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The mediating effect of self-efficacy on social support and cancer screening behavior among Chinese women: a cross-sectional study

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Abstract

Background Breast and cervical cancer are the most common cancers in women, and are associated with high morbidity and mortality rates. Cancer screening can facilitate early diagnosis, reduce mortality, and ease the burden of cancer. Social support and self-efficacy are strongly associated with cancer screening behavior. The present study aimed to explore the mediating effect of self-efficacy on social support and cancer screening behavior.

Methods In this cross-sectional survey study conducted from June to October 2023, 312 women aged 35–65 years were recruited from the East Coast area of China. A general information questionnaire, cancer screening behavior questionnaire, social support scale and self-efficacy scale were used to collect data. Descriptive statistics were used to analyze the general characteristics of participants; one-way analysis of variance was used to test for differences in the measured variables; and Pearson's correlation analyses were used to describe the relationship among social support, self-efficacy, and cancer screening behavior. A mediation model was constructed and analyzed using the PROCESS macro for SPSS.

Results The mean (standard deviation) screening behavior score for breast cancer and cervical cancer was 3.98 (2.79), representing an intermediate level. Self-efficacy was closely related to social support and cancer screening behavior. Social support showed a significant positive correlation with self-efficacy ($r=0.37$, $p<0.01$) and cancer screening behavior ($r=0.18$, $p<0.01$). Self-efficacy was also significantly positively correlated with cancer screening behavior ($r=0.19$, $p<0.05$). Self-efficacy showed a full mediating effect between social support and cancer screening behavior, with an explanatory power of 32%.

Conclusions The findings emphasize the need to increase women's level of social support and self-efficacy, which in turn can increase women's participation in breast and cervical cancer screening.

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Keywords Woman, Breast cancer, Cervical cancer, Cancer screening, Social support, Self-efficacy, Mediating effect

Background

Breast cancer (BC) and cervical cancer (CC) are the most common tumors and the leading causes of cancer-related deaths in women [1]. According to the World Health Organization [2], 2,310,051 new cases of BC were reported worldwide in 2022, and BC was the leading cause of cancer-related mortality among female patients. CC is the fourth-most frequently diagnosed cancer in women, with 662,301 new cases and 348,874 deaths attributable to CC worldwide in 2022. China ranks first in the world in terms of the morbidity associated with BC and CC and second in terms of the mortality associated with these two diseases [2]. The rapid growth of morbidity and mortality related to BC and CC have resulted in a rapid increase in the disease burden associated with these cancers in the Chinese population [3].

Cancer screening has been proven to be an effective approach for detecting BC and CC, and early diagnosis coupled with timely intervention can reduce the morbidity and mortality associated with these cancers [4, 5]. In CC, for example, most cervical lesions are attributable to human papillomavirus (HPV) persistence. A retrospective study conducted on 2,966 women who underwent cervical surgery, showed that the probability of recurrence in women with HPV persistence at 6 months after surgery was 7.46%, while the 5-years recurrence rate in women showing HPV persistence 12 months after surgery was twice that in women showing HPV persistence 6 months after surgery [6]. Several measures can be adopted to prevent CC, including smoking cessation, use of condoms, and HPV vaccination during adolescence. In addition, regular cervical cytological examinations, human papillomavirus testing and colposcopy can allow early detection of CC and change the poor outcomes [7]. Countries such as the United States, Italy, and Ireland [8–11] have implemented structured programs for breast cancer screening (BCS) and cervical cancer screening (CCS). For CC, the U.S. Preventive Services Task Force recommends that women aged 21–29 years should undergo cervical cytology screening every three years, and those aged 30–65 years should undergo high-risk human papillomavirus (hrHPV) testing every five years in addition to cervical cytology screening, or hrHPV testing and cytology screening every 5 years [8]. For BC, biennial mammograms are recommended for women aged 50–74 years [9]. However, in the United States, the BCS participation rate among high-risk women was only 7-22% [12]. In China, BCS and CCS are grouped together and referred to as two-cancer screening (TCS). Since 2009, the Chinese government has been promoting TCS for women aged 35 to 65 years, with medical insurance reimbursing part of cost. By 2019, the cost of TCS was being fully covered by the government [13]. The Chinese government aimed to achieve a TCS rate of 80% by 2022 and 90% by 2030 [14]. However, despite the implementation of clear policies to support TCS for women, the rate of participation in the screening program remains unsatisfactory. In China, the participation rate in TCS among rural women was only 2.3% before 2009, and it increased to 52.1% by 2020. Thus, while the rates of TCS have been gradually increasing since 2009, they need to be improved further [15].

