Genetic Testing among Chinese Breast Cancer Patients: A Survey on Awareness, Uptake, Intention, and Willingness-to-Pay

HSD115

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Introduction

- Around 416,000 breast cancer cases and 117,000 breast cancer deaths were reported in China in 2020, accounting for 18.41% of global breast cancer cases and 17.11% of global breast cancer deaths.
- Genetic testing for pathogenetic variants in common breast cancer susceptibility genes (e.g., *BRCA1* and *BRCA2*) empowers individual cancer risk assessment, which can be used to develop personalised treatment or surveillance strategy for breast cancer patients.
- Access to genetic testing service is limited and concentrated in tertiary care within urban areas in China, potentially leading to disparities and missed opportunities for risk assessment, precise prevention, and clinical management of breast cancer.

Objectives

- This study aimed to investigate the current status and related factors of genetic testing utilization among Chinese breast cancer patients, including the awareness, uptake, intention, and willingness-to-pay for genetic testing.

Methods

- Study design: cross-sectional survey conducted from August to October 2021.
- Study sample: women with breast cancer recruited from a patient association.
- Questionnaire: (1) demographics and socioeconomic status; (2) risk factors and treatment of breast cancer; (3) experience of genetic testing.
- Statistical analysis: (1) descriptive statistics; (2) univariate and multivariate logistic regression for the correlates of the awareness and uptake of genetic testing among all participants, and the intention for genetic testing among participants who had not undergone genetic testing; (3) univariate and multivariate linear regression for the correlates of willingness-to-pay among participants with the intention for genetic testing.

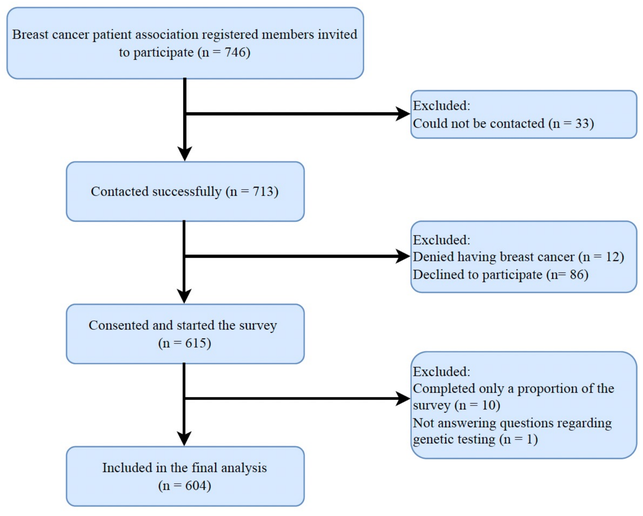

Figure 1. Participant flow into the study

Results

- A total of 604 participants were included with a mean age of 56.61±10.01 years.

Table 1. Participant characteristics

Characteristics	Statistics	Characteristics	Statistics
Age (years)		Menopause status (n (%))	
Mean ± SD	56.61 ± 10.01	Post-menopause	527 (87.25)
Median (IQR)	58 (50–64)	Pre-menopause	77 (12.75)
Annual family income per capita ($)		Live birth (n (%))	
Mean ± SD	7,893 ± 6,456	Yes	551 (91.23)
Median (IQR)	6,975 (3,875–9,300)	No	53 (8.77)
Marital status (n (%))		Breastfeeding (n (%))	
Married	494 (81.79)	Yes	442 (73.18)
Non-married	110 (18.21)	No	155 (25.66)
Education attainment (n (%))		Missing	7 (1.16)
High school or lower	310 (51.32)	Family history of breast or ovarian cancer (n (%))	
College or higher	294 (48.68)	No	501 (82.95)
Employment (n (%))		Yes	96 (15.89)
Non-employed	469 (77.65)	Missing	7 (1.16)
Employed	133 (22.02)	Diagnosis age (n (%))	
Missing	2 (0.33)	>50 years	243 (40.23)
Residence (Hukou, (n (%)))		≤50 years	360 (59.60)
Rural	62 (10.26)	Missing	1 (0.17)
Urban	541 (89.57)	Cancer stage at diagnosis (n (%))	
Missing	1 (0.17)	Non-invasive	67 (11.09)
Menarche age (n (%))		Invasive	514 (85.10)
>12 years	439 (72.68)	Missing	23 (3.81)
≤12 years	162 (26.82)	Surgery type (n (%))	
Missing	3 (0.50)	Breast-conserving surgery	132 (21.85)
		Mastectomy	462 (76.49)
		No surgery or missing	10 (1.66)

- Around 41.89% participants reported being aware of genetic testing; 12.42% had undergone genetic testing before.
- Among participants who had not undergone genetic testing, 49.24% expressed the intention to undergo future genetic testing, and 80.00% with such intentions reported a non-zero willingness-to-pay.
- Willingness-to-pay varied among participants, with the mean (SD) and median (IQR) of $463 (584) and $155 (155–698), respectively.

