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ORIGINAL ARTICLE

Delayed time from first medical visit to diagnosis for breast cancer patients in Taiwan

Shwn-Huey Shieh [a,b], Vivian Chia-Rong Hsieh [c,j], Shu-Hui Liu [c,d], Chun-Ru Chien [e,f], Cheng-Chieh Lin [f,g,h], Trong-Neng Wu [i,j,*]

[a] *Department of Health Services Administration, College of Public Health, China Medical University, Taichung, Taiwan*
[b] *Department of Nursing, China Medical University Hospital, Taichung, Taiwan*
[c] *Department of Public Health, College of Public Health, China Medical University, Taichung, Taiwan*
[d] *Cancer Center, China Medical University Hospital, Taichung, Taiwan*
[e] *Division of Radiooncology, China Medical University Hospital, Taichung, Taiwan*
[f] *School of Medicine, College of Medicine, China Medical University, Taichung, Taiwan*
[g] *Department of Family Medicine, China Medical University Hospital, Taichung, Taiwan*
[h] *Department of Healthcare Administration, College of Health Science, Asia University, Taichung, Taiwan*
[i] *Graduate Institute of Biostatistics, College of Public Health, China Medical University, Taichung, Taiwan*
[j] *Division of Environmental Health and Occupational Medicine, National Health Research Institutes, Miaoli, Taiwan*

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KEYWORDS
breast cancer;
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number of hospitals visited

Background/Purpose: Delay in diagnosis may affect the survival of breast cancer patients. The purpose of this study was to investigate delayed diagnosis for breast cancer patients in Taiwan.
Methods: This study was conducted via one-to-one interviews with structured questionnaires in hospital outpatient visit. Included were 600 breast cancer patients seeking medical care in two medical centers in central Taiwan.
Results: Average delay in breast cancer diagnosis was 27.8 days. Service level of the patients' first visit and number of hospitals patients visited before obtaining a correct diagnosis were significantly associated with delay in diagnosis. Logistic regression analysis found that patients

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* Corresponding author. Graduate Institute of Biostatistics, China Medical University, No. 91, Hsueh-Shih Road, Taichung 40402, Taiwan.
E-mail address: tnwu@mail.cmu.edu.tw (T.-N. Wu).

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who had visited two, and three or more hospitals before getting a correct diagnosis had longer delays in diagnosis than patients who had visited one hospital (odds ratio = 2.23 and 9.26, 95% confidence interval 1.37–3.63 and 95% CI:3.87–22.15, respectively).
Conclusion: Results of this study are anticipated to serve as a reference for the government and medical institutions to develop policies to reduce the number of hospitals visited before diagnosis for breast cancer patients, and ultimately to achieve the goal of early detection and treatment.

Introduction

Breast cancer is the most prevalent cancer in women around the world, and it has had the leading incidence of cancer in Taiwanese females for 25 years.[1] In 2008, breast cancer was ranked among the four leading causes of cancer-attributable deaths. Incidence rate of breast cancer among women in Taiwan is approximately 56.1/100,000 females and mortality rate is 11.3/100,000 females.[2] Breast cancer is also the leading cause of cancer mortality for women in the USA and Canada.[3] Previous studies showed that its incidence rate in USA was 124.3/100,000 and mortality rate was 23.0/100,000 females.[4] The age at onset of female breast cancer in Taiwan is between 45 years and 59 years old,[5] which is almost 10 years younger than that in Western countries. This indicates an early-onset trend in Taiwanese women.[6,7]

Survival rate of breast cancer patients depends greatly on the cancer stage; the earlier the cancer is detected and treated, the better the prognosis and the higher the survival rate.[8–10] Since 2004, the Department of Health has provided free breast mammograms once every 2 years for women aged 50–69 years, but only 12% of all eligible women take advantage of this screening service.[6] In comparison with other developed countries, Taiwanese women have lower awareness of the danger of breast cancer[6]: approximately 85–96% of patients discovered the symptoms for breast cancer by themselves, not via breast screening.[11–14] Furthermore, if the patients do not seek medical treatment promptly after the symptoms are discovered, the clinical stage of breast cancer advances and their survival rate drops as the delay is prolonged.[12,14,15]