The Health Belief Model (HBM) is a psychological model that explains and predicts health-related behaviors by focusing on people's beliefs related to health and disease [16]. HBM is based on the individual's beliefs, including perceived susceptibility, perceived severity, perceived barriers, perceived benefits, self-efficacy and cues for action [16]. HBM argues that an individual's beliefs about health issues determine whether that person will take positive health-related actions, and self-efficacy is an important individual's belief [17]. Self-efficacy refers to an individual's confidence or belief in his or her ability to perform preventive health behaviors in a given setting [18]. Previous studies have shown that self-efficacy is strongly associated with BCS and CCS behaviors [19]. One study found that for every one-point increase in self-efficacy, CCS participation increased 1.09-fold [20]. Action cues have been identified as the "triggers" that motivate a person to take action, and are determinants of health behaviors [16]. Action cues include intrinsic and extrinsic cues, of which extrinsic cues include health promotion and education in the mass media, health professionals' advice to adopt the healthy behaviors, and help or encouragement from family members and groups. Social support is one of the extrinsic cues in the HBM. Social support is a significant predictor of preventive health behaviors, low levels of social support have been associated with poor adherence to BCS among women [21], and social support has been shown to be a contributor to CCS in a survey of cancer screening among adolescents [22].

Nevertheless, while previous studies have demonstrated that social support and self-efficacy are associated with BCS and CCS, the mechanisms underlying these associations have not been elucidated to date. HBM has been widely used in many health behavior-related studies to explore the relevant influencing factors, such as dementia-prevention behaviors among Chinese adults and weight-management behaviors among college students [23, 24]. However, no studies have used this model to explore the mechanisms underlying cancer

screening-related actions. On the basis of previous studies using the HBM, we hypothesized that self-efficacy mediated social support and TCS behavior in women. Therefore, this study aimed to determine the mediating effect of self-efficacy in women to improve their participation in TCS.

Methods

Participants

We conducted a cross-sectional survey in the East Coast area of China from June to October 2023. A convenience-sampling approach was used to recruit women aged 35 to 65 years, consistent with the recommended age range for TCS [25, 26]. Women who were pregnant, those who had undergone a hysterectomy or mastectomy, and those who had not recovered from a serious illness were excluded.

The sample size required to achieve the desired statistical power was calculated using the formula $n = (Z_{\alpha/2} \times \sigma)^2 / \delta^2$, where $Z_{\alpha} = 1.96$, $\delta = 0.5$, and $\sigma = 3.69$ (based on the standard deviation of self-efficacy scores among women in the target age demographic in a preliminary investigation). This calculation indicated that the required sample size was 209. We increased the sample size by 20% to account for attrition, setting it at 251.

Measures

Data collection was performed using a four-part questionnaire (see Additional file 1). The first part collected data for the sociodemographic characteristics of the participants, including their age, ethnicity, religion, marital status, number of children, educational attainment, employment status, occupation, economic level, medical expenses, family history of cancer, and time burden for participating in TCS.

The second part used a specialized questionnaire designed by the research team on the basis of theoretical frameworks and prior literature (see Additional file 1). The questionnaire contained three items and was used to evaluate participants' behaviors related to TCS. The number and extent of screening behavior were categorized into three levels, with scores ranging from 1 to 3, totaling 7 points, and higher scores indicated more proactive screening practices. The internal consistency coefficient and test-retest reliability of the scale were 0.85 and 0.57. The path coefficients in the model for this scale were all significant and the model had good intrinsic quality (please see Additional file 2 for detailed data).

