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Predictors for Reconstruction and Mood Disorder Associated With Reconstruction in Patients With Breast Cancer and Mastectomy

A Retrospective Cohort Study

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Abstract: This study used Taiwan's National Health Insurance medical claims to investigate the predictors for operative modes chosen by early-stage breast cancer patients; as well as to assess whether operative modes are associated with risk of mood disorder. We included 36,377 patients with breast cancer who received surgery between 2000 and 2008, and were followed to the end of 2010; they were further classified into 3 groups: mastectomy alone (n = 34,900), along with early reconstruction (n = 1080), and along with delayed reconstruction (n = 397). The results showed that age, insurance premium, urbanization level, and postsurgery chemotherapy and radiotherapy were all significant predictors for the selection of operative modes. Breast cancer patients with mastectomy alone, early reconstruction, and delayed reconstruction showed a cumulative incidence rate of mood disorder of 36.90%, 41.56%, and 33.89%, respectively. The multiple cox proportional model further revealed that early (hazard ratio [HR] = 1.06, 95% confidence interval (CI) = 0.93–1.21) and delayed (HR = 1.17, 95% CI = 0.96–1.42) reconstruction were associated with a slightly higher but insignificant risk of mood disorder, as compared to the patients received no reconstruction.

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INTRODUCTION

Breast cancer has been the 4th leading cause of cancer death in Taiwan since 1999. The incidence rate of breast cancer has risen globally over the past decade, with a greater increase noted in Asian populations. Additionally, the age at breast cancer incidence was 10 to 20 years earlier in Asian women than in Western women.[1–3]

More than half of ethnic Chinese breast cancer patients experienced high depression level,[4,5] which may lead to poor treatment outcome and undesirable quality of life.[6,7] Moreover, depressed mood was negatively associated with a number of physical and psychological prognostic factors of cancer patients such as future perspective, force handgrip, and physical activity.[8]

Three surgical options including breast-conserving therapy (BCT), mastectomy, and mastectomy with breast reconstruction (immediate or delayed) are available to breast cancer patients. Because of availability of reconstructive options after breast cancer surgery, which greatly improves body image, it shows that an increased number of breast cancer patients received mastectomy.[9,10] Previous studies examined the psychosocial outcomes among breast cancer patients with mastectomy and demonstrated that immediate breast reconstruction is better than the delayed reconstruction.[11,12] In addition, previous studies also showed better psychosocial benefits in breast cancer patients with immediate breast reconstruction than in those with delayed breast reconstruction.[13–15] Despite the above findings, comparison of mood disorders between breast cancer patients with various operative modes was not made in Asian breast cancer patients. We aimed to investigate the predictors for the preference toward operative modes in Taiwanese breast cancer patients; and to assess the incidence rate of mood disorders in association with the above-mentioned 3 surgical options.

METHODS

Source of Data

Data analyzed were retrieved from the National Health Insurance Research Database (NHIRD) from 1997 to 2010. The

NHIRD has been supervised by Taiwan National Health Insurance Administration (NHIA), Ministry of Health and Welfare. The NHIA performs experts' review on random sample of every 50 to 100 ambulatory and inpatient claims quarterly to ensure the accuracy of claim files.[16] The NHIRD includes the medical claims of all residents of Taiwan. At the end of June in 2012, a total of 23,204,518 people were insured, constituting nearly 100% of Taiwan's population.[17]

Both NHI outpatient and inpatient medical claims were used in this analysis. Information on medical claims included patient's demographics, physician's specialty, International Classification of Disease, Ninth Revision, Clinical Modification (ICD-9-CM) disease/procedure codes, and catastrophic illness/injury certifications. Information on mortality was retrieved from the NHI registry for beneficiaries. We used the NHI registry for contracted medical facilities to obtain the information on hospital accreditation level, type of hospital, and district of hospital. All NHI files can be interlinked through personal identification number (PIN) or hospital identification number (HIN). Access to NHIRD was reviewed and approved by the Review Board of the National Health Research Institute.

