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ORIGINAL RESEARCH

The Practice and Willingness of Women Towards Opportunistic Screening for Breast and Cervical Cancers in Sichuan Province, China: A Cross-Sectional Study

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Purpose: To understand the practices and willingness of Chinese women to undergo opportunistic screening for breast cancer (BC) and cervical cancer (CC).

Patients and Methods: From July to August 2021, a cross-sectional study of 1446 women from six cities in Sichuan Province, China, was conducted. A questionnaire was used to investigate practices, willingness, and barriers to opportunistic screening for BC and CC. Furthermore, potential factors for opportunistic screening willingness were analyzed using the chi-squared test and logistic regression.

Results: During their lifetime, 312 (21.6%) and 388 (26.8%) women had undergone opportunistic screening for BC and CC, respectively. There were 1069 (73.9%) women willing to accept physician-recommended screening during a medical visit, while 835 (57.7%) were willing to have a voluntary screening at a healthcare institution. The main barriers to reluctance to participate in physician-recommended and voluntary screenings were "no symptoms; hence, no need for screening" and "unwillingness or difficulty in paying screening cost". Ethnic minorities, lower education levels, and menopause were inversely associated, whereas awareness of the screening methods and eligibility for screening were positively associated with physician-recommended and voluntary screenings ($P < 0.05$). Furthermore, awareness of "two-cancers" screening was positively associated with physician-recommended screening ($P < 0.05$).

Conclusion: BC and CC opportunistic screening rates in Sichuan Province were low. The willingness to undergo physician-recommended screening was high, while that towards individual initiative screening was low. Public health education should be strengthened to increase cancer prevention awareness and knowledge of cancer screening, especially for women with low education, ethnic minorities, and post-menopause, for whom tailored interventions are suggested. In addition, novel ways of sharing screening costs need to be explored.

Keywords: physician-recommended screening, voluntary screening, "two-cancers" screening, behavior, willingness

Introduction

Breast cancer (BC) and cervical cancer (CC) are common malignant tumors in females worldwide.[1] In the past 20 years, the incidence of BC and CC has rapidly increased in China.[2,3] According to Chinese Cancer Registry data from 2016, BC is the most commonly diagnosed carcinoma and the fifth leading cause of cancer death, while the incidence of CC ranked sixth, with mortality ranking eighth among women.[4]

Due to effective early detection techniques and treatment methods, BC and CC are recommended as malignancies that can be prioritized for screening by the World Health Organization.[5] The experience of western countries demonstrates that nationwide organized screening for BC and CC can effectively reduce cancer-specific mortality.[6,7] In China,

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a suitable cancer screening modality and system are still under investigation. Since 2009, the "two-cancers" (BC and CC) free organized screening program for rural women aged 35–64 years old was launched in China.[8] In 2012, the Urban Cancer Early Diagnosis and Treatment Program was launched, which provides free organized screening for five cancer types, including BC, among high-risk urban populations in several provinces.[8]

However, China has a large population, limited health resources, and limited coverage of screening programs for eligible women.[9] Chinese women have a lower incidence of BC and CC compared to Western women. Sun et al, reported that asymptomatic disease screening in the "two-cancers" screening program, which adopted clinical breast examination coupled with ultrasound as the primary tool for BC, was not cost-effective due to high false positive rates, with an incremental cost-effectiveness ratio of $-916/QALY.[10] Thus, the difficulties of implementation and poor cost-effectiveness should be considered when nationally organized opportunistic screening for BC and CC is carried out in China.

Opportunistic screening refers to a woman voluntarily going to a medical institution to be screened or following a doctor's recommendation to undergo screening during a medical visit for various reasons.[11,12] In most European countries where BC and CC screening programs have been well-established, organized, and opportunistic screening coexist, with the extent of opportunistic screening varying among countries.[13,14] Studies have shown that opportunistic screening was also an effective method for diagnosing BC and CC early and reducing their specific mortality.[15,16] A Swiss study revealed that the probability of opportunistic screening in detecting CC in situ was approximately 25% higher than in organized screening.[15] Vutuc et al discovered that Austria, which implemented opportunistic screening, had a more significant annual decline in BC mortality than Finland and Sweden using organized screening.[16]

Opportunistic and organized screenings have their own benefits. Studies from China revealed that opportunistic screening was associated with a lower cost burden than organized screening, and the positive and detection rates of cancer were higher.[17,18] Opportunistic screening is carried out based on routine clinical work; therefore, promoting opportunistic screening may enable more women to undergo screening at least once in their lifetime, thus saving health resources in China, especially in less developed areas.[19] Since 2019, the long-term working mechanism of opportunistic screening for upper gastrointestinal cancer has been being explored in demonstration sites in China.[20] No standard opportunistic screening program or working mechanisms for BC or CC are currently in place. The Healthy China Action 2019–2030 called on all the regions to popularize cancer opportunistic screening based on local cancer prevalence.[21] Understanding the current implementation status of opportunistic screening for BC and CC forms the basis for developing a suitable screening intervention strategy. In addition, opportunistic screening is dependent on the individual's willingness to undergo screening as well as the doctor's recommendation.[12] It's also important to understand the willingness and barriers to undergoing opportunistic screening for BC and CC, which may help inform the design of suitable screening programs in the future. However, detailed information remains lacking in China because few relevant studies have examined this topic.

A recent study reviewed the factors that affected the attendance of organized screening programs for BC, CC and colorectal cancer.[22] Several factors on the individual level were directly related to the screening attendance rate, including background factors (such as social economic status, being part of a minority group), individual characteristics (such as adopting health behaviors, owning prevention-oriented concept), emotions (such as fear of screening test and screening results) and knowledge or awareness about cancer etiology and screening.[22] We hypothesized that several factors across these dimensions would affect the willingness to participate in opportunistic screening for BC and CC. In addition, since the implementation process for opportunistic screening differs from that of organized screening, several unique factors, such as willingness and ability to pay, might influence the adherence to opportunistic screening for BC and CC.