Presently, the international definition of "delay" is not consistent; Unger-Saldana and Infante-Castaneda divided total delay into two categories[16]: (1) delay by patients, which indicates the time from the patients first discovery of the symptoms to the time the patients pay their first visit to the doctor; and (2) delay by providers, which can be further divided into delay in diagnosis and delay in treatment. Smith et al defined diagnosis delay as the time between the first examination and the abnormality being found by clinical breast examination or a mammogram and the diagnosis of breast cancer.[17] Delay in diagnosis signifies the time between the first doctor visit and the time breast cancer is confirmed by the doctor.[16,18–21] Caplan et al found that there is a delay of approximately 81 days from the patients' first visit to the doctor, to the time of correct diagnosis,[19] Norsati et al defined system delay as the time between first medical consultation and first clinic visit, with a mean of 44.8 days and a median of 18 days,[22] while Allgar and Neal found that from the breast cancer patients' first visit to the general practice to the time of correct diagnosis, the delay is approximately 27 days.[23]

In Taiwan, Lin and Hu discovered that the delay in diagnosis of breast cancer is approximately 92 days on average, and for 35.0% of breast cancer patients the delay is >60 days.[13] Wang and Hou (1993) found that although 32.4% of women seek medical attention within 1 week of discovering an abnormality in the breasts, 45% of women delay seeking medical attention for more than 3 months.[14] Chen studied changes of the social and psychological well-being of breast cancer patients with and without delay in medical seeking and diagnosis, and found that the average delay from presenting symptoms to the diagnosis is 187 days[24] from the discovery of suspicious symptoms in patients, to the time of confirmed diagnosis. Literature indicates that age, socioeconomic status, and marital status are potential factors associated with delay in diagnosis of breast cancer.[18,19,25–27]

Taiwan has adopted a single-payer, universal health care system, the National Health Insurance (NHI), whose coverage rate currently exceeds 99%.[28] Using this healthcare system, people can freely access any level of health care institutions, from primary clinics, district hospitals, and regional hospitals to medical centers. No restriction is placed on the frequency or level of care a patient wishes to receive. Treatments for severe diseases, such as breast cancer, and services used in the prediagnosis stage are mostly covered by the NHI, but only medical institutions and regional hospitals of sufficient magnitude can provide advanced technology such as tumor imaging. A literature review on diagnosis delay found that most studies are concerned with the delays caused by the referral system between general practices and hospitals.[23,26] In contrast, due to the implementation of the NHI system, the medical environment allows patients in Taiwan high accessibility to medical care, and people have the freedom to choose their preferred hospitals. Thus, long delays caused by general practices or referral processes are not expected in Taiwan.

Although previous research has examined various aspects of delay in diagnosis, most have focused on the influence of the primary physician and health care system referral systems.[23] The system in Taiwan, however, differs from those of other countries in that insurance beneficiaries have the freedom of choice in seeking medical assistance. This difference in procedure among insurance providers is worth investigating to understand the particular delays in diagnosing breast cancer in Taiwan, to identify the factors associated with such delays, and to predict the crucial factors influencing the delay in diagnosis of breast cancer.

Methods

Participants

Research participants were breast cancer patients cared for at two medical centers in central Taiwan. Face-to-face interviews were conducted from July 26, 2007 to July 31, 2008. During the survey period of this study, a total of 615 female patients agreed to participate in the interviews, and 600 valid questionnaires were received at the end of survey. Participants were all recruited at outpatient services of the two medical centers during their follow-up visit where they were approached by trained interviewers. While all patients had been diagnosed with breast cancer and have already completed active treatment, not all were able to communicate to us effectively (i.e. too old to understand and respond to the questions asked or they were being reserved towards answering questions for research); thus, these patients were not recruited for the study.

