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ORIGINAL RESEARCH

Knowledge, Attitude, and Practice Toward Breast Reconstruction Among Breast Surgery Healthcare Professionals in China

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Purpose: This study evaluated the knowledge, attitude, and practice (KAP) of breast surgery healthcare professionals in China towards breast reconstruction.

Patients and Methods: This multicenter cross-sectional study was performed between July and September 2024, recruiting breast surgery healthcare professionals across China. Data were collected using a self-administered questionnaire with high reliability (Cronbach's $\alpha = 0.915$) to capture demographic and KAP information. Multivariate logistic analyses identified factors independently associated with the KAP.

Results: A total of 371 participants were enrolled. The mean knowledge, attitude, and practice scores were 8.25±3.67, 43.77±6.25, and 25.56±4.77. Working at a teaching hospital (OR=7.019, 95% CI: 2.519–19.562, P<0.001) and performing or participating in breast reconstruction surgery for patients (OR=4.128, 95% CI: 2.170–7.853, P<0.001) were independently associated with adequate knowledge. The knowledge scores (OR=1.093, 95% CI: 1.019–1.173, P=0.013), female gender (OR=3.774, 95% CI: 1.959–7.279, P<0.001), master's degree or above education (OR=5.597, 95% CI: 2.050–15.284, P=0.001), non-public tertiary hospitals (OR=8.196, 95% CI: 2.368–28.363, P=0.001), >20 years of experience (OR=11.249, 95% CI: 1.554–81.443, P=0.017), teaching hospital (OR=3.367, 95% CI: 1.262–8.980, P=0.015), and performed or participated in breast reconstruction surgery for patients (OR=2.228, 95% CI: 1.041–4.769, P=0.039) were independently associated with the positive attitude. The knowledge scores (OR=1.176, 95% CI: 1.095–1.262, P<0.001), doctor (OR=3.502, 95% CI: 1.025–11.971, P=0.046), master's degree or above education (OR=0.116, 95% CI: 0.043–0.313, P<0.001), junior title (OR=0.194, 95% CI: 0.052–0.730, P=0.015), non-public tertiary hospitals (OR=0.225, 95% CI: 0.078–0.650, P=0.006), and 10–20 years of experience (OR=0.318, 95% CI: 0.109–0.924, P=0.035) were independently associated with the proactive practice. Structural equation modeling showed that knowledge significantly influenced both attitudes (β=−1.753, P<0.001) and practices (β=1.981, P<0.001).

Conclusion: While attitudes and practices were generally positive, significant gaps remain in routine recommendation and education practices. Targeted educational programs may enhance their knowledge and improve clinical practices.

Keywords: knowledge, attitude, practice, breast cancer, breast reconstruction, healthcare professionals

Introduction

Breast cancer is the second most common cancer globally and the most frequently diagnosed cancer among women, with an estimated incidence of 2,308,897 new cases reported in 2022 worldwide, accounting for 11.6% of all cancer diagnoses. It is the fourth leading cause of cancer-related mortality, with 665,684 deaths annually, representing 6.9%

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of all cancer-related deaths.[1] The management of breast cancer necessitates a multidisciplinary approach, with surgical resection being crucial to curative treatment.[2,3]

The primary surgical options (mastectomy and lumpectomy) frequently result in significant tissue loss, leading to breast deformities that can profoundly affect patients' physical appearance and self-image.[4–6] Mastectomy and lumpectomy can have a significant cosmetic impact on the patients due to a loss of breast contour and symmetry, scarring and skin changes, absence of nipple and areola, impact on clothing choices, and body image and psychological effects.[7–9] These post-surgical deformities may have severe psychological repercussions, adversely impacting women's well-being, self-esteem, and quality of life.[9–11] Breast reconstruction offers an opportunity to restore the volume, shape, and contour of the breast following tumor resection, employing techniques such as implant-based reconstruction, autologous tissue transfer, and oncoplastic surgery. These procedures can be performed either immediately during the same surgical session as tumor excision or as delayed procedures following adjuvant therapies such as radiotherapy or chemotherapy.[12–14]

Each reconstruction technique has specific indications and contraindications, necessitating comprehensive knowledge among healthcare providers to ensure accurate patient counseling and informed decision-making. Furthermore, considering the resource-intensive nature of these procedures, it is essential for healthcare providers to balance medical necessity with patients' individual preferences and psychosocial well-being. Although breast defects do not directly compromise physical health or survival, they significantly influence quality of life and long-term survivorship.[9–11]