Design and Study Participants

This was a retrospective cohort study design. A total of 92,197 patients were newly diagnosed as breast cancer (ICD-9-CM: 174 or A-code: A113) from 2000 to 2008. After excluding the patients age <18 years (n = 337), suffering from other cancer prior to breast cancer diagnosis (n = 1205), developing other cancer after breast cancer diagnosis (n = 4053), and with a diagnosis of mental illnesses (within 6 months prior to breast cancer diagnosis, n = 27,137 (ICD-9-CM: 290–319 or A-code: A210–A218), 59,465 patients remained in the breast cancer population.

We excluded patients with a history of mastectomy (ICD-9-CM, procedure codes: 85.20, 85.21, 85.23, 85.34, 85.36, 85.40, and 85.41 to 85.48 (n = 21,346), receipt of chemotherapy (n = 1343) or radiotherapy (n = 399) before the index date of receiving mastectomy. The remaining 36,377 patients were considered as breast cancer patients with early staging, which was the study cohort. The flow chart of enrolling patients with early stage breast cancer was shown in Figure 1.

The study cohort was categorized into 3 groups according to whether or when the patients received reconstruction after mastectomy. The patients who received reconstruction during the same admission as mastectomy were considered as "immediate reconstruction" (n = 397); those who did not receive reconstruction during the admission for mastectomy but did receive reconstruction during the follow-up period were categorized as "delayed reconstruction" (n = 1080). The remaining patients were deemed as "no reconstruction" group (n = 34,900).

Follow-Up and End-Point

The index date (ie, starting date of follow-up) for the study patients who received immediate or delayed reconstruction was the date of admission for performing reconstruction procedures. For the no reconstruction group, the index date was set as date of ambulatory care visit or admission for first-time breast cancer diagnosis. We linked the unique PIN of each breast cancer patient to the ambulatory care visit claims in 2000 to 2010 to identify the primary or secondary diagnoses of mood disorders including depression and anxiety (ICD-9-CM: 296, 298, 300, 311, and V790), which were the endpoint of this study. To

ensure the accuracy of information on mood disorders, only the patients with 1 or more admissions for mood disorders or those who had 2 or more diagnoses of mood disorders at ambulatory care settings during follow-up were counted. The day of first-time admission or ambulatory care visit for mood disorders was considered the date when the endpoint of interest occurred. The study period was from January 1, 2000 to December 31, 2010, allowing at least 2 years for each study patient being followed.

Statistical Analysis and Covariates

The first part of analyses done in this study was a cross-sectional analysis of factors associated with the choice of reconstruction. Several potential predictors such as socio-demographic characteristics such as age, insurance premium level, and urbanization of residential areas, treatment modules (chemotherapy and radiation after mastectomy), and selected underlying co-morbidities including hypertension (ICD-9-CM: 401–401), diabetes mellitus (ICD-9-CM: 250), chronic obstructive pulmonary disease (COPD; ICD-9-CM: 490–496), chronic kidney disease (CKD; ICD-9-CM: 585), rheumatoid arthritis (RA; ICD-9-CM:714, 729), ischemic heart disease (IHD; ICD-9-CM:410–414), congestive heart disease (CHD; ICD-9-CM:428–429), and stroke (ICD-9-CM: 430–438) has been explored in this study.

Information on this study subject's history of co-morbidities was retrieved from the inpatient and outpatient medical claims from the first day of 1997 to the index date. In addition, the geographic location of employment or residence was classified as north, central, south, and east. The city/township of employment or residence was further categorized into different levels of urbanization based on the classification scheme by the National Statistics of Regional Standard Classification.[18] Taking into account urbanization status was to make adjustments for possible geographic variations in healthcare accessibility in Taiwan.[19]

We performed multi-nominal logistic regression analysis to assess the relationships between choices of immediate and delayed reconstruction and the selected potential predictors listed above. The odds ratio (OR) and 95% confidence interval (CI) was estimated from the multi-nominal logistic regression to estimate the relative risk of immediate and delayed reconstruction, respectively, in relation to the above potential predictors.

