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Analysis of the Impact of Cervical and Breast Cancer Screening Results on Elderly Women's Demand for Older adults Care Services: A Case Study of Guilin

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Abstract

Background

Population aging has created an urgent need for accurate identification of heterogeneous Older adults care service needs. Current assessment methods rely predominantly on large-scale questionnaires, which are costly, subjective, and difficult to implement at the grassroots level. Routine physical examination data, particularly two-cancer (breast and cervical cancer) screening results, offer a promising low-cost alternative, yet their secondary use in care needs assessment remains underexplored.

Methods

This study utilized two-cancer screening data from 810 women aged 55–80 years across 6 districts and 12 counties in Guilin, China. Breast ultrasonography (BI-RADS grading) and liquid-based cytology (TBS classification) were employed as core indicators. Descriptive statistics, chi-square tests, and Pearson correlation analyses were conducted to examine age-specific distributions and associations. A three-stage mapping framework — "screening results → health risks → care needs" — was constructed as a theoretical lens to translate objective health indicators into stratified care need inferences.

Results

The overall health status of the sample was favorable, but the sample was heavily skewed toward younger age groups: 80.4% were aged 55–64 years, whereas the 75–80 age group accounted for only 1.9%. Notably, this oldest-old group, despite showing the highest LBC positivity rate (26.7%) and dual-abnormality rate (6.7%) in our data, had the lowest screening participation rate, revealing a pronounced "high-risk, low-participation" phenomenon. However, given the extremely small sample size (n = 15) in this age group, these risk estimates should be interpreted with caution and may reflect selection bias (the "healthy worker" effect). Age was significantly associated with LBC classification (P = 0.003) and comprehensive risk level (P = 0.002), but not with BI-RADS grade (P = 0.184). Breast ultrasound and LBC indicators were independent (r = − 0.004, P = 0.920), and combined assessment demonstrated superior risk identification value compared to single-indicator evaluation. Based on the mapping framework, three distinct care need patterns emerged as theoretical inferences: younger-old women (55–64 years) primarily require preventive health management; middle-old women (65–74 years) need health monitoring and facilitated medical access; and the oldest-old (75–80 years) may demand intensive medical care and integrated medical-Older adults services, though this inference awaits verification with larger, more representative samples.

Conclusions

Routine two-cancer screening data can serve as a valid, low-cost, and objective supplementary source for older adults care needs assessment. Combined analysis of breast and cervical screening indicators effectively identifies high-risk groups and can help infer differentiated care needs, providing empirical support for precision allocation of older adults care resources at the grassroots level. Critically, the extremely low participation of the oldest-old underscores the urgent need to improve service accessibility for this vulnerable group rather than simply labeling them as high-risk based on limited data.

1. Introduction

Population aging has become a defining demographic trend in China. According to the Seventh National Population Census, individuals aged 60 and above reached 264 million (18.7%), and those aged 65 and above numbered 191 million (13.5%). China is projected to enter a moderately aging society during the 14th Five-Year Plan period (2021–2025), posing substantial challenges to older adults care service supply. Meanwhile, declining household size has weakened traditional family-based care, creating an urgent need for socialized and professional services [1]. The health status of older adults is increasingly complex, characterized by multimorbidity: chronic disease prevalence reaches 48.4% among those aged 55–64 and rises to 62.3% among those aged 65+ [2]. Since health status determines the type and intensity of care needed, accurately identifying heterogeneous care needs is essential for optimal resource allocation. However, current needs assessment relies predominantly on large-scale questionnaires, which are costly, subjective, and difficult to implement at the grassroots level. A low-cost, efficient, and practical alternative is urgently needed.

Routine physical examination data offer a promising solution. Under China's Healthy China strategy, healthcare institutions at all levels have accumulated vast amounts of standardized examination data. This study focuses on older women. Among routine screenings, breast ultrasonography and liquid-based cytology (LBC)—the two core components of the "two-cancer" (breast and cervical cancer) screening program—stand out for their wide coverage and high data standardization, objectively reflecting health risks and age-related changes in older women [3]. Given that health status drives care needs, such standardized screening data hold potential as objective proxies for needs assessment. Yet, these data remain largely confined to clinical diagnosis and follow-up, with limited secondary use in care needs identification. Encouragingly, national policies such as the 14th Five-Year Plan for the Development of the National Undertakings for the Aged and the Older adults Care Service System explicitly call for demand-oriented service expansion and integrated medical-older adults care, providing policy support for using objective health data to match supply with demand.

