RESEARCH COMMUNICATION

Survival Rates of Invasive Breast Cancer among Ethnic Chinese Women Born in East Asia and the United States

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Abstract

Background: Few studies have compared the breast cancer survival rates of US born ethnic Chinese women and the survival rates of Chinese immigrants. The main purpose of this study is to explore the difference of breast cancer survival rates between the two populations and compare the survival rates to those of Caucasians born in the US. Methods: Between 1973 and 2002, 365,215 women who had been diagnosed with primary invasive breast cancer (ICD-O-2 C500:C509) were recorded in the Surveillance, Epidemiology, and End Results (SEER) registries. Of the 316,881 breast cancer patients who were white, 180,835 (57%) were born in the United States, 20,983 (7%) were born elsewhere, and 115,063 (36%) had unknown birthplaces. Among the 3,634 breast cancer patients who were ethnically Chinese, 952 (26%) patients were born in the US, 1,356 (37%) were born in East Asia, 146 (4%) were born elsewhere, and 1,180 (33%) had unknown birthplaces. We compared the survival rates and estimated the risk ratios (RRs) by the Kaplan-Meier estimates and the Cox proportional hazards models. Results: A lower 5-year overall survival rate of breast cancer was observed among Chinese women born in East Asia (0.74, 95% CI=0.72-0.77) than those born in the U.S. (0.79, 95% CI=0.76-0.81), with an adjusted hazards ratio of 1.22 (95% CI=1.06-1.40). The 5-year survival rates for SEER stage were higher among Chinese women born in the U.S. (localized: 0.90, 95% CI=0.87-0.93; regional: 0.71, 95% CI=66-0.77; distant: 0.16, 95% CI=0.06-0.25) than that among Chinese women born in East Asia (localized: 0.86, 95% CI=0.83-0.89; regional: 0.68, 95% CI=0.63-0.73; distant: 0.16, 95% CI=0.07-0.25). Higher 5-year survival rates among Chinese women born in the U.S. in comparison to Chinese women born in East Asia were also observed in different calendar years (1973-1980, 1981-1990, 1991-2002), in surgery and radiation therapy. Conclusions: Our analysis showed that among the Chinese breast cancer patients, women born in East Asia had lower 5-year survival rates than women born in the United States. SEER stage, grade, and tumor size appear to be important prognostic factors. The poor 5-year survival rates among Chinese women born in East Asia indicate potential problems of accessing medical facilities for early detection, diagnosis and treatment because of potential language and culture barriers, lower education level, as well as stress of the first generation of migrant Chinese women in the United States.

Key Words: Breast cancer - Chinese populations - survival

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Introduction

Breast cancer robs many women's lives every year in the United States. The American Cancer Society reported there would be 40,970 breast cancer deaths in 2006. The estimated age adjusted mortality rate was 26.4/100,000 in the US, 1998-2002. Major risk factors for breast cancer include genetic and familial factors, as well as diet, hormonal, and environmental factors (Harris J et al., 1997). Some of these same risk factors may also be related to the prognoses of patients with breast cancer (Barnett, 2003; Esteva et al., 2002; Campbell, 2002).

Caucasian women with breast cancer in the United States have a higher survival rate than African American women (Edwards et al., 1998; Krieger et al., 1997; Laden et al., 1997; Simon et al., 1996). In comparison to non-Hispanic white women, ethnic Chinese women have a higher survival rate (Krieger et al., 1997). Investigators have suggested that biological differences between the races might influence patients' survival. Other studies indicated that the differences in survival might be due to environmental and geographic factors. The mortality rate for breast cancer has been reported to be higher among Chinese immigrants in the United States than that for Chinese women in East Asia (Chie et al., 1995;

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Petrakis et al., 1998). Chie et al. (1995) compared international and migrant studies and found an increasing trend of breast cancer incidence with the degree of westernization for women of Chinese ethnicity living in the United States. Lifestyle changes, especially westernization of diet, have been found to be associated with breast cancer survival (Chie et al., 1995; Ng et al., 1997; Petrakis et al., 1998; Trichopoulos et al., 1984).