Data collection

Data were collected using a structured questionnaire survey by four registered nurses with related clinical background specifically trained for this interview. The survey included basic personal information (age, educational level, marital status, occupation, and economic status), factors delaying the diagnosis (level of the hospital first visited, number of hospitals the patients visited before breast cancer diagnosis, items inspected on the first visit), and number of days of delayed diagnosis (defined as time elapsed between the first visit for breast cancer-related symptoms and the time of diagnosis).[9,12–16] Because the structured questionnaire was used in the one-on-one interviews, all items including number of days of delay in diagnosis were answered on a recall basis. This resulted in some individuals ($n = 150/600$) with missing data who had to be excluded from our analysis, because of the strict requirements of the quality of data collected, leading to exclusion of any response from participants who were uncertain of their answers, including those on 'length of delay in diagnosis'. Recall bias is believed to have been reduced by only analyzing the 450 patients with complete set of data. Consent was obtained from all participants included in the study.

The questionnaire was designed and developed cooperatively, and its validity was evaluated by five medical experts specializing in breast cancer. This study plan was validated by the Institutional Review Board of China Medical University Hospital (DMR96-IRB-78).

The four hospital levels were categorized according to the NHI's classification of medical institutions by their accreditation criteria. This parameter reflects patients' preferences and their healthcare seeking behavior under universal health insurance. The type of examination at the initial visit of patients would indicate if relative advancement in medical technology on the provider side effectively influences delay in diagnosis.

Statistical analysis

Data analyses first used descriptive statistics to measure frequency distributions of the participants by socio-demographic status and diagnosis delay factors (hospital level the patient first visited, number of hospitals visited before diagnosis, and items examined in the first visit). Mean days taken to have the breast cancer diagnosed were also measured by the same variables. Differences in mean days taken to have the final diagnosis between groups were examined in t test and one-way analysis of variance. The distribution of days required to have breast cancer diagnosed in this group of patients shows that approximately half of study participants had their breast cancer diagnosed no more than 7 days (median). Under normal circumstances, the examination can be scheduled within 2–7 days after a hospital visit in Taiwan and, if any problem is detected in the results, physicians could arrange for further examination or surgical treatment. Histology results are usually obtained within 2–10 days since examination. Therefore, in general, the diagnosis process requires approximately 4–17 days. Days taken for the final diagnosis were thus divided into two groups ($\leq$7 days vs. $>$7 days). Logistic regression analysis was used to investigate factors that may have association with the earlier diagnosis of the disease. All statistical analyses were performed using SAS software, version 9.2 (SAS Institute Inc., Cary, NC, USA).

Results

Of the 450 breast cancer patients recruited for this study, their average age when the symptoms were discovered was 48.7 years old, with 34.5% patients $\leq$44 years old. A computed 75.3% of the patients were married, 43.5% had only secondary education, and 25.7% had an average monthly household income between 25,001 and 45,000 Taiwan Dollars (Table 1). About half (54.9%) of breast cancer patients made their first hospitals visits at medical centers, followed by regional hospitals (20.9%). Most of the participants (64.3%) visited only one hospital and 28.1% visited two hospitals before diagnoses were given. In the first clinical visit, 67.4% participants received a mammogram and 75.9% participants received a breast ultrasound. Diagnoses also used the magnetic resonance imaging (MRI) scan for 14 women, and both breast ultrasound and mammogram for 266 women in the first visit. The average delay in diagnosis was approximately 27.8 days: 302 (67.1%) patients had the disease diagnosed in $\leq$7 days, and 43 (9.7%) experienced a delay of $>$30 days (Table 1).

Table 2 shows the mean number of days it took for women had breast cancer diagnosed by socio-demographic and health care characteristics. Mean days to diagnosis was not significantly different for each of the socio-demographic factors examined. However, it took longer for younger patients to have the disease diagnosed: 37.7 days for those aged $\leq$44 years. Divorced or separated women had longest delay within the marital status category (66.7 days). Average family income was unlikely to be associated with delay in diagnosis.

Table 2 also shows that women cared for at medical centers on their first visit had breast cancer diagnosed in the shortest mean period of 19.2 days, 57.2 days shorter than that required at local clinics ($p = 0.005$). Number of hospitals visited was also associated with the delay in diagnosis. It took 10 times longer to have the breast cancer diagnosed for

Table 1 Patient demographic characteristics and diagnostic factors ($n = 450$).