The third part used the validated Medical Outcomes Study Social Support Survey (MOS-SSS) to measure the level of social support [27]. The MOS-SSS was developed by Sherbourne in 1991 [27] and translated from English to Chinese and back-translated to guarantee the accuracy of the Chinese translation in 2012 [28]. The items and order of the Chinese MOS-SSS were consistent with the English MOS-SSS, including one subjective question and 19 objective questions. The subjective question was not included in the total score, while the responses to the objective questions were based on a 5-point Likert scale (from 1 = "not at all" to 5 = "all the time"), with higher scores indicating superior social support levels. The Chinese version of the MOS-SSS was validated among AIDS patients and showed good reliability (Cronbach's $\alpha = 0.89$). The reliability of MOS-SSS in this study was Cronbach's $\alpha = 0.77$.

The fourth part of the questionnaire used the General Self-efficacy Scale (GSES) [29], which included 10 items, to evaluate self-efficacy. A higher score indicated a greater level of self-efficacy. The reliability of the scale in this study was Cronbach's $\alpha = 0.87$.

Data collection

A network questionnaire survey was used to collect data. The research team contacted and solicited the consent of the participants and then distributed the online questionnaire. We strictly adhered to the ethical principles of informed consent, voluntary participation, anonymity and confidentiality; explained our purpose to the participants at the beginning of the questionnaire survey, and ensured that the information collected by the survey was not disclosed to the public. The survey was completed anonymously and required 10–15 min to complete. Researchers checked the completeness of the questionnaires after the participants finished them. Each internet protocol address could submit the questionnaire only one time. Questionnaires completed within 5 min were disqualified. Participants who completed the entire questionnaire received a gift voucher. The institutional ethic committee of Xuzhou Medical University approved the study (XZHMU-2023033).

Data analysis

We analyzed the data using SPSS software (SPSS v27, IBM Business Analytics, New York, USA). General characteristics of the study participants were presented as frequency and percentage values and analyzed by descriptive statistics. The questionnaire scores were presented as mean and standard deviation values. Correlations between variables were analyzed by obtaining Pearson's correlation coefficients. Differences among the measured variables were analyzed using one-way analysis of variance. We applied the bias-corrected bootstrap method using the SPSS PROCESS macro (Model 4) to analyze mediation effects. We used the bootstrap method to generate 5000 resamples from the original data by random sampling and replacement. If the 95% confidence interval did not contain zero in the mediating effect analysis, the effects were considered to be significant. All

Table 1 Demographic characteristics of the participants ($N=312$)

Variable	*N* (%)	TCS behavior	
		Mean (SD)	*P*
Ethnicity			0.20
Han	310 (99.36)	3.97 (2.79)	
Other	2 (0.64)	6.50 (0.71)	
Religion			0.35
Yes	297 (95.19)	4.02 (2.79)	
No	15 (4.81)	3.33 (2.74)	
Marital status			0.06
Married	296 (94.87)	4.05 (2.77)	
Unmarried	2 (0.64)	0.00 (0.00)	
Divorced, widowed, or otherwise	14 (4.49)	3.07 (2.81)	
Number of children			0.34
0	9 (2.88)	2.89 (2.89)	
1	181 (58.01)	4.11 (2.81)	
2	114 (36.54)	3.96 (2.72)	
> 2	8 (2.56)	2.75 (3.06)	
Educational attainment			0.86
Bachelor's degree or above	133 (42.63)	4.13 (2.91)	
Junior college	57 (18.27)	3.75 (2.83)	
High school	65 (20.83)	3.92 (2.66)	
Junior high school and below	57 (18.27)	3.95 (2.62)	
Employment status			0.09
Retiring	28 (8.97)	3.75 (2.69)	
Working	254 (81.41)	4.13 (2.78)	
Between jobs	30 (9.62)	2.97 (2.81)	
Occupation			0.60
Clerk/worker	127 (40.71)	4.23 (2.72)	
Teacher/Civil servant	84 (26.92)	3.80 (2.87)	
Farmer/individual	22 (7.05)	3.59 (2.65)	
Unemployed/otherwise	79 (25.32)	3.90 (2.85)	
Monthly household income per capita (RMB)			0.45
≤ 2999	55 (17.62)	3.56 (2.63)	
3000–4999	90 (28.85)	4.00 (2.82)	
≥ 5000	167 (53.53)	4.11 (2.82)	
Medical expenses			0.44
Medical insurance	281 (90.10)	4.00 (2.79)	
Self-financed	17 (5.40)	3.29 (2.71)	
Other	14 (4.50)	4.57 (2.77)	
Family history of cancer			0.19
Yes	34 (10.90)	4.59 (2.60)	
No	278 (89.10)	3.91 (2.80)	
Time burden for attending TCS			0.01*
Yes	71 (22.76)	3.23 (2.90)	
No	241 (77.24)	4.21 (2.72)	