The present study investigated whether breast cancer survival differs between Chinese patients who were born in East Asia and those who were born in the United States. We analyzed data from the Surveillance, Epidemiology, and End Results (SEER) cancer registries between 1973 and 2002.

Subjects and Methods

Study Population

Between 1973 and 2002, 365,215 women who had been diagnosed with primary invasive breast cancer (ICD-O-2 C500:C509) were recorded in the Surveillance, Epidemiology, and End Results (SEER) registries. Of the 316,881 breast cancer patients who were white, 180,835 (57%) were born in the United States, 20,983 (7%) were born elsewhere, and 115,063 (36%) had unknown birthplaces. Among the 3,634 breast cancer patients who were ethnically Chinese, 952 (26%) patients were born in the US, 1,356 (37%) were born in East Asia, 146 (4%) were

Table 1. Clinical Pathological Factors for Chinese and White Women with Primary Invasive Breast Cancer

		Chinese, U.S.		Chinese, East Asia		Chinese, Unknown		Caucasian, All		P-value
		N	%	N	%	N	%	N	%	
Total		952		1,356		1,180		316,881		
Age (mean±SD) (years)		59.5±14.15		57.0±14.8		57.4±14.3		61.9±14.5		
Follow-up time (months)		106.5±83.4		84.6±76.1		84.0±71.3		94.0±79.6		
Age at diagnosis	<50	272	28.6	498	36.7	396	33.6	71,399	22.5	<0.0001
(years)	50-59	204	21.4	275	20.3	279	23.6	67,960	21.5	
	60-70	214	22.5	279	20.6	245	20.8	73,900	23.3	
	≥70	262	27.5	304	22.4	260	22.0	103,622	32.7	
Marital Status	Married	569	60.3	893	68.1	803	70.9	167,412	57.3	<0.0001
	Single	139	14.7	109	8.3	128	11.3	26,021	8.9	
	Sep/Div*	59	6.3	66	5.0	40	3.5	25,439	8.7	
	Widowed	177	18.7	243	18.6	161	14.2	73,489	25.1	
	Unknown	8		45		48		24,520		
SEER Stage	Localized	592	63.5	748	57.4	801	69.4	180,803	59.4	<0.0001
	Regional	280	30.0	480	36.8	327	28.4	104,432	34.3	
	Distant	61	6.5	76	5.8	25	2.2	18,968	6.2	
	Unknown	20		52		27		12,678		
Grade	I	85	16.3	150	18.0	153	18.4	27,246	16.3	0.0135
	II	219	41.9	320	38.5	366	43.9	67,876	40.6	
	III	202	38.7	330	39.7	290	34.8	64,116	38.4	
	IV	16	3.1	32	3.8	24	2.9	7,939	4.7	
	Unknown	430		524		347		147,904		
Tumor Size	<=2	345	65.7	516	62.2	602	64.9	109,092	65.5	0.0052
(cm)	2-5	142	27.1	247	29.7	272	29.3	48,730	29.2	
	>5	38	7.2	67	8.1	53	5.7	8,809	5.3	
	Unknown	427		526		253		150,250		
Mastectomy	None	39	5.5	76	6.9	41	3.7	13,690	5.8	0.0006
	Partial	314	44.3	415	37.4	423	38.5	95,017	40.3	
	Total	21	3.0	52	4.7	62	5.6	9,500	4.0	
	Radical	334	47.2	566	51.0	574	52.2	117,583	49.9	
	Unknown	244		247		80		81,091		
Radiation Therapy	None	518	55.3	745	55.7	763	65.2	201,733	65.6	<0.0001
	Yes	419	44.7	593	44.3	408	34.8	105,906	34.4	
	Unknown	15		18		9		9,242		
Hormone Receptor	Negative	80	18.1	155	21.7	154	19.7	24,330	18.4	0.1058
	ERA or PRA+	363	81.9	561	78.3	627	80.3	108,232	81.6	
	Unknown	509		640		399		184,319		
Year of diagnosis	1973-1980	190	20.0	184	13.6	51	4.3	61,950	19.6	<0.0001
	1981-1990	302	31.7	387	28.5	248	21.0	102,456	32.3	
	1991-2002	460	48.3	785	57.9	881	74.7	152,475	48.1	

*Separated/Divorced

born elsewhere, and 1,180 (33%) had unknown birthplaces.