Variables	*n*	%
Age at first detected symptom (y)		
≤44	151	34.5
45–49	99	22.6
50–54	74	16.9
≥55	114	26.0
Missing	12	
Education level		
Elementary or lower	117	26.2
Secondary school	194	43.5
College or higher	135	30.3
Missing	4	
Marital status		
Single	40	8.9
Married	338	75.3
Divorced/Separated	21	4.7
Widowed	50	11.1
Missing	1	
Average family monthly income (TWD)		
≤25,000	50	14.8
25,001–45,000	87	25.7
45,001–65,000	89	26.3
65,001–85,000	47	13.9
>85,000	65	19.2
Missing	112	
Level of medical service at first visit		
Medical center	245	54.9
Regional hospital	93	20.9
District hospital	75	16.8
Local clinic	33	7.4
Missing	4	
Number of hospitals visited before diagnosis		
1	288	64.3
2	126	28.1
≥3	34	7.6
Missing	2	
Examination on first visit		
No	74	16.9
Yes	365	83.1
Missing	11	
Mammography on first visit		
No	143	32.6
Yes	296	67.4
Missing	11	
Breast ultrasound on first visit		
No	106	24.1
Yes	333	75.9
Missing	11	
MRI on first visit		
No	425	96.8
Yes	14	3.2
Missing	11	
Mammography and breast ultrasound on first visit		
No	173	39.4
Yes	266	60.6
Missing	11	
Length of delay in diagnosis (d)		
≤7	302	67.1
8–14	64	14.2
15–21	26	5.8
22–30	15	3.3
31–90	16	3.6
91–180	8	1.8
≥181	19	4.3

Mean of delay in diagnosis = 27.8 ± 88.0 d; mean age at first detected symptom = 48.7 ± 10.5 y.
MRI = magnetic resonance imaging; TWD = New Taiwan Dollars.

women visiting three hospitals compared with women visiting only one hospital (147.4 vs. 14.3 days; $p < 0.001$). Women who received an MRI examination on first visit also had the disease diagnosed much earlier compared with those without the test (8.4 vs. 28.9 days; $p < 0.001$).

Table 3 shows that approximately two-thirds of the patients had the breast cancer diagnosed as early as 7 days or earlier. Diagnosis taking longer than 7 days was not significantly associated with the socio-demographic variables. Among the diagnosis-related health care factors, only number of hospital patient visited was significantly associated with length of delay in diagnosis of the cancer. Compared with women cared for by one hospital, those who visited two hospitals had an odds ratio (OR) of 2.23 [95% confidence interval (CI): 1.37–3.63] to have the disease diagnosed in longer than 7 days. The OR increased to 9.26 (95% CI: 3.87–22.15) for patients who had visited three hospitals.

Discussion

Breast cancer occurs in Taiwanese women mostly aged 45–59 years, approximately 10 years younger than European and American women.[5,13,14,24,29] This study finds that approximately 60.0% of breast cancer patients in Taiwan are under 49 years old, suggesting that the age of Taiwanese women afflicted with breast cancer is decreasing.[5] Moreover, while approximately 85–96% of Taiwanese breast cancer patients discover the symptoms by themselves, most breast cancer patients do not have the habit of performing breast self-examination or any other breast cancer screening before being diagnosed with breast cancer.[11,13,14] It can be seen from the outcomes of our study that women in Taiwan have insufficient knowledge and awareness in breast cancer prevention.[6,30] Therefore, the importance of practicing regular breast self-examinations and screening should be emphasized in young women when implementing preventive medical policies, both at service or government level.

This study finds that of the patient characteristics, age, educational level, marital status, and average monthly household income do not have a significant statistical correlation with delay in diagnosis. However, similar to the studies of Neal and Allgar (2005), Barber et al. (2004), and

Table 2 Differences between patient characteristics, health care factors and delay in diagnosis ($n = 450$).