*$P<0.05$, p p value, SD Standard Deviation, TCS two-cancer screening

Table 2 Descriptive statistics for TCS behavior, self-efficacy, and social support

Variables	Score, mean (SD)	Range
TCS behavior	3.98 (2.79)	0–7
Self-efficacy	27.23 (3.43)	12–40
Social support	64.81 (15.28)	19–95

TCS two-cancer screening, SD Standard Deviation

Table 3 Pearson correlation analysis of study variables (*r*)

Variables	Social support	Self-efficacy	TCS behavior
Social support	1		
Self-efficacy	0.37**	1	
TCS behavior	0.18**	0.19*	1

*$p<0.05$, **$p<0.01$, p p value, TCS two-cancer screening

analyses were two-tailed, the level of statistical significance was set at $p<0.05$.

Results

Participant characteristics

Prior to the formal questionnaire collection, we initiated a pre-collection phase. During this preliminary stage, we disseminated 100 online questionnaires to eligible women, achieving an approximate recovery rate of 50%. Based on the calculated sample size of 251, we subsequently distributed 400 online questionnaires. Among all 500 questionnaires, 312 responses were identified as suitable for statistical analysis, resulting in an effective response rate of 62.4%. A total of 188 questionnaires were excluded, including those completed within 5 min ($n=104$), those submitted multiple times from the same internal protocol address ($n=62$), and those with the same option chosen for all the answers ($n=22$). The mean patient age was 44.17±6.02 years (range: 35–65 years). The majority of the respondents (94.87%) were married, and over 90% of them reported having one or two children. The employment rate was high among respondents (81.41%). The average monthly household income indicated an upper-middle-class status. Table 1 presents the sociodemographic characteristics of the study sample.

Scale scores

The total scores for the MOS-SSS, GSES, and TCS behavior among the participants showed a normal distribution. As shown in Table 2, the mean MOS-SSS, GSES, and TCS behavior scores were 64.81±15.28, 27.23±3.43, and 3.98±2.79, respectively.

Relationships among the study variables

As shown in Table 1, the time burden of TCS ($p<0.05$) was significantly associated with TCS behavior. The Pearson correlation analysis showed that self-efficacy was closely related to social support and TCS behavior (Table 3). Social support showed a significant positive