Knowledge, attitude, and practice (KAP) studies are instrumental in identifying knowledge gaps, misconceptions, and barriers that may hinder optimal clinical practice or influence attitudes toward a specific intervention.[15–17] Such insights are crucial for developing targeted strategies to address these barriers. Despite the well-documented benefits of breast reconstruction, its utilization in Asia, including China, remains relatively low, likely due to cultural, economic, and systemic challenges.[18] Currently, there is a paucity of data on the KAP of breast surgery healthcare professionals regarding breast reconstruction,[19–21] with no studies reported from China to date. Importantly, despite a high volume of mastectomies for breast cancer, the rate of breast reconstruction in China remains low compared to Western countries. Recent multicenter data from 2018 indicate a reconstruction rate of 9.6% after mastectomy, up from about 4.5% in 2012, but still significantly lower than the rates in the United States of America or the United Kingdom, where rates can exceed 20%-50%.[22–24] Beyond the systemic and cultural barriers that could be involved in the low rates,[24,25] part of the reasons for those differences could lie in KAP and should be investigated.

Therefore, this study aims to comprehensively assess the KAP of breast surgery healthcare professionals in China toward breast reconstruction, with the ultimate goal of identifying barriers and proposing strategies to improve clinical practice and patient outcomes in this domain.

Materials and Methods

Study Design and Participants

This multicenter cross-sectional study was conducted between July and September 2024 at Xuzhou Central Hospital, Zhengzhou Traditional Chinese Medicine Hospital, Jiangbin Hospital of Guangxi Zhuang Autonomous Region, Guangxi Province, Yulin People's Hospital, and Zhengzhou People's Hospital. Breast surgery healthcare professionals were recruited as participants. Ethical approval was obtained from the Zhengzhou Traditional Chinese Medicine Hospital Ethics Committee, and informed consent was secured from all participants prior to enrollment.

Inclusion criteria were: (1) in-service breast surgery healthcare professionals; and (2) voluntary agreement to participate by signing the informed consent form. Exclusion criteria included (1) refusal to participate in the study and (2) inability to complete the questionnaire due to psychological, psychiatric, or severe physical illness.

Questionnaire introduction

The self-administered questionnaire was designed based on the literature.[26,27] After design, it was modified for content validity based on the opinions of six experts. It was pilot-tested in 30 individuals, revealing a Cronbach's α coefficient of 0.915, indicating excellent internal consistency.

The final questionnaire was in Chinese and included information on four dimensions (45 items total): nine items for basic information, 17 for knowledge, 12 for attitudes, and seven for practices. The demographic data included gender, occupation, education, professional title, hospital category, years of working experience, teaching hospital, and involvement in reconstruction surgery. For the knowledge dimension, 1 point was scored for correct answers and 0 for incorrect/uncertain answers, with a score range of 0–17. The attitude dimension consisted of 12 questions utilizing a five-point Likert scale. The options were scored from five (positive) to one (negative), with a score range of 12–60. For the practice dimension, options were scored from five (positive) to one (negative), with a total score range of 7–35. P8 and P9 without scores were treated as separate categorical variables. The final questionnaire was in Chinese (a version translated into English was attached as an Appendix).

KAP dimension scores above 70% reflect sufficient knowledge, positive attitudes, and proactive practice, while scores below 70% indicate inadequate knowledge, negative attitudes, and poor practice.[15,17] In this study, the 70% threshold was 11.2 for knowledge, 42 for attitudes, and 24.5 for practice.

Questionnaire Distribution and Quality Control

The online questionnaire was disseminated via the *Sojump* platform (https://www.wjx.cn/). Participants accessed the survey by scanning a QR code or clicking a link shared through WeChat. The consent form was the first page of the questionnaire and was mandatory to gain access to the questionnaire itself. It was compulsory to submit the questionnaire for all items. Only one submission was allowed for a given IP address. Questionnaires responded in <72 s or in >1800 s, with logic errors (eg, age of 554 years) or responded with an obvious pattern (eg, all first choices), which were considered invalid and were excluded from the analyses.

Sample Size

The minimum sample size was determined using the method for quantitative surveys,[28] ie, 10 times the number of survey items. Since there were 36 KAP items, the minimal sample size was 360.

Statistical Analysis

All statistical analyses were performed using SPSS version 27.0 (IBM, Armonk, NY, USA). Continuous variables were expressed as mean ± standard deviation (SD), while categorical variables were presented as n (%). Differences in KAP scores across demographic groups were assessed using Student's *t*-test for comparisons between two groups and one-way analysis of variance (ANOVA) for comparisons among three or more groups. Pearson's correlation analysis was used to evaluate relationships among the KAP dimensions. Univariate and multivariate logistic regression analyses were performed to explore associations between demographic characteristics and good KAP scores (defined as >70%). Variables with $P < 0.05$ in univariate analyses were included in the multivariate logistic regression model. Structural equation modeling (SEM) was employed to test three hypotheses: (H1) knowledge influences attitude, (H2) knowledge influences practice, and (H3) attitude influences practice. Model fit was assessed, and direct and indirect effects were calculated. P-values were reported to three decimal places, with $P < 0.05$ considered statistically significant.