Statistical Analysis

Survival time was defined as the time from the date of diagnosis to death. Patients who were still alive or lost to follow-up were considered as censored. The covariates to be adjusted for in the comparison of survival rates included: age at diagnosis (continuous in years), marital status (single, married, separated/divorced, and widowed), tumor stage (localized, regional, and distant), and year of diagnosis

Table 2. Overall Survival of Chinese Breast Cancer Cases

		Subjects N	Deaths N	Median Survival (months)	5-year survival (95% CI)	Adjusted[1] RR Chinese born US	Adjusted[1]RR Chinese born East Asia
Total		2308	875	180	0.7625 (0.74, 0.78)		
Birthplace	U.S.	952	378	192	0.7852 (0.76, 0.81)	1.00	
	East Asia	1356	497	171	0.7441 (0.72, 0.77)	1.22 (1.06, 1.40)	
	Missing	1180	169	297	0.9022 (0.88, 0.92)	0.58 (0.48, 0.71)	
Age at diagnosis	<50	770	226	268	0.8097 (0.78, 0.84)	1.00	1.00
(years)	50-59	479	156	250	0.8071 (0.77, 0.85)	1.13 (0.82, 1.56)	1.03 (0.76, 1.38)
	60-69	493	204	171	0.7967 (0.76, 0.84)	1.53 (1.13, 2.08)	1.55 (1.18, 2.04)
	≥70	566	289	97	0.6316 (0.59, 0.67)	2.31 (1.68, 3.19)	3.34 (2.50, 4.46)
		P for trend				<0.0001	<0.0001
Marital Status	Married	1462	490	208	0.8055 (0.78, 0.83)	1.00	1.00
	Single	248	86	179	0.7543 (0.70, 0.81)	1.53 (1.13, 2.07)	1.02 (0.68, 1.53)
	Sep/Div	125	42	192	0.7927 (0.71, 0.87)	1.21 (0.79, 1.87)	0.95 (0.57, 1.57)
	Widowed	420	226	119	0.6380 (0.59, 0.69)	1.44 (1.08, 1.92)	1.03 (0.81, 1.32)
	Missing	53	31	100	0.5851 (0.43, 0.71)	1.76 (0.71, 4.35)	1.00 (0.62, 1.60)
SEER Stage	Localized	1340	348	250	0.8799 (0.86, 0.90)	1.00	1.00
	Regional	760	350	126	0.6938 (0.66, 0.73)	2.32 (1.85, 2.92)	2.23 (1.82, 2.73)
	Distant	137	120	18	0.1603 (0.09, 0.23)	15.2 (10.9, 21.1)	9.81 (7.19, 13.4)
	Missing	71	57	73	0.5323 (0.41, 0.64)	5.79 (3.36, 9.96)	2.64 (1.82, 3.84)
		P for trend				<0.0001	<0.0001
Grade	I	235	36	188	0.8971 (0.85, 0.94)	1.00	1.00
	II	539	114	212	0.8610 (0.83, 0.89)	1.24 (0.64, 2.40)	1.40 (0.83, 2.37)
	III	532	199	140	0.6703 (0.63, 0.72)	1.60 (0.84, 3.07)	2.72 (1.64, 4.49)
	IV	48	18	154	0.6751 (0.53, 0.82)	1.91 (0.80, 4.57)	1.30 (0.56, 3.01)
	Missing	954	508	172	0.7367 (0.71, 0.76)	1.37 (0.74, 2.53)	1.85 (1.13, 3.04)
		P for trend				0.0006	<0.0001
Size (cm)	<=2	861	119	NYR[2]	0.8833 (0.86, 0.91)	1.00	1.00
	2-5	389	116	NYR[2]	0.7084 (0.66, 0.76)	1.79 (1.17, 2.74)	1.76 (1.27, 2.46)
	>5	105	50	74	0.5588 (0.45, 0.67)	1.90 (1.06, 3.40)	2.32 (1.47, 3.66)
	Missing	953	590	152	0.7101 (0.68, 0.74)	1.54 (1.01, 2.37)	1.62 (1.14, 2.31)
		P for trend				<0.0001	<0.0001
Mastectomy	None	115	91	20	0.1525 (0.08, 0.24)	1.00	1.00
	Partial	729	114	NYR[2]	0.8719 (0.84, 0.90)	0.26 (0.15, 0.45)	0.30 (0.19, 0.49)
	Total	73	28	104	0.6728 (0.53, 0.78)	0.48 (0.21, 1.10)	0.69 (0.38, 1.27)
	Radical	900	308	192	0.7815 (0.75, 0.81)	0.31 (0.19, 0.52)	0.43 (0.28, 0.65)
	Missing	491	334	154	0.7347 (0.69, 0.77)	0.25 (0.13, 0.45)	0.38 (0.23, 0.62)
Radiation	None	1263	562	176	0.7443 (0.72, 0.77)	1.00	1.00
	Yes	1012	296	180	0.7930 (0.76, 0.82)	0.87 (0.69, 1.09)	0.81 (0.66, 1.00)
	Missing	33	17	149	0.5881 (0.38, 0.75)	0.53 (0.17, 1.67)	0.36 (0.09, 1.43)
Receptor	Negative	235	70	NYR[2]	0.6819 (0.61, 0.75)	1.00	1.00
	ERA/PRA+	924	149	NYR[2]	0.8459 (0.82, 0.87)	0.51 (0.32, 0.82)	0.50 (0.35, 0.72)
	Missing	1149	656	162	0.7228 (0.70, 0.75)	0.77 (0.47, 1.28)	0.68 (0.46, 1.00)
Year of diagnosis	1973-1980	374	260	158	0.7413 (0.70, 0.79)	1.00	1.00
	1981-1990	689	378	167	0.7232 (0.69, 0.76)	0.85 (0.66, 1.09)	1.11 (0.86, 1.44)
	1991-2002	1245	237	NYR[2]	0.8029 (0.78, 0.83)	0.57 (0.42, 0.77)	0.79 (0.59, 1.04)
		P for trend				<0.0001	0.0053