Therefore, this study was conducted to examine women's practice, willingness, and barriers to undergo BC and CC opportunistic screening in Sichuan Province, Southwest China, with a lower economic development level. The goal of this study was to provide the basic evidence for designing opportunistic screening and intervention strategies for BC and CC.

Materials and Methods

Study Design

The Ethics Committee of Southwest Medical University (approval number: KY2021162) approved this cross-sectional study. This study was conducted in accordance with the principles outlined in the Declaration of Helsinki. According to

the average per capita gross domestic product from 2017 to 2019, the cities in Sichuan Province were divided into high, medium, and low economic development levels. Two cities were selected from each level, and six cities were selected, including Chengdu, Mianyang, Luzhou, Suining, Dazhou, and Nanchong. Subsequently, convenience sampling was used to select residents from each selected city for the questionnaire survey.

Study Population

The inclusion criteria involved women aged 35–64 years old who had lived in the survey area for more than 3 years and have a sexual history. Additionally, women with a history of cancer, hysterectomy or mastectomy, mental illness, and hearing or speech impairment were excluded.

Sample Size

According to the principle of variance maximization, the opportunistic screening prevalence of BC or CC was set at 50%. The allowable error was set as 0.1, statistical significance was set at $P < 0.05$, and the sample size for each level was calculated using the following formula:

$$\mathrm{n} = \frac{Z_{\alpha}^{2}}{d^{2}} \times P \times (1 - P) \tag{1}$$

α: significance level; d: the allowable error; P: the opportunistic screening prevalence of BC or CC

The sample size was increased four-fold, considering the usage of convenience sampling. Each level required a sample size of 384. Therefore, the target sample size for this study was set at a minimum of 1152 women.

Questionnaire

The questionnaire was designed based on a literature review and expert consultation. It included eight parts: demographics, reproductive factors, personal history of diseases, family history of cancer, health-related behaviors, screening practice, willingness to undergo opportunistic screening, and awareness of cancer and screening knowledge.

For the screening practice, participants were asked, "Have you ever been screened for BC?" (No/Yes) and "Have you ever been screened for CC?" (No/Yes). If they responded "yes", they were asked about the screening approaches for each cancer, including organized screening, physician-recommended screening during a visit, and a voluntary screening. The latter two cases belonged to opportunistic screening. The most recent opportunistic screening facility was requested if the woman had undergone opportunistic screening for BC and CC.

There were two items regarding willingness to participate in BC and CC opportunistic screening: 1) "If you go to the hospital for a disease other than CC or BC, but the doctor recommends CC or BC screening (not free). Are you willing to participate in the screening? (No/Yes). 2) "Are you willing to go to the hospital for CC or BC screening (not free)?" (No/Yes). If the respondents answered "no", the reasons for their reluctance were asked.

The cancer statuses of first- and second-degree relatives were assessed to establish whether there was any family history of cancer. Subsequently, the type of cancer and the relationship between the relative and the respondent were established.

In the section on health-related behaviors, the frequencies of smoking, alcohol consumption, and physical activity per week were assessed, including less than 1 time, 1–2 times, 3–5 times, and ≥ 6 times. Based on the median frequency, a smoker was defined as someone who smoked ≥1 time per week. A drinker was defined as someone who drank ≥1 time per week. If a woman exercised ≥ 3 times a week, she was deemed to participate in an exercise program.

Concerning the awareness of screening knowledge of BC and CC, four items were assessed, including the screening method (two items) and the eligible population for screening (two items). For cancer knowledge, two items concerned whether early BC and CC could be cured. Five items were about the important risk factors for BC and CC, with one score for the correct answer, resulting in a total score of 0–5 for this section. According to the median total score, a woman with a score of 3 or higher was considered aware of BC and CC risk factors. In addition, the awareness of "two-cancers" screening was investigated.

Data Collection

The survey was conducted between July and August of 2021. Uniformly trained investigators approached potential participants and assessed their eligibility. The study's purpose was explained to potential participants, who were also informed that all data obtained from them would be kept confidential and anonymous. A self-administered interview was conducted after obtaining informed consent. If the respondent had questions about the questionnaire items, she could ask the investigator for help at any time. A face-to-face interview was conducted if a respondent found it difficult to read or understand the questionnaire.

Statistical Analysis

Epi-data version 3.0 was used to enter the data, which were then analyzed using SPSS 27.0. Data were summarized using the appropriate descriptive statistics. The opportunistic screening rate equals the number of participants who self-reported receiving opportunistic screening for BC or CC divided by the total number of participants. Chi-squared tests were used to test the associations between opportunistic screening practices and willingness for BC or CC and to compare the distribution differences in screening willingness among women with different characteristics. Factors with $P \leq 0.05$ were included in the multivariable logistic regression to identify the independent impact factors of screening willingness, using the likelihood ratio forward method to select variables, with the entry criterion being $P = 0.05$ and the exclusion criterion being $P = 0.1$. The results were presented as odds ratios (OR) with 95% confidence intervals (CI). All tests were two-sided with a significance level of 0.05.

Results

Participant's Characteristics

In this study, 1446 (94.4%) valid questionnaires out of 1531 questionnaires were included in the final analysis. The median age of the respondents was 47 years, and 40.4% were aged 45–54 years old. Table 1 presents the socio-demographic characteristics of the participants.

Opportunistic Screening Status

In this study, 458 women (31.7%) had been screened for BC in their lifetime, and 312 had undergone opportunistic screening, with an opportunistic screening rate of 21.6% (312/1446). During a clinical visit, 194 women reported being screened for BC at a doctor's recommendation. In the last physician-recommended screening, the most common screening location was district or county hospitals (85/193, 44.0%). One hundred and ninety-eight women reported having undergone voluntary screening for BC, with municipal hospitals (44.9%) (88/196) as the most screening sites in the last screening (Figure 1).