The second part of the analyses was conducted to examine the respective effect of immediate and delayed reconstruction on risk of developing mood disorders. The study participants who did not encounter mood disorders were considered censored in the survival analysis. The date of censoring was either the date of a patient's termination of her NHI policy or the date of follow-up termination (ie, December 31, 2010). The life-table method was used to estimate period-specific survival rates and cumulative survival rates for the breast cancer patients from the 3 study groups.[20]

We then calculated specific incidence density of mood disorders with person-years observed as the denominator under the Poisson assumption. To assess the independent effect of immediate and delayed reconstruction on the risks of mood disorders, we used multiple Cox proportional hazard regression models adjusting potential confounders. The log (−log) graph showed that the assumption of proportionality can be confirmed.

All statistical analyses were performed using the Statistical Analysis Software (version 9.3; SAS Institute, Cary, NC). A P value of <0.05 was considered statistically significant.
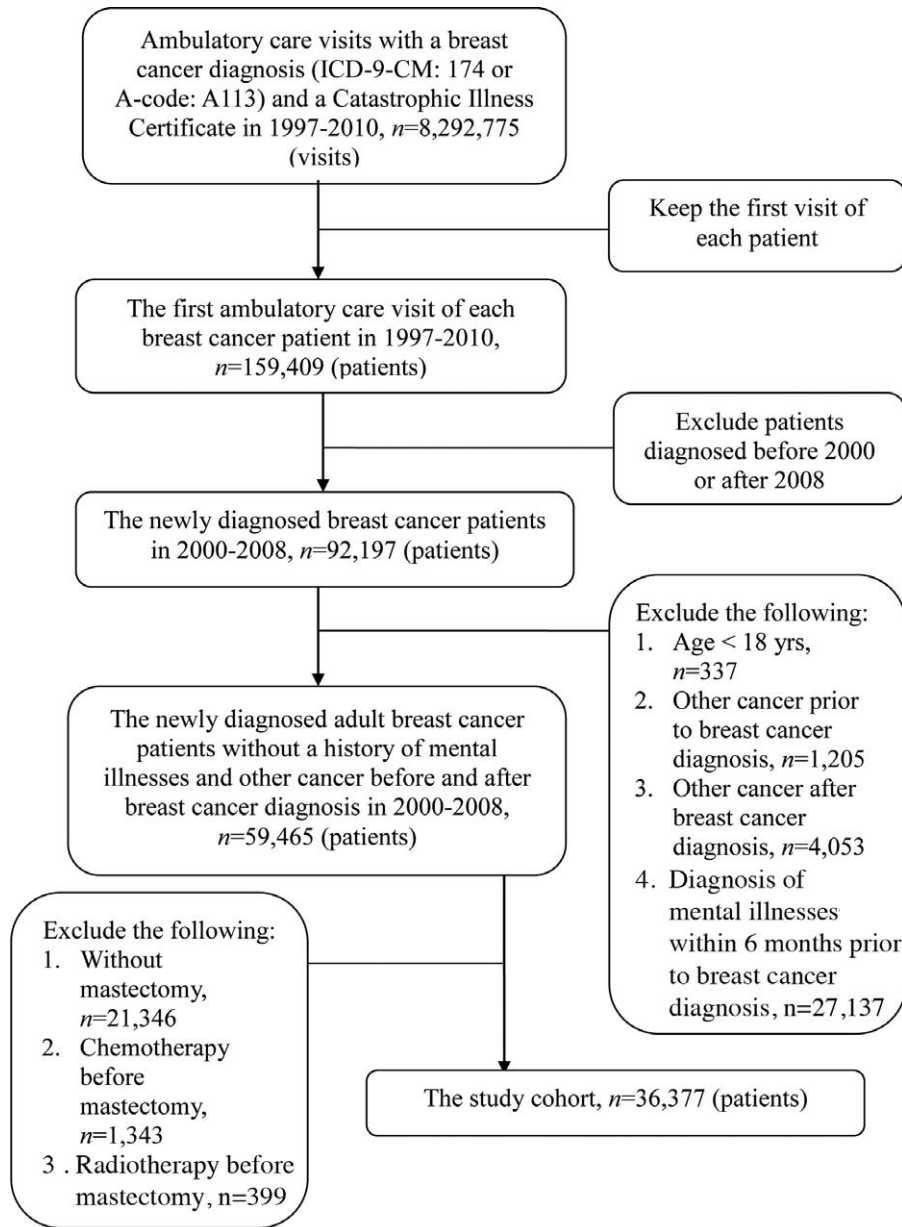
FIGURE 1. Flow chart of study participants' enrollment.