[1]Adjusted for age at diagnosis (continuous in years), marital status (categories), SEER stage (localized, regional, distant), and year of diagnosis (continuous) [2]Not yet reached

(continuous).

Chi-square tests (Alan Agresti, 1990) were performed to compare all of the clinical pathological factors among the different subgroups. We employed the Kaplan-Meier estimate as well as the log-rank test (Klein JP et al., 1997) and the Cox proportional hazards model (Klein JP et al., 1997), in order to compare the survival functions and to calculate the risk ratios (RRs) of each of the covariates. All calculations were performed using the Statistical Analysis System (SAS).

Results

The distributions of basic demographic, clinical pathological factors and basic treatments for Chinese and Caucasian women with invasive breast cancer are shown in Table 1. Chinese patients born in East Asia had the youngest mean age at diagnosis among the three groups while Caucasian women were the oldest. More than half of the patients were married and were diagnosed with localized stage. Chinese women seemed to have larger tumor sizes. A

Table 3. 5-Year Survival and 95% Confidence Intervals among Chinese and caucasian Populations in the USA

	Chinese			Caucasian	
	Born U.S.	Born East Asia	Born unknown	Born U.S.	Born unknown
Total		0.8008 (0.79, 0.82)		0.7284 (0.73, 0.73)	
Sub-Total	0.7852 (0.76, 0.81)	0.7441 (0.72, 0.77)	0.9022 (0.88, 0.92)	0.6265 (0.62, 0.63)	0.9448 (0.94, 0.95)
Age at diagnosis (years)					
<50	0.7950 (0.74, 0.85)	0.8182 (0.78, 0.86)	0.9392 (0.91, 0.97)	0.7062 (0.70, 0.71)	0.9664 (0.96, 0.97)
50-59	0.8192 (0.76, 0.87)	0.7956 (0.74, 0.85)	0.9011 (0.86, 0.94)	0.6913 (0.69, 0.70)	0.9675 (0.96, 0.97)
60-69	0.8300 (0.78, 0.88)	0.7664 (0.71, 0.82)	0.9217 (0.88, 0.96)	0.6800 (0.67, 0.68)	0.9570 (0.95, 0.96)
≥70	0.7102 (0.65, 0.77)	0.5588 (0.50, 0.62)	0.8229 (0.77, 0.88)	0.5132 (0.51, 0.52)	0.8822 (0.88, 0.89)
Marital Status					
Married	0.8410 (0.81, 0.87)	0.7803 (0.75, 0.81)	0.9177 (0.90, 0.94)	0.6764 (0.67, 0.68)	0.9644 (0.96, 0.97)
Single	0.7078 (0.63, 0.79)	0.8305 (0.75, 0.91)	0.9127 (0.86, 0.97)	0.5956 (0.59, 0.60)	0.9305 (0.92, 0.94)
Sep/Div*	0.7375 (0.62, 0.86)	0.8465 (0.75, 0.95)	0.9371 (0.85, 1.00)	0.6235 (0.62, 0.63)	0.9429 (0.94, 0.95)
Widowed	0.6924 (0.62, 0.76)	0.5946 (0.53, 0.66)	0.8418 (0.78, 0.91)	0.5377 (0.53, 0.54)	0.8846 (0.88, 0.89)