Five hundred and fifty-nine (38.7%) participants had been screened for CC in their lifetime, with 388 having undergone opportunistic screening, and at a rate of 26.8% (388/1446). Of the opportunistic screening participants, 236 reported having been screened for CC under a doctor's recommendation during a medical visit. In the last physician-recommended screening, the most common screening site was district or county hospitals (43.4%) (102/235) (Figure 1). Two hundred and sixty-two individuals reported having approached medical and healthcare institutions to be screened for CC, with municipal hospitals (40.0%) (104/260) being the most recent screening sites (Figure 1).

The Willingness and Barriers to Opportunistic Screening

During a clinical visit, 1069 (73.9%) women were willing to undergo screening for CC or BC under a doctor's recommendation, although the presenting disease was not CC or BC. The top three reasons for reluctance were:

1. No symptoms; hence, no need for screening (280/375, 74.7%),
2. Unwillingness or difficulty in paying the screening cost (91/375, 24.3%), and
3. Focusing only on the target disease (62/375, 16.5%) (Figure 2).

There were 835 (57.7%) participants willing to have CC or BC screening performed proactively at medical and healthcare institutions. The top three reasons for reluctance were:

Table 1 Sociodemographic Characteristics of the Participants

Variables	Frequency	Percent
Age (year)		
35–44	555	38.4
45–54	584	40.4
55–64	307	21.2
Nationality		
Han	1407	97.3
Others	39	2.7
Marital status		
Unmarried	27	1.9
Married	1299	89.8
Divorced/widowed	120	8.3
Residence		
Urban	1043	72.1
Rural	403	27.9
Education level		
Primary school and below	431	29.8
Junior high school	469	32.4
High school/technical secondary school	286	19.8
College degree and above	260	18.0
Job		
Retired	125	8.7
Full-time housework	417	28.9
Managers of enterprises and institutions	100	6.9
Professional and technical personnel	115	8.0
Office clerks	66	4.6
Social production and life service	418	28.9
Farmer	110	7.6
Manufacturing personnel	65	4.5
Others	29	2.0
Per capita monthly household income (RMB)		
<1000	183	12.7
1000–2999	504	35.0
3000–4999	437	30.3
≥5000	316	21.9
Medical insurance		
No	9	0.6
Yes	1435	99.4

Notes: There was one case of absence for the variable "job", six cases for the variable "Per capita monthly household income (RMB)", and two for the variable "medical insurance".

1. No symptoms; hence, no need for screening (444/608, 73.0%),
2. Unwillingness to devote time to visit the hospital for screening (179/608, 29.4%), and
3. Unwillingness or difficulty in paying the screening cost (137/608, 22.5%) (Figure 3).

The Association Between Opportunistic Screening Willingness and Practice

This study discovered a positive association between willingness and practice towards physician-recommended screening ($P < 0.05$) for CC and BC. Furthermore, the willingness for individual voluntary screening was positively associated with individual active screening behavior for CC and BC ($P < 0.05$) (Figure 4).

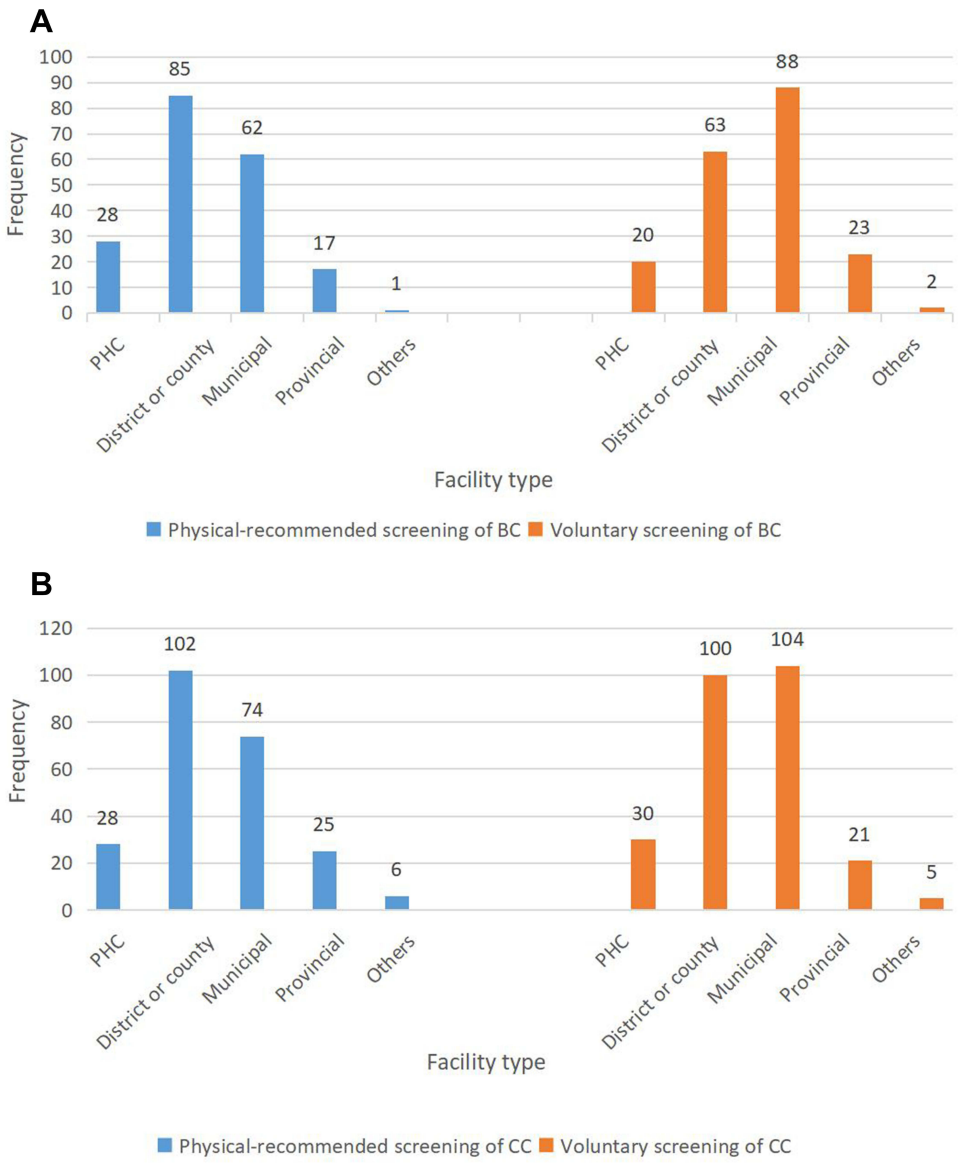

Figure 1 The medical and health institutions of the most recent opportunistic screening. (**A**) The medical and health institutions of the most recent physician-recommended and voluntary screening for BC. (**B**) The medical and health institutions of the most recent physician-recommended and voluntary screening for CC.
Abbreviations: BC, breast cancer; CC, cervical cancer.