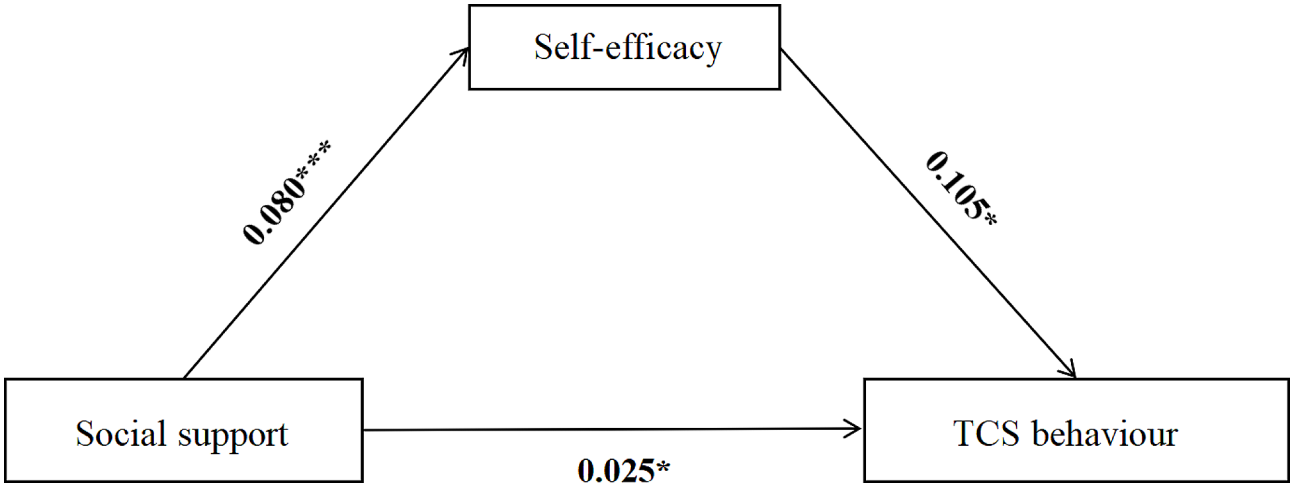

Fig. 1 Self-efficacy mediator model. *, $P<0.05$; ***, $P<0.001$; TCS, two-cancer screening

Table 4 Characteristics of total effect, direct effect, and intermediate effect

Item	Paths	Effect size	Boot SE	Boot LLCI	Boot ULCI
Total effect	C	0.025	0.010	0.005	0.045
Direct effect	c'	0.017	0.011	-0.004	0.038
Indirect effect	ab	0.008	0.004	0.001	0.017

correlation with self-efficacy ($r=0.37$, $p<0.01$) and TCS behavior ($r=0.18$, $p<0.01$). Self-efficacy also showed a significant positive correlation with TCS behavior ($r=0.19$, $p<0.05$).

Mediation analysis

We performed mediation analysis after controlling the time burden of TCS as a covariate. As shown in Fig. 1, social support was a significant positive predictor of self-efficacy (β=0.080, $P<0.001$), and self-efficacy positively predicted TCS behavior (β=0.105, $P<0.05$). As shown in Table 4, the confidence intervals for the indirect effect did not contain zero, indicating that the mediating effect of self-efficacy on social support and TCS behavior was significant. After self-efficacy was included in the mediation model, the direct effect of social support on TCS behavior was no longer significant. Thus, the findings indicated that self-efficacy plays a full mediating role between social support and TCS behavior. The mediating effect value was 0.008, and the total effect value was 0.025. The explanatory power of self-efficacy for screening behavior was 32%.

Discussion

The findings indicated that the time burden associated with TCS may limit women's participation. Social support and self-efficacy were positively associated with TCS behavior. Higher levels of social support significantly increased participants' self-efficacy. The mediation analysis showed that self-efficacy fully mediated the relationship between social support and TCS behavior.

The mean total score for TCS behavior in this study was 3.98 (2.79), reflecting an intermediate level (maximum total score=7), and time burden was a negative factor for TCS. These findings were similar to those reported in previous studies. For example, Xu and Wang [30] found that married Chinese women showed low awareness of CC and lacked motivation to undergo screening. Patel et al. [31] found that lack of time was a barrier to participation in cancer screening among low-income African-American women in Tennessee. Although the Chinese government has been promoting TCS, the current screening situation is not encouraging, owing to the country's large population, uneven economic development, low education levels among women in the countryside, and the time burden associated with screening [32, 33]. Thus, to improve TCS, the influencing factors should be identified and addressed to promote screening behavior among women.

The present study showed that social support was positively related with TCS behavior. This finding is consistent with previous studies. One study showed that social support from other women and their family members, especially partners, was a key factor for participation in BCS [34], while Darj et al. [35] reported that more women will attend CCS if their family members encourage them to get tested. People with a high level of social support may be able to reduce their financial burden by accessing additional financial resources; moreover, social support facilitates the sharing of favorable screening experiences through social networks and offers relevant information and counsel, encouraging women to seek healthcare services [18]. Thus, the participation rate in TCS can be increased by raising the level of social support, especially familial support, for women.