SEER Stage					
Localized	0.9005 (0.87, 0.93)	0.8618 (0.83, 0.89)	0.9544 (0.94, 0.97)	0.7617 (0.76, 0.76)	0.9686 (0.96, 0.97)
Regional	0.7145 (0.66, 0.77)	0.6784 (0.63, 0.73)	0.8524 (0.81, 0.90)	0.5858 (0.58, 0.59)	0.9212 (0.92, 0.93)
Distant	0.1575 (0.06, 0.25)	0.1609 (0.07, 0.25)	0.3445 (0.14, 0.55)	0.1465 (0.14, 0.15)	0.5799 (0.56, 0.60)
Grade					
I	0.9428 (0.89, 1.00)	0.8660 (0.80, 0.94)	0.9477 (0.90, 1.00)	0.7612 (0.75, 0.77)	0.9719 (0.97, 0.98)
II	0.8400 (0.79, 0.89)	0.8769 (0.83, 0.92)	0.9532 (0.93, 0.98)	0.6887 (0.68, 0.69)	0.9674 (0.96, 0.97)
III	0.6941 (0.63, 0.76)	0.6500 (0.59, 0.71)	0.8493 (0.80, 0.90)	0.5412 (0.54, 0.55)	0.9424 (0.94, 0.95)
IV	0.5455 (0.29, 0.80)	0.7530 (0.58, 0.93)	0.8696 (0.69, 1.00)	0.5626 (0.55, 0.58)	0.9377 (0.93, 0.95)
Size (cm)					
<=2	0.9035 (0.87, 0.94)	0.8668 (0.83, 0.90)	0.9518 (0.93, 0.97)	0.7456 (0.74, 0.75)	0.9775 (0.97, 0.98)
2-5	0.7067 (0.62, 0.79)	0.7070 (0.64, 0.78)	0.8818 (0.84, 0.93)	0.5293 (0.52, 0.54)	0.9434 (0.94, 0.95)
>5	0.5671 (0.40, 0.73)	0.5430 (0.40, 0.69)	0.7828 (0.65, 0.91)	0.3403 (0.33, 0.35)	0.8914 (0.88, 0.90)
Surgery					
None	0.2055(0.06, 0.35)	0.1382(0.05, 0.23)	0.4861(0.30, 0.67)	0.1383(0.13, 0.15)	0.7102(0.69, 0.73)
Partial	0.8843(0.84, 0.92)	0.8606(0.82, 0.90)	0.9354(0.91, 0.96)	0.7064(0.70, 0.71)	0.9720(0.97, 0.97)
Total	0.6737(0.46, 0.89)	0.6624(0.50, 0.82)	0.9186(0.82, 1.00)	0.4236(0.41, 0.44)	0.9168(0.90, 0.93)
Radical	0.8030(0.76, 0.85)	0.7663(0.73, 0.81)	0.9187(0.89, 0.94)	0.6559(0.65, 0.66)	0.9645(0.96, 0.97)
Radiation					
None	0.7739 (0.74, 0.81)	0.7215 (0.69, 0.76)	0.8963 (0.87, 0.96)	0.6272 (0.62, 0.63)	0.9359 (0.93, 0.94)
Yes	0.8085 (0.77, 0.85)	0.7793 (0.74, 0.82)	0.9200 (0.89, 0.95)	0.6540 (0.65, 0.66)	0.9609 (0.96, 0.97)
Hormone Receptor					
Negative	0.6431 (0.53, 0.76)	0.7028 (0.62, 0.79)	0.8701 (0.81, 0.93)	0.4940 (0.48, 0.50)	0.9479 (0.94, 0.95)
ERA/PRA positive	0.8736 (0.84, 0.91)	0.8231 (0.78, 0.86)	0.9254 (0.90, 0.95)	0.6660 (0.66, 0.67)	0.9687 (0.96, 0.97)
Year of diagnosis					
1973-1980	0.7474 (0.69, 0.81)	0.7350 (0.67, 0.80)	0.8017 (0.69, 0.91)	0.6432 (0.64, 0.65)	0.7870 (0.78, 0.80)
1981-1990	0.7680 (0.72, 0.82)	0.6881 (0.64, 0.73)	0.9346 (0.90, 0.97)	0.6450 (0.64, 0.65)	0.9548 (0.95, 0.96)
1991-2002	0.8207 (0.78, 0.86)	0.7894 (0.75, 0.82)	0.8950 (0.87, 0.92)	0.5869 (0.58, 0.59)	0.9604 (0.96, 0.97)