Univariate Analysis of Influencing Factors for Opportunistic Screening

The willingness towards physician-recommended screening differed among women of different ages, nationalities, residences, education levels, jobs, per capita monthly household income (RMB), menopausal status, awareness of "two-cancers" screening, awareness of eligible women for screening, awareness of screening methods, awareness of BC and CC risk factors, and awareness of BC and CC early cure effect ($P < 0.05$). The willingness towards voluntary screening differed among women of different ages, nationalities, residences, education levels, jobs, per capita monthly household income (RMB), menopausal status, personal history of the disease, smoking, physical activity, awareness of "two-cancers" screening, awareness of screening eligible women, awareness of screening methods, awareness of BC and CC risk factors, and awareness of the BC and CC early cure effect ($P < 0.05$) (Table 2).

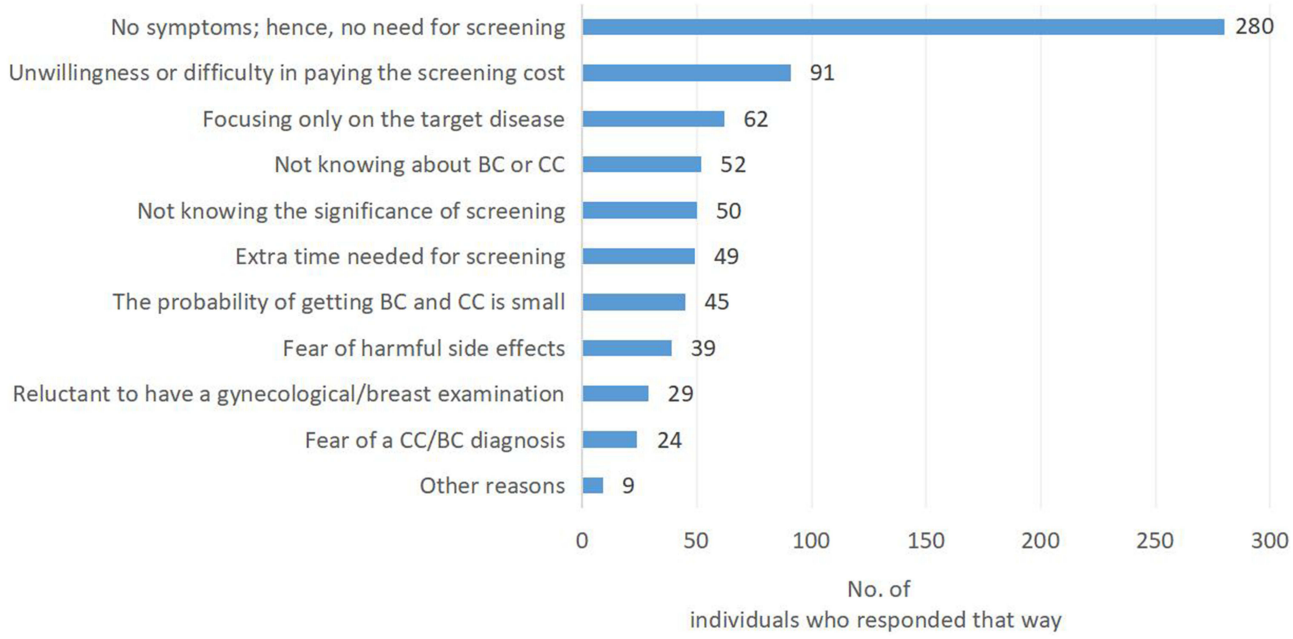

Figure 2 Barriers to the physician-recommended screening of BC and CC.
Abbreviations: BC, breast cancer; CC, cervical cancer.