Results

Characteristics of the Participants

A total of 371 participants were included. There were 245 (66.04%) males, 126 (33.96%) females, 330 (88.95%) physicians, and 41 (11.05%) nurses. The highest frequencies of participants were observed for Western medicine practitioners (84.37%), with a bachelor's degree or below (56.87%), intermediate title (73.32%), public tertiary hospitals (92.45%), 5–10 years of experience (59.84%), and working in a teaching hospital (51.75%). They were not performing or participating in breast reconstruction surgery on patients (83.83%) (Table 1).

Knowledge, Attitude, and Practice

The mean knowledge score was 8.25±3.67 on a possible maximum of 17 (48.53%), indicating inadequate knowledge. The knowledge scores were associated with gender (P=0.009), education (P<0.001), professional title (P=0.036), hospital

Table 1 Characteristics of the Participants

	N (%)	Knowledge Score		Attitude Score		Practice Score	
		Mean±SD	P	Mean±SD	P	Mean±SD	P
Total score	371	8.25±3.67		43.77±6.25		25.56±4.77	
Gender			0.009		<0.001		<0.001
Male	245 (66.04)	8.18±3.01		41.99±5.20		26.44±3.99	
Female	126 (33.96)	8.38±4.70		47.24±6.67		23.83±5.62	
Occupation			0.672		0.038		0.097
Doctor	330 (88.95)	8.36±3.48		43.47±6.02		25.69±4.66	
Nurse	41 (11.05)	7.37±4.91		46.17±7.50		24.49±5.49	
Education			<0.001		<0.001		<0.001
Bachelor's degree and below	211 (56.87)	8.00±2.57		41.80±4.84		27.06±3.21	
Master's degree and above	160 (43.13)	8.57±4.73		46.37±6.93		23.57±5.68	
Professional title			0.036		<0.001		<0.001
No professional title	6 (1.62)	8.17±5.19		39.83±3.31		25.67±3.67	
Junior	41 (11.05)	6.93±5.40		43.54±6.48		22.41±5.61	
Intermediate	272 (73.32)	8.28±3.11		43.10±5.73		26.10±4.42	
Associate senior/senior	52 (14.02)	9.15±4.28		47.92±7.27		25.17±5.05	
Hospital category			0.039		0.024		<0.001
Public tertiary hospital	343 (92.45)	8.42±3.47		43.55±6.15		25.92±4.44	
Non-public tertiary hospital	28 (7.55)	6.14±5.20		46.46±6.88		21.14±6.29	
Years of working experience			0.380		<0.001		<0.001
<5 years	51 (13.75)	7.39±5.22		45.02±7.18		23.10±6.22	
5–10 years	222 (59.84)	8.43±2.61		42.07±4.84		26.69±3.50	
10–20 years	81 (21.83)	8.22±4.64		46.31±7.26		24.06±5.62	
>20 years	17 (4.58)	8.59±4.64		50.12±5.83		25.18±5.34	
The hospital is a teaching hospital			<0.001		<0.001		<0.001
Yes	192 (51.75)	8.61±4.64		46.33±6.99		24.30±5.39	
No	179 (48.25)	7.85±2.14		41.02±3.76		26.91±3.55	
Performed or participated in breast reconstruction surgery on patients			<0.001		<0.001		<0.001
Yes	60 (16.17)	10.70±3.64		49.88±7.77		27.02±4.18	
No	311 (83.83)	7.77±3.49		42.59±5.15		25.27±4.83	

category (P=0.039), teaching hospital (P<0.001), and performing or participating in breast reconstruction surgery on patients (P<0.001) (Table 1). The knowledge items with the lowest scores were K8 (4.58%; "Delayed breast reconstruction offers better psychological and cost benefits compared to immediate reconstruction, as it maximally preserves the aesthetic elements of the breast and achieves optimal aesthetic outcomes"). K10 (5.12%; "The presence of definite tumor residues in the breast reconstruction area is a relative contraindication for breast reconstruction surgery"), and K7 (9.16%; "Preoperative radiation therapy significantly increases the incidence of complications after autologous tissue flap breast reconstruction"). The knowledge items with the highest scores were K2 (83.83; "Breast reconstruction surgery is generally divided into three types: implantation, autologous tissue flap, and autologous fat graft breast reconstruction"), K5 (82.21%; "The timing of breast reconstruction surgery can be classified as immediate, delayed, or delayed-immediate reconstruction"), and K4 (81.94%; "Skin flaps used for breast reconstruction are typically taken from the abdomen or back but can also be harvested from the thighs or buttocks") (Supplementary Table S1).