RESULTS

Table 1 compares the characteristics of patients from the 3 study groups. The patients with immediate and delayed reconstruction tended to be younger and with higher income levels. They also tended to be residents or employed in metropolitan areas. Some 33.1% of patients without reconstruction received chemotherapy after mastectomy. The corresponding figures for patients with immediate and delayed reconstruction were 27.1% and 32.7%, respectively. Similarly, more patients without reconstruction received radiation therapy after mastectomy (9.1% vs 7.4%, 6.7%). Additionally, the prevalence of selected underlying co-morbidities was consistently and significantly higher in patients without reconstruction than in those with reconstruction.

Age was inversely associated with odds of receiving reconstruction in breast cancer patients with mastectomy. Compared to older patients (>60 years), patients ages 18 to 29 years had a covariate adjusted odds ratio (AOR) of 11.00 in favor of immediate breast reconstruction, and an AOR of 24.27 in favor of delayed reconstruction. Additionally, patients with the highest insurance premium level (>25,200 NTD) had a significantly increased AOR of immediate (1.22, 95% CI = 1.02–1.46) and delayed (1.56, 95% CI = 1.16–2.08) breast reconstruction. Compared to those residing in rural areas, patients from metropolitan areas and satellite cities were 1.55 (95% CI = 1.29–1.85) and 1.35 (95% CI = 1.11–1.65), respectively, more likely to perform breast reconstruction. But, no urbanization effect on the odds of receiving delayed reconstruction. Receipt of