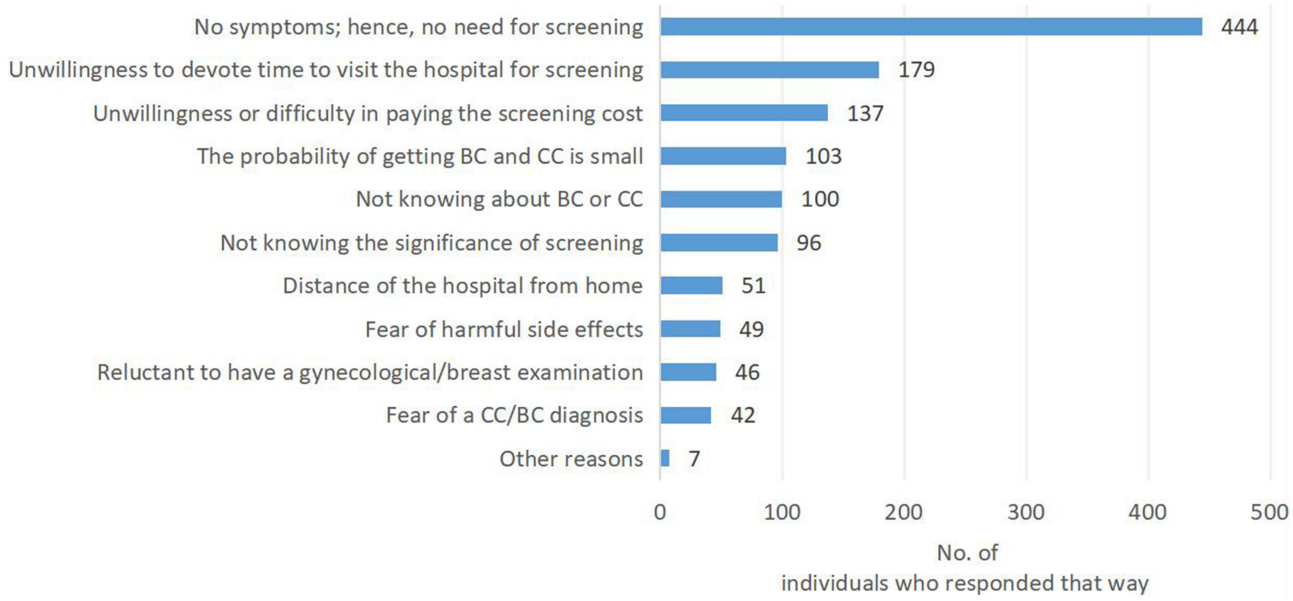

Figure 3 Barriers to voluntary screening of BC and CC.
Abbreviations: BC, breast cancer; CC, cervical cancer.

Multivariable Analysis of Influencing Factors for Opportunistic Screening

Regarding willingness towards physician-recommended screening, postmenopausal women were less willing (OR = 0.514, 95% CI: 0.392–0.674). Other ethnic groups were less willing than the Han nationality (OR = 0.357, 95% CI: 0.177–0.721). The willingness increased with education level (referred to primary school and below, junior high school: OR = 1.713, 95% CI: 1.251–2.777; high school/technical secondary school: OR = 1.881, 95% CI: 1.274–2.777; college degree and above: OR = 1.938, 95% CI: 1.254–2.996). Women who had heard of "two-cancers" screening (OR = 1.586, 95% CI: 1.156–2.178) were more willing than those who had not. Women who had heard of BC and CC screening

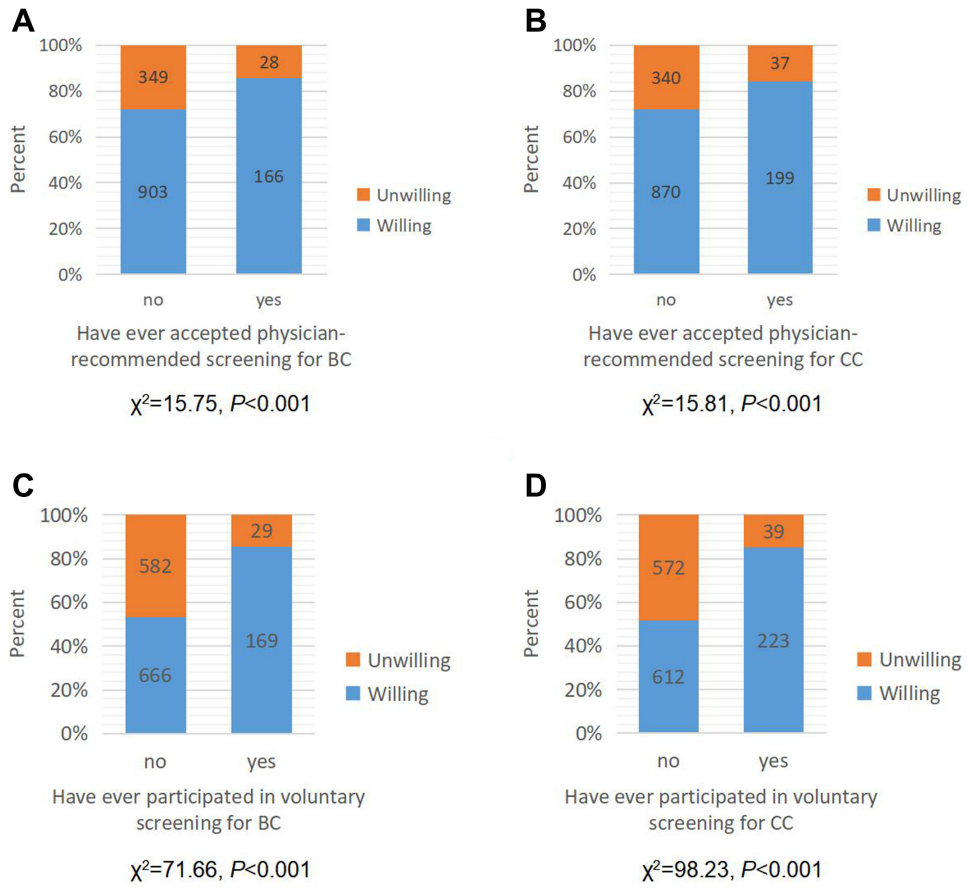

Figure 4 Associations between practice and willingness toward opportunistic screening. (**A**) A comparison of the willingness of women with and without physician-recommended screening for BC. (**B**) A comparison of the willingness of women with and without physician-recommended screening for CC. (**C**) A comparison of the willingness of women with and without voluntary screening for BC. (**D**) A comparison of the willingness of women with and without voluntary screening for CC.
Abbreviations: BC, breast cancer; CC, cervical cancer.

methods were more willing than those who had not (OR = 1.713, 95% CI: 1.200–2.447). In addition, awareness of eligible women for screening was positively associated with screening willingness (only BC or CC vs None: OR = 1.783, 95% CI: 1.335–2.381; both BC and CC vs None: OR = 1.751, 95% CI: 1.188–2.581) (Table 3).