The mean attitude score was 43.77±6.25, on a possible maximum of 60 (72.95%), indicating positive attitudes. The attitude scores were associated with gender (P<0.001), position (P=0.038), education (P<0.001), professional title (P<0.001), hospital category (P=0.024), years of experience (P<0.001), teaching hospital (P<0.001), and performed or participated in breast reconstruction surgery on patients (P<0.001) (Table 1). The attitude toward oncoplastic surgery was

high (A1; 83.29%). Oncological safety remains a top priority for the participants (A2; 94.88%), including preoperative assessment (A3; 95.96%). The participants believed in the benefits of breast reconstruction (A4; 95.96%) and that all women undergoing breast tumor resection should be informed on the reconstruction options (A5; 91.38%) (Supplementary Table S1).

The mean practice score was 25.56±4.77, on a theoretical maximum of 35 (73.03%), suggesting proactive practice. The practice scores were associated with gender (P<0.001), practice category (P=0.005), education (P<0.001), professional title (P<0.001), hospital category (P<0.001), years of experience (P<0.001), teaching hospital (P<0.001), and performed or participated in breast reconstruction surgery on patients (P<0.001) (Table 1). Not all participants provide information about breast reconstruction to the general public (P2; 59.57%) or patients (P3; 64.96%). Many professionals (59.03%) do not recommend considering breast reconstruction unless specifically requested by the patients (P7) (Supplementary Table S1). Most participants would perform breast reconstruction in their department if a patient expressed her desire to undergo the surgery (Supplementary Figures S1–S3).

Correlations

The knowledge scores were correlated to the attitude (r=0.404, P<0.001) and practice (r=0.276, P<0.001), while the attitude scores were not correlated to the practice scores (P=0.435) (Table 2).

Multivariate Analysis

Working at a teaching hospital (OR=7.019, 95% CI: 2.519–19.562, P<0.001) and performing or participating in breast reconstruction surgery for patients (OR=4.128, 95% CI: 2.170–7.853, P<0.001) were independently associated with adequate knowledge (Table 3). The knowledge scores (OR=1.093, 95% CI: 1.019–1.173, P=0.013), female gender

Table 2 Correlation Analysis

	Knowledge	Attitude	Practice
Knowledge	1		
Attitude	0.404 (P<0.001)	1	
Practice	0.276 (P<0.001)	0.041 (P=0.435)	1

Table 3 Univariate and Multivariate Logistic Regression of Knowledge

Knowledge Dimension	Univariate Analysis		Multivariate Analysis	
	OR (95% CI)	P	OR (95% CI)	P
Gender				
Male	Ref.		Ref.	
Female	3.115 (1.872, 5.183)	<0.001	1.387 (0.752, 2.561)	0.295
Occupation				
Doctor	0.549 (0.270, 1.116)	0.098		
Nurse	Ref.			
Education level				
Undergraduate and below	Ref.		Ref.	
Master's and above	4.885 (2.828, 8.439)	<0.001	1.421 (0.711, 2.842)	0.320
Professional title				
No title	0.800 (0.134, 4.777)	0.807		
Junior	0.830 (0.353, 1.948)	0.668		
Intermediate	0.309 (0.162, 0.589)	<0.001		
Associate Senior/Senior	Ref.			

(*Continued*)

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Table 3 (Continued).

Knowledge Dimension	Univariate Analysis		Multivariate Analysis	
	OR (95% CI)	P	OR (95% CI)	P
Hospital category				
Public level three	Ref.			
Non-public level three	1.233 (0.504, 3.013)	0.646		
Years of work				
<5 years	Ref.		Ref.	
5–10 years	0.337 (0.169, 0.673)	0.002	1.153 (0.509, 2.612)	0.732
10–20 years	0.945 (0.448, 1.994)	0.883	0.922 (0.409, 2.078)	0.846
>20 years	0.833 (0.252, 2.752)	0.765	1.120 (0.312, 4.022)	0.862
Teaching hospital				
Yes	12.825 (5.957, 27.611)	<0.001	7.019 (2.519, 19.562)	<0.001
No	Ref.		Ref.	
Performed or participated in breast reconstruction surgery for patients?				
Yes	7.533 (4.139 13.712)	<0.001	4.128 (2.170, 7.853)	<0.001
No	Ref.		Ref.	

