the verification of catastrophic diseases is very strict. For example, catastrophic certification for malignancy requires tissue confirmation, and mood disorders are confirmed by the prescription of mood disorder-related medication for more than 30 days. The certification process makes the diagnosis of mood disorders and breast cancer in this study highly exhaustive and reliable.

Among all the mood disorders we analyzed, there was an increased risk of depression and anxiety in the breast cancer cohort, which was reported in previous studies [3,30,33–37]. However, it is noteworthy that there was also an increased incidence of bipolar disorder in the breast cancer cohort. This finding has never been previously reported. There are a number of possible causes for the increased incidence of bipolar disorder in breast

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Table 2. Incidences of mood disorders for patients with breast cancer and matched cohort

	Patients with breast cancer, $n = 26,629$		Matched cohort, $n = 26,629$			
Characteristics	**No. of mood disorders**	**Per 1000 person-year**	**No. of mood disorders**	**Per 1000 person-year**	**IRR (95% CI)**	***p***
Total	5223	65.04	4448	48.74	1.33 (1.28–1.39)	<0.0001
Age						
<40	706	52.98	534	35.20	1.51 (1.34–1.69)	<0.001
40–59	3372	67.42	2757	48.42	1.39 (1.32–1.46)	<0.001
≥60	1145	67.53	1157	60.43	1.12 (1.03–1.21)	<0.001
Comorbidities						
Diabetes mellitus	741	74.21	695	62.97	1.18 (1.06–1.31)	0.002
Hypertension	1277	75.18	1292	68.91	1.09 (1.01–1.18)	0.027
Congestive heart failure	172	85.98	186	83.01	1.03 (0.84–1.28)	0.739
COPD	618	80.97	583	70.02	1.16 (1.03–1.30)	0.012
Chronic kidney disease	257	75.13	248	66.46	1.13 (0.95–1.35)	0.169
Liver cirrhosis	41	61.57	51	73.77	0.84 (0.54–1.28)	0.391
Autoimmune diseases	290	86.53	273	75.83	1.14 (0.96–1.35)	0.118
Ischemic heart disease	590	83.26	618	81.26	1.02 (0.91–1.15)	0.674
Cerebrovascular disease	318	85.18	310	73.98	1.15 (0.98–1.35)	0.078
Geographic region						
Urban	3536	64.26	2993	48.07	1.34 (1.27–1.40)	<0.001
Suburban	1348	66.50	1157	49.72	1.34 (1.24–1.45)	<0.001
Rural	339	67.81	298	52.11	1.30 (1.11–1.53)	0.0009
Income–related insured amount						
<20,000 NTD/month	1353	68.24	1178	48.64	1.40 (1.30–1.52)	<0.001
20,000–39,999 NTD/month	2387	64.43	2020	49.19	1.31 (1.23–1.39)	<0.001
≥40,000 NTD/month	1483	63.30	1250	48.14	1.32 (1.22–1.42)	<0.001
Follow-up						
0–1 year	2617	107.39	1339	51.88	2.07 (1.94–2.12)	<0.001
≥1 year	2606	46.59	3109	47.50	0.98 (0.93–1.03)	0.467

IRR, incidence rate ratio; CI, confidence interval; COPD, chronic obstructive pulmonary disease; NTD, new Taiwan dollars.

Table 3. Incidence of different types of mood disorders among patients with breast cancer and matched cohort

Subtype of mood disorders (ICD-9)	Patients with breast cancer, $n = 26,629$		Matched cohort, $n = 26,629$			
	No. of mood disorders	**Per 1000 person-year**	**No. of mood disorders**	**Per 1000 person-year**	**IRR (95% CI)**	***p***
Bipolar	69	0.86	38	0.42	2.06 (1.37–3.15)	0.0003
Depressive disorder	1168	14.55	685	7.51	1.94 (1.76–2.13)	<0.001
Anxiety	3986	49.64	3725	40.82	1.22 (1.16–1.27)	<0.001
Total mood disorders	5223	65.04	4448	48.74	1.33 (1.28–1.39)	<0.001

ICD, International Classification of Diseases; IRR, incidence rate ratio; CI, confidence interval.

Table 4. Multivariate analysis for prediction of development of mood disorders

	Univariate analysis			Multivariate analysis		
Variables	**HR**	**95% CI**	***p* value**	**HR**	**95% CI**	***p* value**
Breast cancer	1.35	1.30–1.41	<0.001	1.31	1.26–1.36	<0.001
Age	1.01	1.008–1.012	<0.001	1.003	1.001–1.0055	0.001
Diabetes mellitus	1.28	1.21–1.35	<0.001			
Hypertension	1.37	1.31–1.43	<0.001	1.16	1.10–1.22	<0.001
Congestive heart failure	1.38	1.24–1.54	<0.001			
COPD	1.34	1.26–1.42	<0.001	1.18	1.10–1.25	<0.001
Chronic kidney disease	1.27	1.16–1.39	<0.001			
Liver cirrhosis	1.23	1.01–1.51	0.042			
Autoimmune disease	1.47	1.35–1.59	<0.001	1.30	1.20–1.42	<0.001
Ischemic heart disease	1.40	1.29–1.52	<0.001	1.22	1.14–1.31	0.001
Cerebrovascular disease	1.39	1.28–1.51	<0.00	1.11	1.02–1.21	0.016
Urban versus rural	0.92	0.85–1.00	0.044			
Suburban versus rural	0.94	0.86–1.03	0.168			
20,000–39,999 versus <20,000 NTD/month	0.97	0.92–1.02	0.223			
≥40,000 versus <20,000 NTD/month	0.94	0.89–1.00	0.039			