Table 2 Population Characteristics by Willingness Towards Opportunistic Screening of BC and CC Among Women Aged 35–64 Years

Variables	Willingness Towards Physician-Recommended Screening				Willingness Towards Voluntary Screening			
	Yes (N, %)	No (N, %)	χ^2	*P value*	Yes (N, %)	No (N, %)	χ^2	*P value*
Age (year)								
35–44	470 (84.7)	85 (15.3)	69.30	**<0.001**	376 (67.7)	179 (32.3)	53.84	**<0.001**
45–54	417 (71.4)	167 (28.6)			330 (56.5)	254 (43.5)		
55–64	182 (59.3)	125 (40.7)			129 (42.0)	178 (58.0)		
Nationality								
Han	1049 (74.6)	358 (25.4)	10.66	**0.001**	820 (58.3)	587 (41.7)	6.11	**0.01**
Others	20 (51.3)	19 (48.7)			15 (38.5)	24 (61.5)		
Marital status								
Unmarried	23 (85.2)	4 (14.8)	1.91	0.39	14 (51.9)	13 (48.1)	1.17	0.56
Married	959 (73.8)	340 (26.2)			747 (57.5)	552 (42.5)		
Divorced/widowed	87 (72.5)	33 (27.5)			74 (61.7)	46 (38.3)		

(*Continued*)

Table 2 (Continued).

Variables	Willingness Towards Physician-Recommended Screening				Willingness Towards Voluntary Screening			
	Yes (N, %)	No (N, %)	χ^2	*P value*	Yes (N, %)	No (N, %)	χ^2	*P value*
Residence								
Urban	794 (76.1)	249 (23.9)	9.38	**0.002**	652 (62.5)	391 (37.5)	34.85	**<0.001**
Rural	275 (68.2)	128 (31.8)			183 (45.4)	220 (54.6)		
Education level								
Primary school and below	248 (57.5)	183 (42.5)	71.76	**<0.001**	174 (40.4)	257 (59.6)	87.64	**<0.001**
Junior high school	365 (77.8)	104 (22.2)			280 (59.7)	189 (40.3)		
High school/technical secondary school	234 (82.1)	51 (17.9)			183 (64.0)	103 (36.0)		
College degree and above	221 (85.0)	39 (15.0)			198 (76.2)	62 (23.8)		
Job								
Retired	95 (76.0)	30 (24.0)	52.66	**<0.001**	77 (61.6)	48 (38.4)	46.23	**<0.001**
Full-time housework	284 (68.1)	133 (31.9)			214 (51.3)	203 (48.7)		
Managers of enterprises and institutions	84 (84.0)	16 (16.0)			76 (76.0)	24 (24.0)		
Professional and technical personnel	100 (87.0)	15 (13.0)			79 (68.7)	36 (31.3)		
Office clerks	52 (78.8)	14 (21.2)			43 (65.2)	23 (34.8)		
Social production and life service	319 (76.3)	99 (23.7)			243 (58.1)	175 (41.9)		
Farmer	60 (54.5)	50 (45.5)			43 (39.1)	67 (60.9)		
Manufacturing personnel	56 (86.2)	9 (13.8)			43 (66.2)	22 (33.8)		
Others	19 (65.5)	10 (34.5)			17 (58.6)	12 (41.4)		
Per capita monthly household income (RMB)								
<1000	105 (57.4)	78 (42.6)	37.73	**<0.001**	77 (42.1)	106 (57.9)	45.91	**<0.001**
1000–2999	363 (72.0)	141 (28.0)			265 (52.6)	239 (47.4)		
3000–4999	338 (77.3)	99 (22.7)			270 (61.8)	167 (38.2)		
≥5000	261 (82.6)	55 (17.4)			221 (69.9)	95 (30.1)		
Medical insurance								
No	5 (55.6)	4 (44.4)	-	0.25	4 (44.4)	5 (55.6)	-	0.51
Yes	1062 (74.0)	373 (26.0)			829 (57.8)	606 (42.2)		
Menopausal status								
No	756 (81.0)	177 (19.0)	68.80	**<0.001**	606 (65.0)	327 (35.0)	55.97	**<0.001**
Yes	313 (61.0)	200 (39.0)			229 (44.6)	284 (55.4)		
Personal history of diseases								
None	848 (73.5)	306 (26.5)	2.50	0.48	653 (56.6)	501 (43.4)	10.99	**0.01**
Breast benign diseases	116 (78.4)	32 (21.6)			100 (67.6)	48 (32.4)		
Benign diseases of the reproductive system	73 (70.9)	30 (29.1)			53 (51.5)	50 (48.5)		
Both	32 (78.0)	9 (22.0)			29 (70.7)	12 (29.3)		
Family history of cancer in first- and second-degree relatives								
No	993 (73.4)	360 (26.6)	3.13	0.08	776 (57.4)	577 (42.6)	1.32	0.25
Yes	76 (81.7)	17 (18.3)			59 (63.4)	34 (36.6)		
Smoking								
No	983 (73.6)	352 (26.4)	0.62	0.43	759 (56.9)	576 (43.1)	5.03	**0.03**
Yes	84 (77.1)	25 (22.9)			74 (67.9)	35 (32.1)		
Alcohol consumption								
No	790 (73.2)	289 (26.8)	1.01	0.31	621 (57.6)	458 (42.4)	0.03	0.86
Yes	277 (75.9)	88 (24.1)			212 (58.1)	153 (41.9)		
Physical exercise								
No	780 (72.9)	290 (27.1)	2.12	0.14	596 (55.7)	474 (44.3)	6.68	**0.01**
Yes	287 (76.7)	87 (23.3)			237 (63.4)	137 (36.6)		
Awareness of "two-cancers" screening								
No	294 (59.6)	199 (40.4)	79.29	**<0.001**	199 (40.4)	294 (59.6)	92.61	**<0.001**
Yes	775 (81.3)	178 (18.7)			636 (66.7)	317 (33.3)		
Awareness of the BC and CC risk factors								
No	646 (70.8)	266 (29.2)	12.27	**<0.001**	479 (52.5)	433 (47.5)	27.62	**<0.001**
Yes	423 (79.2)	111 (20.8)			356 (66.7)	178 (33.3)		

(*Continued*)

Table 2 (Continued).