(OR=3.774, 95% CI: 1.959–7.279, P<0.001), master's degree or above education (OR=5.597, 95% CI: 2.050–15.284, P=0.001), non-public tertiary hospitals (OR=8.196, 95% CI: 2.368–28.363, P=0.001), >20 years of experience (OR=11.249, 95% CI: 1.554–81.443, P=0.017), teaching hospital (OR=3.367, 95% CI: 1.262–8.980, P=0.015), and performed or participated in breast reconstruction surgery for patients (OR=2.228, 95% CI: 1.041–4.769, P=0.039) were independently associated with the positive attitude (Table 4). The knowledge scores (OR=1.176, 95% CI: 1.095–1.262, P<0.001), doctor (OR=3.502, 95% CI: 1.025–11.971, P=0.046), master's degree or above education (OR=0.116, 95% CI: 0.043–0.313, P<0.001), junior title (OR=0.194, 95% CI: 0.052–0.730, P=0.015), non-public tertiary hospitals (OR=0.225, 95% CI: 0.078–0.650, P=0.006), and 10–20 years of experience (OR=0.318, 95% CI: 0.109–0.924, P=0.035) were independently associated with the proactive practice (Table 5).

Table 4 Univariate and Multivariate Logistic Regression of Attitude

Attitudes Dimension	Univariate Analysis		Multivariate Analysis	
	OR (95% CI)	P	OR (95% CI)	P
Knowledge score	1.100 (1.034, 1.170)	0.003	1.093 (1.019, 1.173)	0.013
Gender				
Male	Ref.		Ref.	
Female	9.510 (5.800, 15.593)	<0.001	3.774 (1.959, 7.279)	<0.001
Occupation				
Doctor	0.274 (0.138, 0.542)	<0.001	0.273 (0.080, 0.928)	0.052
Nurse	Ref.		Ref.	
Education level				
Undergraduate and below	Ref.		Ref.	
Master's and above	7.756 (4.828 12.460)	<0.001	5.597 (2.050, 15.284)	0.001
Professional title				
No title	0.081 (0.009, 0.753)	0.027	0.088 (0.006, 1.268)	0.074
Junior	0.426 (0.181, 1.003)	0.051	1.157 (0.303, 4.416)	0.831
Intermediate	0.175 (0.091, 0.336)	<0.001	1.281 (0.467, 3.519)	0.630
Associate senior/senior	Ref.		Ref.	

(*Continued*)

Table 4 (Continued).

Attitudes Dimension	Univariate Analysis		Multivariate Analysis	
	OR (95% CI)	P	OR (95% CI)	P
Hospital category				
Public level three	Ref.		Ref.	
Non-public level three	3.824 (1.679, 8.712)	0.001	8.196 (2.368, 28.363)	0.001
Years of work				
<5 years	Ref.		Ref.	
5–10 years	0.215 (0.113, 0.407)	<0.001	0.707 (0.285, 1.756)	0.455
10–20 years	1.473 (0.721, 3.009)	0.288	1.374 (0.480, 3.934)	0.554
>20 years	6.161 (1.275, 29.765)	0.024	11.249 (1.554, 81.443)	0.017
Teaching hospital				
Yes	14.677 (8.391, 25.670)	<0.001	3.367 (1.262, 8.980)	0.015
No	Ref.		Ref.	
Performed or participated in breast reconstruction surgery for patients?				
Yes	6.067 (3.262, 11.283)	<0.001	2.228 (1.041, 4.769)	0.039
No	Ref.		Ref.	

Table 5 Univariate and Multivariate Logistic Regression of Practice

Practice Dimension	Univariate Analysis		Multivariate Analysis	
	OR (95% CI)	P	OR (95% CI)	P
Knowledge score	1.178 (1.106, 1.254)	<0.001	1.176 (1.095, 1.262)	<0.001
Attitude score	0.979 (0.946, 1.013)	0.225		
Gender				
Male	Ref.		Ref.	
Female	0.207 (0.129, 0.330)	<0.001	0.591 (0.312, 1.119)	0.106
Occupation				
Doctor	3.161 (1.632, 6.123)	<0.001	3.502 (1.025, 11.971)	0.046
Nurse	Ref.		Ref.	
Education level				
Undergraduate and below	Ref.		Ref.	
Master's and above	0.164 (0.101, 0.265)	<0.001	0.116 (0.043, 0.313)	<0.001
Professional title				
No title	0.857 (0.158, 4.648)	0.858	0.329 (0.031, 3.453)	0.354
Junior	0.549 (0.239, 1.260)	0.157	0.194 (0.052, 0.730)	0.015
Intermediate	2.675 (1.451, 4.932)	0.002	0.383 (0.144, 1.022)	0.055
Associate senior/senior	Ref.		Ref.	
Hospital category				
Public level three	Ref.		Ref.	
Non-public level three	0.192 (0.084, 0.439)	<0.001	0.225 (0.078, 0.650)	0.006
Years of work				
<5 years	Ref.		Ref.	
5–10 years	6.811 (3.523, 13.165)	<0.001	1.287 (0.522, 3.176)	0.584
10–20 years	0.954 (0.470, 1.936)	0.895	0.318 (0.109, 0.924)	0.035
>20 years	2.417 (0.774, 7.546)	0.129	1.018 (0.226, 4.597)	0.981