*Separated/Divorced

higher proportion of Chinese women born in East Asia had radical mastectomy but lower partial mastectomy than the other 2 groups. Chinese women, whether born in the US or in East Asia, were more likely to receive radiation therapy than Caucasian women.

The overall survival rates from breast cancer among Chinese women were described in Table 2. Survival rates were lower for women who were older, widowed, at a later stage at diagnosis, at a higher grade, had a larger tumor size, and were estrogen receptor (ERA) or progesterone receptor (PRA) positive. However, survival rates did not differ very much in regards to radiation therapy and total mastectomy.

Table 3 shows the 5-year survivals and confidence intervals among East Asian born Chinese, US born Chinese, and US born Caucasians. Generally speaking, Chinese women born in the US had better survival rates than Chinese women born in East Asia in the older age group and in every calendar year. SEER stage, grade, and tumor size had similar trends across all groups. In the distant stage, ethnicity and place of birth did not significantly affect survival rates. For grade IV, Chinese patients born in East Asia had better survival rates than other groups. Patients without birthplace information might have inflated the survival of every subgroup.

Discussion

Ethnic Chinese women who were born in East Asia were found to have a poorer 5-year breast cancer survival rate than those who were born in the United States. These results might be due to cultural and educational differences (Hoeman et al., 1996). Another reason might be due to environmental differences and the quality of medical and health care received. Overall, Caucasian women had poorer survival rates than Chinese women. Ethnicity may be an indicator of dietary fat intake (Prentice et al., 1988; Lands et al., 1990). Asian Americans have lower fat intake than Caucasians (Kolonel et al., 1981). A recent analysis of dietary components and breast cancer survival rates among female nurses in the US found that fat consumption before diagnosis was significantly associated with increased mortality (Holmes et al., 1999).