Variables	Willingness Towards Physician-Recommended Screening				Willingness Towards Voluntary Screening			
	Yes (N, %)	No (N, %)	χ^2	*P value*	Yes (N, %)	No (N, %)	χ^2	*P value*
Awareness of the BC and CC early cure effect								
No	138 (59.5)	94 (40.5)	33.60	**<0.001**	97 (41.8)	135 (58.2)	31.16	**<0.001**
Only BC or CC	115 (70.6)	48 (29.4)			90 (55.2)	73 (44.8)		
Both BC and CC	816 (77.6)	235 (22.4)			648 (61.7)	403 (38.3)		
Awareness of eligible women for screening								
No	251 (60.5)	164 (39.5)	55.53	**<0.001**	160 (38.6)	255 (61.4)	88.96	**<0.001**
Only BC or CC	581 (78.5)	159 (21.5)			477 (64.5)	263 (35.5)		
Both BC and CC	237 (81.4)	54 (18.6)			198 (68.0)	93 (32.0)		
Awareness of the screening method								
No	363 (62.1)	222 (37.9)	86.00	**<0.001**	235 (40.2)	350 (59.8)	142.51	**<0.001**
Only BC or CC	142 (71.1)	56 (28.3)			112 (56.6)	86 (43.4)		
Both BC and CC	564 (85.1)	99 (14.9)			488 (73.6)	175 (26.4)		

Notes: There was one case of absence for the variable "job", six for the variable "Per capita monthly household income (RMB)", and two for the variables "medical insurance", "smoking", "alcohol drinking", and "physical exercise". For the variables "age", "education level", and "Per capita monthly household income (RMB)", Chi-square test for trend was used. For the variable "medical insurance", the Fisher's exact probability was used. The bold front indicated the *P* value was less than or equal to 0.05.
Abbreviations: BC, breast cancer; CC, cervical cancer.

Table 3 Multiple Logistic Regression to Analyze the Potential Factors Associated with Physician-Recommended Screening Willingness

Variables	*P* value	OR (95% CI)
Nationality		
Han		1.00
Others	0.004	**0.357 (0.177, 0.721)**
Education level		
Primary school and below		1.00
Junior high school	0.001	**1.713 (1.251, 2.345)**
High school/technical secondary school	0.001	**1.881 (1.274, 2.777)**
College degree and above	0.003	**1.938 (1.254, 2.996)**
Menopausal status		
Pre-		1.00
Post-	<0.001	**0.514 (0.392, 0.674)**
Awareness of the "two-cancers" screening		
No		1.00
Yes	0.004	**1.586 (1.156, 2.178)**
Awareness of the screening method		
None		1.00
Only BC or CC	0.678	1.087 (0.734, 1.610)
Both BC and CC	0.003	**1.713 (1.200, 2.447)**
Awareness of eligible women for screening		
No		1.00
Only BC or CC	<0.001	**1.783 (1.335, 2.381)**
Both BC and CC	0.005	**1.751 (1.188, 2.581)**

Notes: The bold front indicated the 95% CI excluded 1.
Abbreviations: OR, Odds Ratio; CI, Confidence Interval; BC, breast cancer; CC, cervical cancer.

Similar results were observed for willingness towards voluntary screening. Postmenopausal women were less willing than premenopausal women (OR = 0.610, 95% CI: 0.475–0.784). Women of other ethnicities were less willing to screen than women of the Han nationality (OR = 0.469, 95% CI: 0.229–0.963). Screening willingness increased with increasing

Table 4 Multiple Logistic Regression to Analyze the Potential Factors Associated with Individual Voluntarily Screening Willingness

Variables	*P* value	OR (95% CI)
Nationality		
Han		1.00
Others	0.039	**0.469 (0.229, 0.963)**
Education level		
Primary school and below		1.00
Junior high school	0.004	**1.532 (1.144, 2.052)**
High school/technical secondary school	0.012	**1.548 (1.099, 2.179)**
College degree and above	<0.001	**2.477 (1.687, 3.635)**
Menopausal status		
Pre-		1.00
Post-	<0.001	**0.610 (0.475, 0.784)**
Awareness of the screening method		
None		1.00
Only BC or CC	0.006	**1.612 (1.143, 2.273)**
Both BC and CC	<0.001	**2.723 (2.097, 3.537)**
Awareness of eligible women for screening		
No		1.00
Only BC or CC	<0.001	**2.245 (1.716, 2.938)**
Both BC and CC	<0.001	**2.111 (1.496, 2.979)**

Notes: The bold front indicated the 95% CI excluded 1.
Abbreviations: OR, Odds Ratio; CI, Confidence Interval; BC, breast cancer; CC, cervical cancer.

education level (referred to as primary school and below as reference, junior high school: OR = 1.532, 95% CI: 1.144–2.052; high school/technical secondary school: OR = 1.548, 95% CI: 1.099–2.179; college degree and above: OR = 2.477, 95% CI: 1.687–3.635). Awareness of screening methods was positively associated with higher willingness to undergo screening (only BC or CC vs None: OR = 1.612, 95% CI: 1.143–2.273; both BC and CC vs None: OR = 2.723, 95% CI: 2.097–3.537). Awareness of eligible women for screening was also positively associated with screening willingness (only BC or CC vs None: OR = 2.245, 95% CI: 1.716–2.938; both BC and CC vs None: OR = 2.111, 95% CI: 1.496–2.979) (Table 4).

Discussion

In this study, the prevalence of previous screening for BC or CC among participants was less than 40%, and opportunistic screening rates were less than 30%. This suggests that there is still a long way to improve the 5-year cancer survival rates in the Healthy China 2030 Plan.[23] For the most recent opportunistic screening institution, district or county hospitals accounted for a higher proportion of physician-recommended screening, while municipal hospitals accounted for a higher proportion of women's initiative screening. This indicated that women were more inclined to visit hospitals with high comprehensive levels for BC and CC screening. In this study, only a few participants underwent BC and CC opportunistic screening in community and township health service institutions, which are primary health care (PHC) institutions in China. In Western countries, opportunistic screening is implemented based on the PHC system.[24] In China, PHC institutions performed multiple tasks in the "two-cancers" screening program under the direction of the superior unit, which was included in the basic national essential public health services package (NEPHSP) in 2019,[25] launched by the Chinese Central Government and supported by government subsidies.[26] However, PHCs still face the challenges of unavailable screening equipment and unsatisfactory screening techniques.[8] Efforts should be made to optimize health resource allocation, strengthen screening technology training, and establish a screening quality control system and referral channel for screening positives in PHC institutions, which could also improve the role of PHC in opportunistic screening of BC and CC.