Variables	Delay in diagnosis (d)			
	Mean	SD	F(t)	p
Age at first detected symptom (y)[a]			1.25	0.292
≤44	37.7	102.6		
45–49	25.9	92.8		
50–54	30.7	102.8		
≥55	16.7	46.6		
Education level[a]			0.59	0.556
Elementary or lower	20.4	66.1		
Secondary school	31.3	98.2		
College or higher	29.4	90.5		
Marital status[a]			1.66	0.175
Single	30.9	116.9		
Married	26.7	75.5		
Divorced/Separated	66.7	201.6		
Widowed	17.0	58.8		
Average family monthly income (TWD)[a]			0.29	0.884
≤25,000	22.8	57.0		
25,001–45,000	31.5	98.3		
45,001–65,000	31.5	106.1		
65,001–85,000	23.5	62.8		
>85,000	39.1	111.2		
Level of medical service at first visit[a]			4.33	0.005
Medical center	19.2	58.4		
Regional hospital	28.5	88.7		
District hospital	34.5	104.6		
Local clinic	76.4	177.5		
Number of hospitals visited before diagnosis[a]			40.83	<0.001
1	14.3	45.3		
2	26.7	68.3		
≥3	147.4	231.3		
Examination on first visit[b]			0.65	0.520
No	35.6	111.1		
Yes	26.8	84.0		
Mammography on first visit[b]			1.63	0.105
No	40.6	127.5		
Yes	22.3	61.9		
Breast ultrasound on first visit[b]			0.09	0.931
No	28.9	93.6		
Yes	28.1	87.7		
MRI on first visit[b]			4.51	<0.001
No	28.9	90.4		
Yes	8.4	4.7		
Mammography and breast ultrasound on first visit[b]			1.30	0.194
No	35.9	116.5		
Yes	23.3	65.0		

MRI = magnetic resonance imaging; SD = standard deviation; TWD = New Taiwan Dollars.
[a] ANOVA.
[b] t test.

Ramirez et al. (1990), this study observed that delay in diagnosis was longest (38 days) in breast cancer patients aged ≤44 years and that approximately 60% of the breast cancer patients were <49 years old.[18,26,27] For those who were not yet married and assumed multiple roles, Chie and Chang also indicated in their study that the general opinion holds that the younger population is less likely to have cancer and do not practice regular breast self-examination.[11] In addition, patients in Taiwan prefer to seek treatment from well-known doctors and would rather be put on waiting list just to be examined or treated by these physicians. As a result, it is likely that patients are too late to start process of diagnosis and treatment. Caplan et al, in contrast, found that patients experience longer delays because most tend to believe their conditions are not serious.[19]

Table 3 Influence of demographics and health care factors on the delay in diagnosis of breast cancer (n = 420).

Variables	Days before diagnosis		OR (95% CI)	p
	≤7 n %	>7 n %		
Age at first detected symptom (y)				
≤44 (ref)	89 (31.7)	54 (38.9)		
45–49	68 (24.2)	24 (17.3)	0.59 (0.31–1.13)	0.110
50–54	47 (16.7)	24 (17.3)	1.06 (0.55-2.04)	0.858
≥55	77 (27.4)	37 (26.6)	1.19 (0.64–2.21)	0.587
Education level				
Elementary or lower (ref)	81 (28.8)	31 (22.3)		
Secondary school	122 (43.4)	57 (41.0)	1.29 (0.71–2.32)	0.403
College or higher	78 (27.8)	51 (36.7)	1.70 (0.89–3.24)	0.110
Marital status				
Single (ref)	26 (9.3)	13 (9.4)		
Married	210 (74.7)	108 (77.7)	1.35 (0.62–2.95)	0.449
Divorced/Separated	11 (3.9)	6 (4.3)	1.13 (0.30–4.35)	0.854
Widowed	34 (12.1)	12 (8.6)	1.07 (0.36–3.15)	0.898
Level of medical service at first visit				
Medical center (ref)	166 (59.1)	64 (46.0)		
Regional hospital	53 (18.9)	35 (25.2)	1.29 (0.74–2.26)	0.369
District hospital	47 (16.7)	24 (17.3)	0.95 (0.50–1.80)	0.867
Local clinic	15 (5.3)	16 (11.5)	1.40 (0.60–3.29)	0.439
Number of hospitals visited before diagnosis				
1 (ref)	204 (72.6)	64 (46.0)		
2	68 (24.2)	50 (36.0)	2.23 (1.37–3.63)	0.001
≥3	9 (3.2)	25 (18.0)	9.26 (3.87–22.15)	<0.001
MRI on first visit				
No (ref)	275 (97.9)	132 (95.0)		
Yes	6 (2.1)	7 (5.0)	3.30 (1.04–10.48)	0.043
Mammography and breast ultrasound on first visit				
No (ref)	100 (35.6)	64 (46.0)		
Yes	181 (64.4)	75 (54.0)	0.76 (0.48–1.20)	0.240

CI = confidence interval; MRI = magnetic resonance imaging; OR = odds ratio.