(*Continued*)

Table 5 (Continued).

Practice Dimension	Univariate Analysis		Multivariate Analysis	
	OR (95% CI)	P	OR (95% CI)	P
Teaching hospital				
Yes	0.112 (0.064, 0.194)	<0.001	0.390 (0.151, 1.011)	0.053
No	Ref.		Ref.	
Performed or participated in breast reconstruction surgery for patients?				
Yes	1.106 (0.606, 2.017)	0.743		
No	Ref.			

Structural Equation Modeling

The SEM analysis (Figure 1) showed that knowledge influenced attitude (β = −1.753, P<0.001) and practice (β=1.981, P<0.001), while attitude influenced practice (β = −0.312, P<0.001) (Table 6). The SEM demonstrated highly favorable model fit indices (CMIN/DF = 5.060, RMSEA = 0.105, IFI = 0.815, TLI = 0.777, and CFI = 0.814), suggesting a well-fitting model (Supplementary Table S2).

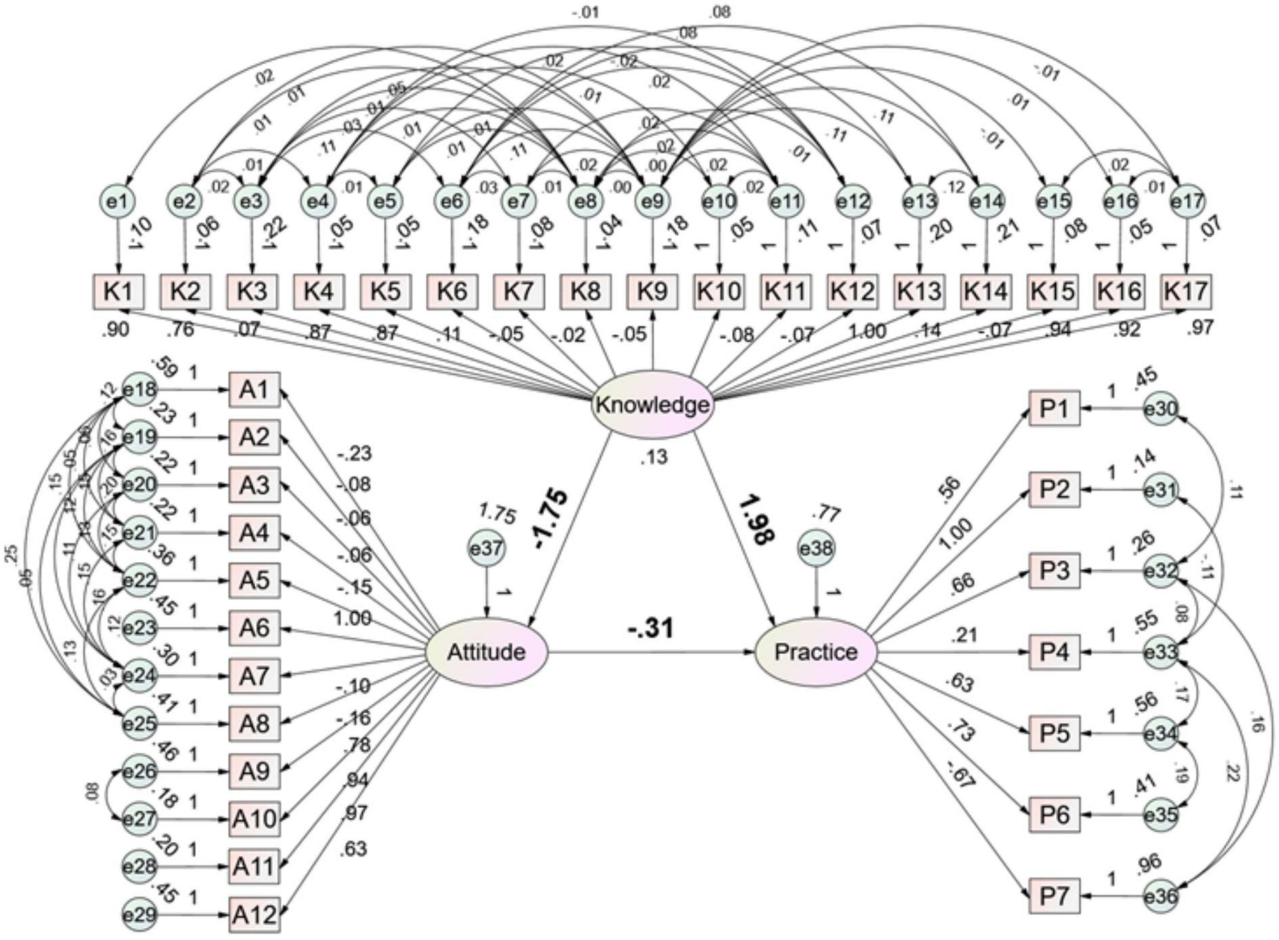

Figure 1 Structural equation modeling analysis.

Table 6 SEM Analysis

			β	P
Attitude	←	Knowledge	−1.753	<0.001
Practice	←	Attitude	−0.312	<0.001
Practice	←	Knowledge	1.981	<0.001

Discussion

This multicenter cross-sectional study investigated the KAP of breast surgery healthcare professionals toward breast reconstruction in China. The findings revealed inadequate knowledge but generally positive attitudes and proactive practices toward breast reconstruction. These insights provide a foundation for targeted interventions aimed at improving the KAP of healthcare professionals in this domain.

Adequate knowledge of reconstruction options, their indications, contraindications, and associated advantages or disadvantages is vital for counseling patients about surgical choices. While the study revealed favorable attitudes and proactive practices among participants, based on the scores, a notable proportion (59.03%) did not recommend breast reconstruction unless prompted by patients, suggesting passive rather than proactive engagement. The underlying reasons for this reluctance were not explored in the present study but could include resource limitations (eg, surgical expertise and operating room availability), cost concerns, or skepticism about the benefits of reconstruction. Future studies should address these factors comprehensively. Despite this reluctance, participants overwhelmingly acknowledged the psychological and physical benefits of breast reconstruction and endorsed