This study investigated women's willingness to undergo BC and CC screening based on the doctors' recommendations and on their initiative and observed positive correlations between screening willingness and practice. The proportion of women willing to undergo screening on doctors' recommendation was high (73.9%), while it was relatively low (57.7%) on individuals'

initiative. Healthcare professionals' recommendations and the quality of patient-provider communication strongly influenced screening participation.[27] Our findings emphasized the importance of doctors explaining the importance of BC and CC screening, especially for high-risk women. In some developed countries, the role of the specialist breast-care nurse has evolved, and these nurses are often involved in other tasks such as public advocacy.[28] In the future, considerations of the role of health staff should attach importance to when the opportunistic screening programs were designed.

We further investigated barriers to screening intentions. The top barrier for physician-recommended and voluntary screenings, was "no symptoms; hence, no need for screening." This is consistent with previous studies suggesting that Chinese women participated in healthcare activities mainly for treatment rather than prevention.[29] This feature was also reflected in the third barrier to physician-recommended screening that 'only pay attention to the target disease.'

Inability and unwillingness to pay for screening were the main obstacles to women's participation in BC and CC screening. Additionally, several studies have observed an association between income deprivation and screening underuse.[30,31] It is necessary to explore appropriate ways to raise screening funds,[20] for example, establishing appropriate medical insurance policies to reduce the proportion of individual out-of-pocket payments, and improving residents' enthusiasm to participate in opportunistic screening for BC and CC.

In addition, "not knowing the significance of screening" and "not knowing about BC or CC" were important reasons for women's unwillingness to be screened. In this study, the awareness rate of BC and CC knowledge, including important risk factors and early cure effects, was only 50%. A previous study reported that public awareness of basic cancer knowledge is low in China, which may contribute to low attendance rates for in organized screening programs.[8]

In this study, some women thought that "the probability of getting BC and CC is small." In Chinese culture, cancer is regarded as an unpreventable and fatal disease.[32] Excessive fear of cancer may result in a defensive perception of low susceptibility and active screening avoidance.[33] Our findings amplified the requirement for health education and the dissemination of disease knowledge to form the correct risk awareness of cancer, as well as to recognize the importance of the early diagnosis and treatment of cancer.

This study identified several factors influencing women's willingness to participate in both physician-recommended and voluntary screening. It has been documented that educational level is an important factor affecting screening practice.[22,34] In this study, we observed that willingness to undergo opportunistic screening for BC and CC increased with educational level. Participants who are more educated may have better access to social and mass media screening information and may be more aware of the significance of screening.

Compared to the Han nationality (the largest ethnicity in China), women of ethnic minorities were more reluctant to be screened for BC and CC. Previous Chinese studies found that women of ethnic minorities had lower BC and CC screening program attendance rates than women of Han nationality.[9] This finding may be explained by the lower awareness of BC and CC prevention knowledge among ethnic minority women.[35,36]

This study found that postmenopausal women were less willing to undergo BC and CC screening than premenopausal women. One possible explanation was that postmenopausal females (31.4%) had lower awareness of cancer knowledge (data not shown) than premenopausal women (68.6%). In China, the incidence of BC peaks and remains high in the 45–64 years age group,[4] while the peak of CC incidence occurred at the age of 50–54 years old.[4] The recommended age for CC screening in most countries is between 25 and 65 years old.[37] The United States Preventive Services Task Force recommends screening between 50 and 74 years old for BC.[38] These results highlight the need for tailored intervention to encourage postmenopausal women to participate in BC and CC opportunistic screening.

In this study, awareness of screening knowledge was an important factor affecting women's willingness to undergo opportunistic screening for BC and CC. The promoting effect of high knowledge on screening, such as screening recommendations and procedures, has previously been reported.[22] We also discovered that women who had heard about the "two-cancer" screening program were more willing to participate in physician-recommended screening. Knowledge of the free screening policy has been positively associated with increased participation in BC screening.[34] Another study reported that increasing women's awareness of CC screening services could promote their willingness to participate in screening.[39] The findings of this study suggest that advocacy for cancer screening policies may also improve women's adherence to opportunistic screening for BC and CC.

Our findings emphasize the importance of health education campaigns and health promotion channels in raising public awareness of BC and CC risk factors, as well as the significance of screening, screening programs, and screening services. Acceptable intervention strategies, such as simpler print materials, culturally accepted languages, and lively media activity, should be developed for low-education groups, different ethnic minorities, and postmenopausal women. In addition, healthcare providers should play an important role in disseminating knowledge regarding BC and CC screening.

Limitation

This study had some limitations. First, convenience sampling was adopted, and the population representation of women in Sichuan Province was limited to respondents in this study. Second, recall bias may have existed in this study, since the participants self-reported their screening history.

Conclusion

The findings of this study suggested that opportunistic screening rates for BC and CC in Sichuan Province were low. The willingness towards physician-recommended screening was high, while that towards individual initiative screening was low. The lack of understanding surrounding cancer prevention and concerns about screening costs were the main obstacles to BC and CC opportunistic screening. Furthermore, ethnic minorities, postmenopausal women, those who had low education levels, those who lacked screening knowledge or awareness of screening services were less willing to participate in opportunistic screening for BC and CC.

Abbreviations

BC, breast cancer; CC, cervical cancer; QALY, quality-adjusted life year; OR, odds ratio; CI, confidence interval; PHC, primary health care; NEPHSP, National essential public health services package.

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Disclosure

The authors report no conflicts of interest in this work.

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