TABLE 1. Characteristics of Study Patients

Characteristics	Total n (%)	Mastectomy Only n (%)	Mastectomy + Immediate Breast Reconstruction n (%)	Mastectomy + Delayed Breast Reconstruction n (%)	P Value
Age at cancer diagnosis					<0.0001
18−29	790 (2.2)	717 (2.1)	52 (4.8)	21 (5.3)	
30−39	5219 (14.4)	4791 (13.7)	283 (26.2)	145 (36.5)	
40−49	13,508 (37.1)	12,848 (36.8)	501 (46.4)	159 (40.1)	
50−59	9547 (26.2)	9284 (26.6)	199 (18.4)	64 (16.1)	
>60	7313 (20.1)	7260 (20.8)	45 (4.2)	8 (2.0)	
Mean ± SD	50.20 ± 11.70	50.49 ± 11.70	43.76 ± 9.00	42.01 ± 8.60	
Insurance premium (NTD$)					<0.0001
0*	9925 (27.3)	9631 (27.6)	223 (20.7)	71 (17.9)	
0−19,200	6322 (17.4)	6052 (17.4)	192 (17.8)	78 (19.7)	
19,200−25,200	11,072 (30.4)	10,687 (30.6)	291 (26.9)	94 (23.7)	
>25,200	9058 (24.9)	8530 (24.4)	374 (34.6)	154 (38.7)	
Level of urbanization[†]					<0.0001
Metropolitan areas	18,095 (50.3)	17,271 (50.0)	611 (57.4)	213 (54.1)	
Satellite cities	10,130 (28.1)	9730 (28.1)	296 (27.8)	104 (26.4)	
Rural towns	7793 (21.6)	7559 (21.9)	157 (14.8)	77 (19.5)	
Chemotherapy after surgery					0.0073
Yes	11,975 (32.9)	11,552 (33.1)	293 (27.1)	130 (32.7)	
No	24,402 (67.1)	23,348 (66.9)	787 (72.9)	267 (67.3)	
Radiation after surgery					0.0107
Yes	3282 (9.0)	3176 (9.1)	80 (7.4)	26 (6.5)	
No	33,095 (91.0)	31,724 (90.9)	1000 (92.6)	371 (93.5)	
Underlying co-morbidity[‡]					
Hypertension	7935 (21.8)	7783 (22.3)	113 (10.5)	39 (9.8)	<0.0001
Diabetes mellitus	4756 (13.1)	4651 (13.3)	80 (7.4)	25 (6.3)	<0.0001
COPD	7505 (20.6)	7245 (20.8)	186 (17.2)	74 (18.6)	0.0112
CKD	513 (1.4)	508 (1.5)	4 (0.4)	1 (0.3)	0.0017
RA	13,515 (37.2)	13,028 (37.3)	367 (34.0)	120 (30.2)	0.0013
IHD	3421 (9.4)	3355 (9.6)	49 (4.5)	17 (4.3)	0.0001
CHD	1443 (4.0)	1410 (4.0)	27 (2.5)	6 (1.5)	0.0016
Stroke	1724 (4.7)	1686 (4.8)	30 (2.8)	8 (2.0)	0.0003
Total	36,377	34,900	1080	397	

CHD = congestive heart disease, COPD = chronic obstructive pulmonary disease, IHD = ischemic heart disease, SD = standard deviation.

* Dependence.

[†] Inconsistency between total population and population summed for individual variables was due to missing information.

[‡] Inconsistency between total population and population summed for individual variables was due to more than 1 co-morbidity for a person.

chemotherapy (AOR = 0.68, 95% CI = 0.61−0.80) or radiotherapy (AOR = 0.77, 95% CI = 0.61−0.98) was found to deter patients from undergoing immediate breast reconstruction; but only radiotherapy was significantly associated with a reduced AOR of delayed breast reconstruction (AOR = 0.58, 95% CI = 0.39−0.88). None of the selected underlying co-morbidities suffered by the patients were significantly associated with receipt of reconstruction (Table 2).

Over a maximum of 11 years of follow-up, 270 patients with immediate breast reconstruction and 110 patients with delayed reconstruction developed mood disorder, with a cumulative event rate of 42% and 37%, respectively. The corresponding figures for patients without reconstruction were 8707 patients and 42% (Table 3). After adjustment for covariates, the AORs of developing mood disorder for patients with immediate (AOR = 1.06, 95% CI = 0.93−1.21) and delayed (AOR = 1.17, 95% CI = 0.96−1.42) breast reconstruction were essentially compared to null (Table 4).

Table 4 also shows predictors for developing mood disorders in breast cancer patients with mastectomy. Compared to older patients (>60 years), younger patients (18−29 years) had a significantly reduced AOR (0.75, 95% CI = 0.62−0.90) of mood disorder onset, but middle ages patients (40−59 years) experienced significantly elevated AORs (1.61 and 1.19 for those ages 40−49 years and 50−59 years, respectively). Patients from metropolitan areas (AOR = 0.86, 95% CI = 0.81−0.91) or satellite cities (AOR = 0.90, 95% CI = 0.85−0.96) were less likely to suffer from mood disorder than those from rural areas. Moreover, patients who suffered from secondary cancer after mastectomy were at a significantly increased risk of mood disorder (AOR = 1.33, 95% CI = 1.22−1.45). In addition, certain selected underlying co-morbidities including hypertension, COPD, RA, IHD, and CHD were also associated with a significantly increased risk of depression, with an AOR ranging from 1.07 (hypertension) to 1.21 (IHD).