HR, hazard ratio; CI, confidence interval; COPD, chronic obstructive pulmonary disease.

cancer patients. Firstly, hormones may play an important role in the onset of bipolar disorder. Previous studies reported a correlation between hormone level and bipolar episodes [38,39]. Hormone therapy has been used to treat patients with bipolar disorder [40], and hormone therapy is a routine in premenopausal patients with hormone

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receptor-positive breast cancer [41]. Secondly, gene polymorphisms may contribute to the onset of disease. A gene-wide association study found significant associations between bipolar disorder and the breast cancer related genes BRCA2 and PALB2 [42]. Thirdly, hypothalamic-pituitary-end organ dysfunction might also be a concern [43]. Although the IRR of development of bipolar disorder was higher in depression and anxiety, the absolute rate of bipolar disorder was quite low compared with depressive disorders and, especially, anxiety disorders (1.32%, 22.36%, and 76.31% in total mood disorders, respectively). In daily practice, depressive disorders and anxiety would be much more common, and more emphasis should be placed on.

The IRR of mood disorders was significantly higher in the breast cancer cohort in the first year. After one year, the impact seemed to be reduced, and the incidence was no longer higher in the breast cancer cohort. This change may be due to that most breast cancer management, such as invasive examinations, operations, radiation, and chemotherapy, was performed within the first year. A previous cross-sectional study demonstrated differences in the risk of depression at different observation time points after diagnosis.[44] Moreover, an observational cohort study that enrolled 222 women with early breast cancer demonstrated a point prevalence of depression, anxiety, or both of 33% at diagnosis, 24% at 3 months after diagnosis, and 15% at 1 year after diagnosis [45]. In a Chinese study, the risk of depression within the first year after surgery was two times as high as the risk after the first year [34]. A study held in the Netherlands also reported a similar conclusion [46]. Previous study had also suggested that early referral, early identification, and early treatment of psychiatric condition in cancer patients may improve the quality of life [8] and even may be associated with a longer survival [19,47]. Some studies have suggested modified criteria for mood disorders in cancer patients to help identifying cancer patients with mood disorders [48–50].

In this study, a significant increase in the risk of mood disorders was noted in the breast cancer cohort in comparison with the matched group with an IRR of 1.33. The trend was consistent in every age group. However, a higher IRR of 1.51 was noted in the age group younger than 40 years old. Previous studies reported similar results [51–53]. Economic and geographic statuses were not independent risk factors of mood disorders in our study. In contrast, a nationwide prospective study held in Denmark that enrolled 4917 women indicated that an upper–middle household income was an independent predictor of depressive symptoms [54]. Other studies reported similar results [31,51,53,55]. We only found that breast cancer, age, hypertension, COPD, autoimmune disease, ischemic heart disease, and cerebrovascular disease were independent risk factors for mood disorders (Table 4). According to previous studies, medical illness and mood disorders may be bidirectional in nature [56]. Diabetes mellitus, hypertension, congestive heart failure, COPD, chronic kidney disease, liver cirrhosis, autoimmune disease, ischemic heart disease, or cerebrovascular disease had been discussed to be associated with mood disorders [56–68]. However, scanty studies have mentioned the specific comorbidities that correlated with mood disorders in patients with breast cancer. Some studies had referred to the cumulative effect of medical illness to the incidence of mood disorders. Ostergaard *et al*. pointed out that depression is relatively common in primary care patients suffering from physical illness, particularly if the illness is severe and chronic [69]. The breast cancer could be the 'straw that broke the camel's back'.

Our study has several limitations. Firstly, a number of potential confounders, including education, occupation, marriage status, cancer staging, and family history of malignancy, were not available for analyses. In addition, some important laboratory data, including estrogen receptor, progesterone receptor, and human epidermal growth factor receptor 2 results, were also lacking in the NHI database. Furthermore, the mood disorders may have been diagnosed a long time ago before the registry of NHI Research Database (1995) and undiagnosed prior to cancer diagnosis; this could not be detected or excluded in this study. We could not detect the mood disorder status, and these disorders could be induced again by stress or therapy, including chemotherapy, surgery, and radiation therapy. Future studies will be needed to analyze the impact of different chemotherapy regimens on mood disorders.

In conclusion, breast cancer patients had a significantly higher risk of mood disorders, not only for major depression and anxiety but also for bipolar disorder. This risk was mostly significant in the first year after diagnosis. Moreover, breast cancer patients with younger age or comorbid diseases such as hypertension, COPD, autoimmune disease, ischemic heart disease, and cerebrovascular disease are also at risk for developing mood disorders. Early appropriate psychiatric referral might identify patients with mood disorders, and thus may provide appropriate psychosocial support and medical aids to improve their quality of life.

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Conflict of interest

The authors declare no conflict of interest.

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