The results of this study showed that self-efficacy was positively associated with TCS behavior. Previous studies have also confirmed this finding. Zhang et al. [36] found that self-efficacy was a significant factor determining women's screening intention. Wang et al. [37] found that perceived self-efficacy can increase women's confidence in their ability to undergo BCS. Individuals with high self-efficacy are more likely to have excellent self-management skills, allowing them to better manage the anxiety associated with the screening process and its results and thereby actively participate in screening activities [38, 39]. These findings suggest that self-efficacy is a significant factor in improving women's participation in TCS. Thus, future studies should also consider developing strategies to enhance self-efficacy to boost the rates of TCS.

We also found a mediating effect of self-efficacy between social support and TCS behavior. Our analysis indicated that social support enhances self-efficacy, which in turn facilitates increased screening behavior. In the HBM, action cues are personal incentives to change health behaviors, such as friends' experience with TCS and family members' encouragement to participate in TCS. These external incentives may diminish an individual's negative beliefs such as fear of TCS, and increasing their positive beliefs such as their confidence in managing their health better, facilitating their active participation in TCS. Previous studies have shown that women with high levels of social support had greater self-efficacy, leading to a stronger commitment to self-care and preventive health actions [19]. This heightened self-efficacy fosters a proactive approach to health management, yielding improved screening behavior for cancers. These findings suggest that women's self-efficacy can be improved by increasing their social support, thereby promoting participation in TCS. Thus, social support is a key intervening factor for women in promoting their active participation in TCS.

This study had some limitations. First, while this was a cross-sectional study, TCS behavior may be influenced by individuals and their environment, and self-efficacy can change at certain times and circumstances, so a longitudinal study design is necessary to clarify the path relationships among social support, self-efficacy, and TCS behavior. Second, the study population only included individuals from the East Coast area of China, which limited the generalizability of the findings. Future studies should include participants from different regions, and a larger, representative sample could increase the generalizability of the findings. Third, we used a questionnaire developed by the research team to evaluate participants' TCS-related behaviors. Although the questionnaire showed good reliability, the relatively limited number of entries could be a limitation. Thus, future studies should be conducted with validated questionnaires. Finally, social support can be derived from a variety of sources, such as emotional support, information support, and financial support. Future studies should aim to elucidated the types of social support that play more important roles in predicting cancer screening.

Implications

We found that self-efficacy acts as a mediator and indirectly influences TCS behavior. This finding suggests that targeted health education and psychological interventions for women of the appropriate age should be implemented to promote motivation for screening. Encouraging women to understand cancer screening and enhance their cognitive mastery is necessary, since this could help them improve their screening self-efficacy [19]. The availability of social support, especially family support, can enabler enhanced individual cancer screening decisions [40]. Implementing family-centered interventions can increase women's perception of social support and thus facilitate their participation in cancer screening.

Conclusions

Self-efficacy showed a mediating effect between social support and TCS behavior, and social support and self-efficacy positively affected TCS behavior. These findings imply that government and healthcare organizations can take measures to increase women's self-efficacy and social support, especially family support, to promote women's participation in cancer screening.

Abbreviations

BC	Breast Cancer
BCS	Breast Cancer Screening
CC	Cervical Cancer
CCS	Cervical Cancer Screening
GSES	General Self-efficacy Scale
HBM	Health Believe Model
HPV	Human Papillomavirus
MOS-SSS	Medical Outcomes Study Social Support Survey
SD	Standard Deviation
TCS	Two-Cancer Screening

Supplementary Information

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Supplementary Material 1

Supplementary Material 2

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Author contributions

HT and LZ were the principal investigator, collected and analyzed the data, and wrote a draft of the manuscript. MX and ZZ were involved in the discussion and conclusions drawn from the study results. JH and LY designed

the study and contributed to data interpretation and critical review. All authors read and approved the final manuscript.

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Data availability
The datasets used and/or analysed during the current study are available from the corresponding author on reasonable request.

Declarations

Ethics approval and consent to participate
Ethical approval and clearance for this study were obtained from ethics committee of Xuzhou Medical University (XZHMU-2023033). Informed consent was obtained from all participants.

Consent for publication
Not applicable.

Competing interests
The authors declare no competing interests.

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