the necessity of informing all women undergoing breast cancer surgery about reconstruction options. The disconnect between these attitudes and actual practices may indicate that external barriers, rather than intrinsic resistance, hinder proactive recommendations. Nevertheless, those findings indicate the KAP items and areas that could be targeted by continuing education activities, ie, the items with low scores. The activities could take the form of seminars, websites, podcasts, lectures, and reading materials. The results also suggest barriers that could be addressed by policymakers and stakeholders.

Previous studies corroborate these findings. Ranganathan et al highlighted similar barriers in West Africa, including limited patient awareness, technical expertise, and financial constraints.[21] A study from the patient's perspective in South Asia reported low rates of breast reconstruction.[18] Abdullah et al[29] identified low physician and public awareness as key contributors to the underutilization of breast reconstruction in Pakistan. Alsubhi et al's international survey across 79 countries attributed low reconstruction rates primarily to inadequate physician knowledge, underscoring the pivotal role of healthcare providers in informing patients.[19] Ishak et al[20] further demonstrated that patients were significantly more likely to opt for reconstruction when recommended by their surgeons, emphasizing the importance of addressing physician hesitation to improve uptake.

This study is the first to assess the KAP of Chinese breast surgery professionals toward reconstruction, addressing a notable gap in the literature. Interestingly, it aligns with findings from a related study on the poor-to-moderate KAP of Chinese healthcare providers toward managing sexual dysfunction in breast cancer survivors.[30] Sexual function after breast cancer is a complex matter.[31] Indeed, adjuvant hormonal therapy has several side effects that can hinder proper sexual functioning in women.[32] In addition, the appearance of the breasts is involved in self-appearance and self-esteem and plays an essential role in sexual function and the feeling of attracting a sexual partner.[33,34] Therefore, breast reconstruction should have a role in sexual function after breast cancer.[35]