In comparison with single women, divorced or separated women have a longer, but not statistically significant so, delay in diagnosis of approximately 36 days. The divorce rate increases gradually year after year in modern Taiwanese society, with an increase of 10.0% since 2000—the divorce rate was 11.5% in 2010 (58,037 couples in total).[31] Neal and Allgar (2005) point out that single, separated or divorced women are more likely to experience delays in diagnosis as compared to married women.[26] It has been argued that divorced and separated women have extensive socio-economic burden and family responsibilities, which consequently leads to a delay in diagnosis after acknowledging symptoms of breast cancer. One other potential factor is that women who have spouses are likely to discover abnormalities on the breast through their spouses. In addition, their spouses can support them in seeking medical help promptly, and thus shorten the delay in diagnosis. Thus, divorced women should be a group to which government related organizations must pay more attention, particularly in regards to their health condition.

Low socioeconomic status is one of the factors for delay in diagnosis.[25,26] However, results of this study show that the average monthly family income has no significant correlation with delay in diagnosis. This discrepancy from other studies may be due to the different health systems between Taiwan, Europe, and the USA. Caplan et al found no significant correlation between income and delay in diagnosis in breast cancer patients, but Caucasian women who participate in Medicaid are more likely to experience a delay in diagnosis, as compared to those having both Medicaid and private insurance.[25] Despite the free services at point of use, the referral system in the UK is stringent. Patients must consult general practitioners first, and are only referred to hospitals for further examination and treatment when necessary. Therefore, waiting for medical attention, and delays in diagnosis and treatment may occur. However, people with better socioeconomic status would purchase private insurance to avoid having to wait to get further treatment. Since the implementation of Taiwan's NHI in 1995, the coverage rate in 2010 reached 99.4% (approximately 23.03 million people), the accessibility of medical care for the Taiwanese is high; and people are free to choose preferred hospitals for treatment.[6] Thus, we believe that socioeconomic status is unlikely to be the factor for delay in diagnosis for patients.

Results of this study indicate a significant difference between the level of the hospital first visited and days of delay in diagnosis ($p = 0.005$): the lower the hospital level of the first visit, the longer the delay in diagnosis. If patients visit a local clinic first, they may be transferred to larger hospitals for further examination, diagnosis, and treatment. This transfer from small to large hospitals would prolong the diagnosis process. Average delay in diagnosis for breast cancer is approximately 28 days in this study, but Lin and Hu found that the delay in diagnosis is 92 days on average.[13] Length of delay in diagnosis has been reduced significantly since Lin and Hu's study, which might be a result of the launch of the policy of "free mammogram once every 2 years for women aged between 50 and 69" by the government in 2004, and the corresponding emphasis of breast cancer diagnosis quality by hospitals. It could also be the outcome of the government's active promotion of preventive medical policy. Generally, in Taiwan, however, it takes about 2–10 days from organizing a breast cancer examination to obtain a confirmed diagnosis by a histology report, and this can be a key factor for generating a delay in diagnosis. Because of the health insurance system in Taiwan, patients have high accessibility to medical care, and are free of the referral processes as seen in the European and American countries. The length of delay in diagnosis (28 days) in breast cancer patients, however, is still similar to the 27-day delay reported by Allgar and Neal for breast cancer patients in England's health system with a referral system.[23] Therefore, medical institutes should carefully review and improve the internal procedures with regard to examination arrangements, and report waiting time to shorten the diagnosis time for breast cancer patients.