Another reason might be that potential selection bias which may have occurred because women with unknown birthplaces were excluded from analysis. Women with unknown birthplace information had much higher survival rates than those who had birthplace data. Caucasian women had higher survival rates than Chinese women in this group. Furthermore, the birthplaces of deceased subjects were more obtainable since birthplace information is reported in death certificates (Pineda et al., 2001). The loss of person-time-at-risk from un-deceased cases could have inflated the hazard rates, but the direction of the bias in the relative risk comparing Asian-born to US-born women could not be determined.

It has been indicated in the SEER manual that "The survival time recode is calculated using the date of diagnosis and one of the following: date of death, date last known to be alive, or follow-up cutoff date used for this file". The "date last known to be alive" was considered in our study. The rates of lost-to-follow-up with and without birthplace information were 6.9% and 11.1% for Chinese women and 2.3% and 5.8% for Caucasian women. Compared to those who were not lost-to-follow-up, these patients were younger, married or single, or in lower stages of cancer. These characteristics corresponded to better survival rates. Thus, the higher lost-to-follow-up rate in the missing birthplace group might be related to better survival rates.

Chinese women who were born in East Asia and diagnosed with invasive breast cancer were generally younger than those who were born in the United States. The survival rate for Chinese women older than the age of 70 who were born in East Asia was much lower than the survival rate for Chinese women who were born in the US. However, according to the distribution of stage at diagnosis, older Chinese women born in East Asia tended to be diagnosed at a later stage. This discrepancy was more obvious in the age group of 70 years or older. The proportions of distant stage at diagnosis for patients born in East Asia and the US were 9.47% and 6.69% (p=0.0155). A cross-sectional survey (Chen et al., 2004) was conducted to investigate Chinese women's knowledge of breast cancer. The study consisted of 135 female Chinese immigrants in New York. They found that most of them did not acculturate to Western society and strongly believed in Chinese medicine. Lack of acculturation might pose an important barrier to medical access. Reliance on Chinese medicine might prevent Chinese women from treatment, resulting in delayed diagnosis and inappropriate treatment.

Our study has found that widowed women have a higher risk of death. However, age of diagnosis was correlated with marital status. Sixty-eight percent of widowed women were age 70 or older. Thus, we could expect lower survival rates in this group. Furthermore, widowers have been found to experience deterioration in physical health following bereavement and episodes of psychiatric disturbances (Meng et al., 1997). Single and separated/divorced East Asian born Chinese women had better survival rates. Compared to single Chinese women born in the US, East Asian Chinese single women tended to be diagnosed at a younger age (45% vs. 63% under 50 years old). This was also the case for separated/divorced women (32% vs. 47% under 50 years-old). Age could be one reason to explain the difference.

Stage of disease, grade, and tumor size were positively associated with risk of death. They seemed to be more important risk factors over ethnicity and birthplace. Each subgroup of stage of disease, grade, or tumor size showed no difference in survival functions among each ethnicity group.

Stratified analysis showed that ERA or PRA positive patients who were in the later stages of disease, in grade III, or had tumor sizes between 20-50 mm might have higher survival rates. However, when the disease worsened, this association was not so obvious anymore. ERA or PRA

positive patients might be more sensitive to chemical therapy; thus, they might have higher survival rates. However, the validity whether ERA and PRA could predict the effectiveness of chemical therapy is still under debate. Cancer type (ER+ or ER-), drug concentration, and drug type might also affect a patient's sensitivity (Bertelsen et al., 1984).

Radiation did not show much benefit in our study, which might be due to the fact that the use of radiation therapy was targeted to local or regional control (Pierce, 2005). However, if we focus on patients who underwent surgery, those who underwent radiation therapy showed a lower risk of death than those who did not undergo radiation therapy (adjusted RR=0.56, 95% CI=0.53-0.59). Therefore, radiation therapy, serving as an assistant role to surgery, might result in higher survival rates for invasive breast cancer patients.

In summary, our results showed that among the Chinese breast cancer patients, women born in East Asia had lower 5-year survival rates than women born in the United States. The poor 5-year survival rates among Chinese women born in East Asia indicate potential problems of accessing medical facilities for early detection, diagnosis and treatment because of potential language and culture barriers, lower education levels, as well as stress of the first generation of migrant Chinese women in the United States.

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