Table 2. Factors associated with the awareness and uptake of genetic testing

Characteristics	Awareness of genetic testing						Uptake of genetic testing					
	Univariate associations			Best multivariate model			Univariate associations			Best multivariate model		
	OR	95%CI	P	OR	95%CI	P	OR	95%CI	P	OR	95%CI	P
Age	0.98	0.96–0.99	0.005				0.99	0.97–1.01	0.385			
Annual family income per capita (Log)	1.68	1.33–2.13	<0.001	1.40	1.08–1.81	0.01	1.54	1.08–2.18	0.017			
Marital status												
Married	Ref						Ref			Ref		
Non-married	1.25	0.82–1.89	0.293				1.92	1.10–3.34	0.021	1.72	0.90–3.27	0.099
Education attainment												
High school or lower	Ref			Ref			Ref			Ref		
College or higher	3.43	2.44–4.81	<0.001	3.27	2.24–4.77	<0.001	1.91	1.16–3.14	0.011	1.79	1.03–3.10	0.040
Employment												
Non-employed	Ref						Ref					
Employed	2.11	1.43–3.12	<0.001				1.04	0.58–1.85	0.905			
Residence (Hukou)												
Rural	Ref						Ref					
Urban	1.73	0.98–3.04	0.059				1.37	0.57–3.29	0.485			
Menarche age												
>12 years	Ref						Ref					
≤12 years	1.48	1.03–2.12	0.035				0.92	0.53–1.59	0.754			
Menopause status												
Post-menopause	Ref						Ref					
Pre-menopause	1.25	0.78–2.03	0.355				0.92	0.44–1.94	0.831			
Live birth												
Yes	Ref						Ref					
No	1.62	0.92–2.86	0.093				2.26	1.13–4.53	0.021			
Breastfeeding												
Yes	Ref						Ref					
No	1.17	0.81–1.69	0.41				1.61	0.95–2.72	0.074			
Family history of breast or ovarian cancer												
No	Ref						Ref			Ref		
Yes	1.25	0.81–1.94	0.313				2.00	1.12–3.55	0.018	2.22	1.20–4.09	0.011
Diagnosis age												
>50 years	Ref						Ref					
≤50 years	1.39	1.00–1.94	0.052				1.21	0.73–2.00	0.468			
Cancer stage at diagnosis												
Non-invasive	Ref						Ref					
Invasive	1.20	0.71–2.02	0.495				1.05	0.48–2.30	0.901			
Surgery type												
Breast conserving surgery	Ref						Ref			Ref		
Mastectomy	1.19	0.80–1.77	0.386				1.15	0.63–2.11	0.641	2.06	0.90–4.73	0.088

- The awareness of genetic testing was more common in participants reporting a higher annual family income and in participants with a college or higher education; the uptake of genetic testing was higher in participants with a college or higher education and in participants reporting a family history of breast or ovarian cancer.

Table 3. Factors associated with the intention and willingness-to-pay for genetic testing

Characteristics	Intention for genetic testing						Willingness-to-pay for genetic testing					
	Univariate associations			Best multivariate model			Univariate associations			Best multivariate model		
	OR	95%CI	P	OR	95%CI	P	β	95%CI	P	β	95%CI	P
Age	0.97	0.95–0.99	0.001	0.97	0.95–0.99	0.001	-0.04	-0.08–0.00	0.039			
Annual family income per capita (Log)	0.88	0.70–1.11	0.268				0.33	-0.15–0.80	0.174			
Marital status												
Married	Ref						Ref					
Non-married	0.76	0.48–1.21	0.253				-0.91	-2.01–0.18	0.101			
Education												
High school or lower	Ref						Ref			Ref		
College or higher	1.00	0.71–1.42	0.978				0.94	0.25–1.63	0.008	0.82	0.07–1.57	0.032
Employment												
Non-employed	Ref						Ref					
Employed	1.52	1.00–2.33	0.052				1.00	0.28–1.71	0.006			
Residence (Hukou)												
Rural	Ref						Ref					
Urban	0.96	0.54–1.71	0.898				0.12	-0.86–1.10	0.813			
Menarche age												
>12 years	Ref			Ref			Ref					
≤12 years	1.76	1.18–2.61	0.006	1.71	1.11–2.63	0.014	0.49	-0.24–1.22	0.183			
Menopause status												
Post-menopause	Ref						Ref			Ref		
Pre-menopause	1.64	0.96–2.79	0.070				1.16	0.51–1.81	0.001	1.05	0.33–1.76	0.004
Live birth												
Yes	Ref						Ref					
No	0.86	0.45–1.64	0.647				-0.02	-1.68–1.63	0.977			
Breastfeeding												
Yes	Ref						Ref					
No	1.07	0.72–1.59	0.746				-0.26	-1.11–0.60	0.557			
Family history of breast or ovarian cancer												
No	Ref						Ref					
Yes	1.39	0.85–2.27	0.193				0.09	-0.85–1.03	0.851			
Diagnosis age												
>50 years	Ref						Ref					
≤50 years	1.53	1.07–2.18	0.019				-0.05	-0.78–0.69	0.901			
Cancer stage at diagnosis												
Non-invasive	Ref						Ref					
Invasive	0.74	0.42–1.29	0.292				0.05	-1.15–1.25	0.935			
Surgery type												
Breast conserving surgery	Ref						Ref					
Mastectomy	0.94	0.61–1.43	0.765				-0.30	-1.10–0.51	0.470			

- The intention to undergo genetic testing was associated with a younger age and a younger menarche age; the willingness-to-pay for genetic testing was higher in participants with a college or higher education and pre-menopausal participants.

Conclusions

- The awareness and uptake of genetic testing were relatively low among Chinese breast cancer patients; nearly half of the participants who had not undergone genetic testing expressed the intention for future genetic testing, but with varying willingness-to-pay.
- Younger, pre-menopausal, well-educated, and wealthier participants, together-with those with a family history, tended to have better access to genetic testing or report a higher willingness-to-pay for genetic testing.

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