TABLE 2. Factors Associated With Receipt of Immediate or Delayed Reconstruction Following Mastectomy

Characteristics	Mastectomy + Immediate Breast Reconstruction				Mastectomy + Delayed Breast Reconstruction			
	n	AOR	95% CI	*P* Value	n	AOR	95% CI	*P* Value
Age at cancer diagnosis								
18−29	52	11.00	7.12−17.00	<0.0001	21	24.27	10.30−57.20	<0.0001
30−39	283	8.69	6.11−12.37	<0.0001	145	24.61	11.54−52.49	<0.0001
40−49	501	5.80	4.13−8.13	<0.0001	159	10.24	4.85−21.65	<0.0001
50−59	199	3.36	2.38−4.73	<0.0001	64	5.64	2.65−12.01	<0.0001
>60	45	1.00			8	1.00		
Insurance premium (NTD$)								
0*	223	1.00			71	1.00		
0−19,200	192	1.00	0.81−1.22	0.9622	78	1.22	0.88−1.70	0.2382
19,200−25,200	291	0.96	0.80−1.16	0.6750	94	0.95	0.69−1.31	0.7500
>25,200	374	1.22	1.02−1.46	0.0271	154	1.56	1.16−2.08	0.0032
Level of urbanization								
Metropolitan areas	611	1.55	1.29−1.85	<0.0001	213	1.06	0.81−1.39	0.1793
Satellite cities	296	1.35	1.11−1.65	0.0031	104	0.95	0.71−1.28	0.1095
Rural towns	157	1.00			77	1.00		
Chemotherapy after surgery (yes)	293	0.68	0.61−0.80	<0.0001	130	0.91	0.73−1.13	0.3950
Radiation after surgery (yes)	80	0.77	0.61−0.98	0.0302	26	0.58	0.39−0.88	0.0095
Underlying co-morbidity								
Hypertension (yes)	113	0.86	0.69−1.08	0.1878	39	1.06	0.73−1.54	0.7516
Diabetes Mellitus (yes)	80	0.99	0.78−1.27	0.9450	25	0.93	0.60−1.42	0.7238
COPD (yes)	186	1.00	0.85−1.18	0.9781	74	1.18	0.91−1.53	0.2119
CKD (yes)	4	0.38	0.14−1.03	0.0570	1	0.29	0.04−2.05	0.2123
RA (yes)	367	1.02	0.89−1.16	0.7933	120	0.88	0.71−1.01	0.2671
IHD (yes)	49	0.90	0.66−1.23	0.5098	17	1.03	0.62−1.73	0.9068
CHD (yes)	27	1.28	0.86−1.91	0.2317	6	0.84	0.37−1.92	0.6814
Stroke (yes)	30	1.22	0.83−1.78	0.3139	8	1.01	0.49−2.08	0.9734

AOR = adjusted odds ratio, CHD = congestive heart disease, CI = confidence interval, CKD = chronic kidney disease, COPD = chronic obstructive pulmonary disease, IHD = ischemic heart disease, RA = rheumatoid arthritis.
* Dependence.

TABLE 3. Cumulative Proportion Free From Mood Disorder During the Follow-Up Period in Women With Various Modes of Mastectomy

Year of Follow-Up	Mastectomy Only (n = 34,900)			Mastectomy + Immediate Breast Reconstruction (n = 1080)			Mastectomy + Delayed Breast Reconstruction (n = 397)		
	No. of Depression	Proportion Surviving	Cumulative Proportion Surviving at End of Interval	No. of Depression	Proportion Surviving	Cumulative Proportion Surviving at End of Interval	No. of Depression	Proportion Surviving	Cumulative Proportion Surviving at End of Interval
0−2	5050	0.85	0.85	171	0.84	0.84	64	0.84	0.84
2−4	1694	0.93	0.79	52	0.93	0.78	27	0.91	0.76
4−6	1023	0.93	0.74	25	0.95	0.74	6	0.97	0.73
6−8	621	0.93	0.69	11	0.96	0.71	11	0.91	0.67
8−10	265	0.94	0.65	8	0.93	0.66	1	0.98	0.66
10−12	54	0.95	0.58	3	0.88	0.58	1	0.95	0.63
Total	8707			270			110		