The SEM analysis revealed that knowledge positively influenced both attitudes and practices, with attitudes mediating the relationship between knowledge and practice. These findings suggest that enhancing knowledge through continuing education or workshops could indirectly improve practices. However, a paradoxical observation was that higher knowledge negatively influenced attitudes, potentially reflecting more realistic expectations about the limitations and outcomes of reconstruction. Similar findings have been reported in a recent study on breast ultrasound screening, which found a significant negative association between knowledge and attitude ($\beta = -1.090$, $p = 0.015$).[36] This counterintuitive finding has been interpreted as increased knowledge sometimes leading to greater critical awareness, resulting in more reserved attitudes. Teaching hospitals, often at the forefront of medical advancements, were associated with higher knowledge

levels, while professionals directly involved in reconstruction procedures demonstrated superior understanding. Female professionals exhibited more positive attitudes, likely due to greater empathy for the psychological and physical significance of breasts for women.[37] Interestingly, while higher educational attainment correlated with more positive attitudes, it was paradoxically associated with less proactive practices, a discrepancy that warrants further exploration. Nevertheless, a higher education among physicians in China could be related to lower KAP toward breast reconstruction for several nuanced reasons, reflecting both systemic and cultural factors unique to the Chinese healthcare context. Indeed, physicians with higher education and senior professional titles may adhere more strictly to traditional or conservative treatment protocols, especially if their advanced training emphasized oncologic safety over reconstructive or quality-of-life outcomes. In China, there is a long-standing emphasis on radical surgery for cancer, and reconstructive options may be viewed as secondary or even risky, especially by those trained in earlier eras or in more conservative academic environments.[38] More highly educated or senior physicians may be more skeptical about the benefits of breast reconstruction, viewing it as less essential or as introducing unnecessary risks (eg, complications, interference with cancer surveillance). This skepticism can translate into lower enthusiasm for recommending or supporting reconstruction, even if they have the knowledge to do so.[38] In China, cultural norms often place the physician as the unquestioned authority, and patient-centered or shared decision-making is still developing.[38,39] Physicians with higher education may feel more responsibility to guide patients toward what they perceive as the safest or most medically justified choice, which may not include reconstruction, especially if they believe patients lack the knowledge to make an informed choice.[38,39] Despite higher education, many Chinese physicians may have had limited exposure to reconstructive surgery during their training, as breast reconstruction is less common and less emphasized in Chinese medical curricula and practice compared to Western countries.[40] This can result in higher theoretical knowledge but less practical confidence or enthusiasm for breast reconstruction. Studies show that more highly educated and senior medical professionals in China tend to have greater knowledge about external breast prostheses and may recommend these over surgical reconstruction, possibly due to perceptions of lower risk and easier patient acceptance.[41] This focus could contribute to lower KAP toward surgical reconstruction specifically. Finally, younger and less senior medical professionals may be more open to new techniques and patient-centered care, while those with higher education and seniority may be more entrenched in established practices, leading to a paradox where more education correlates with less progressive attitudes toward breast reconstruction.[41]

Despite its multicenter design, this study had a relatively modest sample size, which may limit the generalizability of the findings. A sampling bias could be present since the questionnaire was administered through WeChat, also limiting generalizability. The questionnaire was tailored to the specific context of Chinese clinical practice, potentially constraining its applicability to other healthcare settings. Additionally, as a cross-sectional study, causal relationships cannot be definitively established. Although SEM was employed to infer causal pathways among KAP dimensions, such relationships remain statistically derived rather than directly observed.[28,42,43] Nevertheless, SEM is a complex model that typically requires larger samples to ensure stability. It could be why a negative β-value was observed between knowledge and attitude. Finally, as with all KAP studies, responses may have been influenced by social desirability bias.[44,45]

Conclusion

While attitudes and practices were generally positive, significant gaps remain in routine recommendation and education practices. Structural equation modeling showed that knowledge significantly influenced both attitudes and practices. These findings underscore the need for targeted educational interventions to enhance knowledge and bridge the gap between attitudes and practices. Future research should explore the barriers to breast reconstruction implementation and assess the effectiveness of tailored interventions in overcoming these challenges.

Data Sharing Statement

All data generated or analysed during this study are included in this published article.

Ethics Approval

The study was approved by the Zhengzhou Hospital of Traditional Chinese Medicine, Zhengzhou (V2024071508). I confirm that all methods were performed in accordance with the relevant guidelines. All procedures were performed in accordance with the ethical standards laid down in the 1964 Declaration of Helsinki and its later amendments.

Author Contributions

(I) Conception and design: Liu jun, Duan Qiong; (II) Administrative support: Kong Desheng; (III) Provision of study materials or patients: Duan Qiong, Sun Mingyu, Liu Bo; (IV) Collection and assembly of data: Li Kelin; (V) Data analysis and interpretation: Kong Desheng, Li Kelin; (VI) Manuscript writing: All authors; (VII) Final approval of manuscript: All authors. All authors made a significant contribution to the work reported, whether that is in the conception, study design, execution, acquisition of data, analysis and interpretation, or in all these areas; took part in drafting, revising or critically reviewing the article; gave final approval of the version to be published; have agreed on the journal to which the article has been submitted; and agree to be accountable for all aspects of the work.

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