Caplan et al studied American women, and found that the average delay in diagnosis was 81 days.[19] Because the USA strictly implements the referral system, diagnosis is often delayed for many patients during the referral process. In contrast, Taiwanese have high accessibility to medical care, and thus experience shorter delays in diagnosis. Also, Taiwanese patients tend to seek medical attention in large hospitals if an abnormality is suspected[32]: more than half of the patients in this study chose medical centers as their first hospitals. In addition, the results of this study indicate that delays in diagnosis for patients who visit more than three hospitals before confirmed diagnosis are approximately 133 days longer than for patients who visited only one hospital, and patients who visited three or more hospitals before getting a correct diagnosis had longer delays in diagnosis than patients who had visited one hospital (OR = 9.26, 95% CI: 3.87–22.15). This result verifies the assumption that the fewer the hospitals visited before a correct diagnosis, the shorter the delay. More importantly, we would like to point out that there is no strict referral system based on the primary physician mechanism in Taiwan. Patients can freely access healthcare institutions, in order to obtain opinions from different physicians without a referral from their primary care physician.[33] In our study, >35% of patients sought second opinions at more than one hospital. Therefore, we believe that the delay in diagnosis is prolonged due to 'physician shopping' or 'hospital shopping' behavior.

For the examination items received in the first visit to the hospital, only MRI has a significant association with delay in diagnosis ($p = 0.043$). Patients who received MRI had shorter delays in diagnosis. However, the cost for an MRI scan is high, so a breast ultrasound is often performed as an initial screening at the initial stage of detecting abnormalities in the breasts, and a mammogram would be performed later if necessary.[13]

Overall, the NHI system reduces the financial barriers to seeing doctors, and increases access to medical services across populations in Taiwan. Therefore, the length of delay in diagnosis for breast cancer is shorter in comparison to Western countries. Positive outcomes in some of the NHI preventive health care programs are also illustrated. This study also finds that the higher the level of the hospital first visited, the shorter the delay in diagnosis, and the more hospitals visited before a breast cancer diagnosis, the longer the delay in diagnosis. Therefore, this study suggests that when a clinic or small hospital discovers that a patient is suspicious of having the symptoms of breast cancer, the hospital should take the initiative of transferring the patient to a larger hospital for further examination. This would prevent the repetitive use of medical services and subsequently shorten the delay in diagnosis.

Although the participants of this study were confirmed breast cancer patients in two medical centers in central Taiwan, because of convenient transportation, it takes only 1 hour from central Taiwan to reach northern or southern Taiwan. As a consequence, these two medical centers also include patients from northern and southern Taiwan, and therefore, the sample selection bias is minimal. Finally, for the administering of questionnaire for this study, patients were asked to fill out the length of delay of their diagnosis from memory, which may pose recall bias on the collected data despite precautions adopted by conducting the interviews with breast cancer patients after treatment. The duration since diagnosis and treatment to the time of interview greatly deals with recall bias in the provided response of our participants. However, because having undergone a major life event such as breast cancer examination and diagnosis has substantial impact on one's life, we would like to believe that most (if not all) patients would still be likely to recall their course of seeking medical care, including duration before their examinations, diagnosis, and treatment. Still, the four interviewers of this study had >3 years of clinical experience and received interview training, and should be able to ensure consistency in the data collected. Participants with missing data on length of delay in diagnosis were also excluded from analysis. Moreover, the association between stage of disease and delay in diagnosis was not examined for the following reasons: the diagnosis of breast cancer is typically confirmed following a standardized protocol of examinations via imaging including mammography and ultrasound in Taiwan hospitals. Patients undergo these examinations regardless of their cancer stage. Thus, we believe that the time to diagnosis should not differ by stage. Secondly, the stage of breast cancer has been proved not to be associated with delay in its diagnosis.[21] Although they seem counter-intuitive, results from a number of past studies are in agreement with this finding.[21,34,35]

Findings of this study would help the Bureau of NHI to improve understanding of the conditions of delay in the diagnosis of breast cancer in Taiwan-to serve as a reference

for developing breast cancer prevention policies, to educate and remind the population of the importance of earlier detection and earlier treatment, to encourage medical systems to pay attention to the timeliness of breast cancer diagnosis, and to improve the quality of Taiwan's breast cancer medical treatment. Besides investigating the causes of the low breast cancer screening prevalence among the public, the government should also clarify whether conducting breast cancer screenings has any effect on diagnosis delays. This study can also provide references associated with delay in the diagnosis of breast cancer and its predictors in Taiwan for international comparison and future studies.

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