TABLE 4. Incidence Rates and Relative Hazards of Mood Disorder in Relation to Mode of Surgery and Other Covariates in Breast Cancer Patients With Mastectomy

	Person-Years	No. of Depression	Incidence Rate, per 1000 Person-Years (95% CI)	AHR	95% CI
Mode of surgery					
Mastectomy only	161,410	8707	53.9 (52.8–55.1)	1.00	
Mastectomy + immediate reconstruction	4865	270	55.5 (48.9–62.1)	1.06	0.93–1.21
Mastectomy + delayed reconstruction	1968	110	55.9 (45.4–66.3)	1.17	0.96–1.42
Age at cancer diagnosis					
18–29	4112	142	34.5 (28.9–40.2)	0.75	0.62–0.90
30–39	26,101	1124	43.1 (40.5–45.6)	0.95	0.87–1.04
40–49	64,612	3488	54.0 (52.2–55.8)	1.61	1.08–1.25
50–59	41,865	2522	60.2 (57.9–62.6)	1.19	1.11–1.27
>60	31,551	1811	57.4 (54.8–60.0)	1.00	
Insurance premium (NTD$)					
0*	44,267	2393	54.1 (51.9–56.2)	1.00	
0–19,200	28,660	1561	54.5 (51.8–57.2)	1.03	0.97–1.11
19,200–25,200	51,857	2970	57.3 (55.2–59.3)	1.02	0.96–1.08
>25,200	42,208	2163	51.2 (49.1–53.4)	0.97	0.91–1.04
Level of urbanization					
Metropolitan areas	85,414	4379	51.3 (49.7–52.8)	0.86	0.81–0.91
Satellite cities	46,483	2560	55.1 (52.9–64.9)	0.90	0.85–0.96
Rural towns	34,511	2148	62.2 (59.6–64.9)	1.00	
Chemotherapy after surgery (yes)	49,230	2782	56.5 (54.4–58.6)	1.01	0.96–1.06
Radiation after surgery (yes)				0.96	0.89–1.04
Underlying co-morbidity					
Hypertension (yes)	32,815	2179	66.4 (63.6–69.2)	1.07	1.01–1.14
Diabetes mellitus (yes)	19,498	1271	65.2 (61.6–68.8)	1.04	0.97–1.12
COPD (yes)	30,869	2033	65.9 (63.0–68.7)	1.11	1.06–1.18
CKD (yes)	1995	130	65.2 (54.0–76.4)	1.01	0.84–1.21
RA (yes)	54,964	3612	65.7 (63.6–67.9)	1.19	1.14–1.25
IHD (yes)	13,549	1062	78.4 (73.7–83.1)	1.21	1.12–1.31
CHD (yes)	5489	422	76.9 (69.5–84.2)	1.13	1.01–1.26
Stroke (yes)	6538	494	75.6 (68.9–82.2)	1.06	0.96–1.18
Frequency of outpatient visit in the year of breast cancer diagnosis (mean ± SD)				1.04	1.01–1.07
Total	68,244	9087	133.2		

AHR = adjusted hazard ratio, CHD = congestive heart disease, CI = confidence interval, CKD = chronic kidney disease, COPD = chronic obstructive pulmonary disease, IHD = ischemic heart disease, RA = rheumatoid arthritis.
* Dependence.

DISCUSSION

Our cohort study incorporated a long-term follow-up period and showed that age, insurance premium level, urbanization level, and postsurgery chemotherapy and radiotherapy were all significant predictors for choice of operative modes. Additionally, the breast cancer patients with mastectomy alone, immediate reconstruction, and delayed reconstruction showed a cumulative incidence rate of mood disorder at 36.90%, 41.56%, and 33.89%, respectively. Compared to mastectomy alone, immediate and delayed reconstructions were associated with a slightly elevated but insignificant risk of mood disorder, suggesting no significant influences of operative modes on mood disorder.

Our findings are consistent with some previous studies that also noted that age, insurance premium level, urbanization level, and postsurgery chemotherapy and radiotherapy were all significantly associated with choice of operative modes.[21–24]

A cross-sectional study of women with early stage breast cancer identified factors affecting BCT versus mastectomy choice and found that age >70 years, rural location, and lack of insurance were the strongest predictors for mastectomy and not receiving adjuvant radiotherapy.[22] Dragun et al examined factors influencing the receipt of mastectomy and found that determinants of higher rates of mastectomy for in situ and early stage breast cancer included stage, moderate or poorly differentiated histology, ages older than 70 years, uninsured and government-insured, rural location, receptor negative disease. The study by Dragun et al also found that rate of mastectomy was most increased in women ages <50 years and those ≥70 years.[23]

Gumus et al[24] found that age, parenthood, lactation, positive familial history, and type of surgery information were all significant predictors for patients' decision of surgery. Additionally, Wexelman et al[21] who conducted a study of

women who underwent mastectomy in the United States indicated that reconstructed women tended to be younger, have fewer chronic illnesses, more often living in urban areas and have higher incomes, as compared with those without reconstruction. Sio et al[25] also noted that young women were more likely than old women to receive aggressive therapies and have better physical functioning. Patients' involvement in decision-making about chemotherapy and adjuvant endocrine therapy was strongly affected by their experience of decision-making about surgery.[26] Women should have the right to choose their treatments, and should be well informed of advantages and disadvantages associated with treatment options in order to optimize the treatment outcomes are optimized.[27]

Predictors for mood disorder onset in breast cancer patients with mastectomy have been inconclusive. A prospective study documented psychological condition among breast cancer patients after surgery and found that mastectomy was significantly associated with a higher level of depression, as compared to breast conserving surgery.[6] Medeiros et al[7] conducted a study to determine the occurrence of depression in women who underwent conservative surgery for breast cancer with or without breast reconstruction and showed that there were no significant differences between groups in age, educational level, or occurrence of depression. Our results showed that breast reconstruction posed no significant influence on mood disorder in breast cancer patients with mastectomy.

This study was based on the unselected breast cancer population, which is considered to be highly representative. In addition, we considered several socio-economic characteristics and major diseases in the regression model to minimize their potential confounding. Moreover, the chance of loss to follow-up was minimal as the follow-up of study cohort was conducted by using linter-linkage of the NHI claims. Despite the above strengths, our study has challenges. The accuracy of diagnostic codes of both breast cancer and mood disorders could be inadequate. However, such disease misclassification bias is expected to underestimate rather than over estimate the true relative hazard of mood disorder in association with operation modes of breast cancer patients. Additionally, patients were likely to receive a mood disorder diagnosis simply because of their increased interaction with the clinicians due to their specific operation mode. Such potential disease surveillance bias can be largely minimized as we managed to adjust for the frequency of outpatient visits for each study subject during the 1-year period. Some known risk factors for mood disorder such as cancer staging, hormone therapy, familial history of depression, history of depression, individual financial condition, occupations, and marriage status were not adjusted in the regression models, our study findings might have suffered from residual confounding.

CONCLUSIONS

Socio-economic variables such as age, insurance premium, urbanization level, and postsurgery chemotherapy and radiotherapy were significant predictors for a breast cancer patient's decision on whether to receive breast reconstruction after mastectomy, but receipt of breast reconstruction, either immediate or delayed, posed no significant influence on risk of mood disorder onset. Middle-aged patients, those from urban areas, and patients who suffered from secondary cancer diagnosis after mastectomy and some underlying co-morbidities should be the objects for attention in preventing the occurrence of mood disorders in patients with breast cancer and mastectomy.

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