Internationally, older adults care needs assessment has developed mature frameworks, most commonly grounded in Andersen's Behavioral Model, which evaluates needs across predisposing, enabling, and need dimensions [4, 5]. Objective health data—including routine examinations, chronic disease surveillance, and cancer screening—have long been integrated into health risk warning and service allocation, emphasizing multi-source data integration and longitudinal tracking to reduce subjective bias

[6–8]. In two-cancer screening, extensive research has examined screening coverage, adherence factors, and referral pathways for abnormal findings among older women, establishing standardized protocols [9]. However, directly applying screening results to care stratification and long-term care planning remains rare. Domestically, Chinese studies have focused on care need heterogeneity, precise identification methods, and integrated medical-older adults care models [10, 11]. Most employ questionnaires for needs measurement [12] and analyze influencing factors based on Andersen's model or ERG theory [13–15]. Two-cancer screening research has concentrated on clinical diagnosis, result interpretation, and nursing management [16]; while some studies have explored the informatization and multidimensional use of screening data, their secondary application in care needs assessment remains inadequate. Although scholars broadly agree on stratified and targeted service provision based on age and health status [17–20], health status is typically treated as a background variable. Few studies have used objective, standardized, and accessible screening indicators—such as two-cancer screening results—as core evidence for care needs assessment [21], and systematic mapping from "screening results → health risks → care needs" is lacking.

Three major gaps thus emerge. First, care needs assessment remains questionnaire-dominated—costly, subjective, and insufficiently dynamic—with few low-cost objective alternatives suitable for grassroots implementation. Second, two-cancer screening data are largely confined to clinical use, with their value unexpended to older adults care and long-term care planning. Third, joint risk assessment integrating breast and cervical screening findings for care stratification is virtually absent. To address these gaps, this study uses physical examination data of women aged 55–80 in Guilin, China, focusing on breast ultrasonography (BI-RADS grading) and LBC (TBS classification) as core two-cancer screening indicators. Specific objectives are: (1) to describe the age-specific distribution of two-cancer screening results, analyzing differences in BI-RADS grades, LBC grades, and comprehensive risk levels across age groups to identify high-risk age clusters; (2) to test the statistical association between age and abnormal screening rates, clarifying the direction and significance of age effects; (3) to construct a theoretical mapping framework of "screening results → health risks → care needs," translating statistical findings into age-stratified care need inferences to inform differentiated resource allocation; and (4) to validate the feasibility of using routine examination data as a supplementary source for care needs assessment, providing a low-cost, operable technical pathway for grassroots implementation. Theoretically, unlike existing research relying heavily on surveys and macro-level statistics, this study takes the specific health dimension of two-cancer screening, using clinically standardized indicators (BI-RADS and LBC), to develop a three-stage analytical framework—"data description → association analysis → needs inference"—thereby exploring the mapping logic between routine health data and care needs. This perspective extends the methodological boundaries of care needs assessment, enriches the theoretical connotation of secondary health data use, and provides an analytical paradigm for future research.

2. Method

2.1 Data Sources and Sample Selection

2.1.1 Data Sources

The data for this study were obtained from the health examination information system of a tertiary hospital in Guilin City, covering the period from January 2021 to November 2025. The center provides a large annual volume of health check-up services, serving six districts and twelve counties in Guilin City. The data records are standardized and highly complete, providing a reliable foundation for the research. The original dataset consists of 6,202 records, including female examinees aged 19 to 87. Extracted fields include gender, age, examination items, and test results. All data have been anonymized, excluding personal identification information such as names, ID numbers, and contact details, retaining only the variables required for analysis.

2.1.2 Sample Screening

To focus on the relationship between "two cancers" screening and older adults women's demand for older adults care services, this study set the inclusion criteria as: female, aged 55–80 years, and completion of both breast color Doppler ultrasound and liquid-based cytology tests. The exclusion criteria were: age mismatch, completion of only one test, or cases with missing or uninterpretable results.

The original data was in a long-format table. After age screening, item screening, result organization, and data restructuring, standardized analytical data with one row per individual was finally obtained, yielding 810 valid samples.

2.1.3 Sample Size Explanation

This study had an effective sample size of 810 cases, which meets the basic requirements for descriptive statistics and cross-tabulation analysis. A 5×3 contingency table was constructed based on 5 age groups and 3 BI-RADS categories, resulting in 15 cells. Among them, 40.0% of the cells had expected counts less than 5, with the minimum expected count being 0.19. Given that the sample size of the oldest age group (75–80 years) was only 15 cases, which falls under low-frequency categories, the above situation is within an acceptable range for exploratory analysis. However, this small subsample severely limits the statistical power and generalizability of findings related to this age group. All inferences concerning the 75–80 group are therefore presented as preliminary observations requiring confirmation in larger, more representative samples. Subsequent statistical inferences regarding the high-age group will be approached with caution.

2.2 Variable Setting and Coding Scheme

According to internationally recognized age classification standards for the older adults, individuals aged 55–80 were divided into five groups at 5-year intervals and then merged into three categories: young-old, middle-old, and old-old. Based on the highest risk level indicated in breast ultrasound reports, results were classified into three categories—negative/benign, probably benign, and suspicious abnormality—to reflect the gradient of lesion risk. The Thin Prep cytologic test (TBS) classification system was used to

dichotomize liquid-based cytology results into NILM (no abnormality) and ASC-US or above (positive) to indicate cervical lesion risk. Breast ultrasound and liquid-based cytology results were combined to form three comprehensive risk levels—double negative, single abnormality, and double abnormality—enabling integrated risk assessment for "two cancers" (breast and cervical). Additionally, two binary indicators—abnormal ultrasound and positive cytology—were set for trend analysis and correlation testing. All variables were numerically coded according to statistical analysis requirements, covering age, age groups, BI-RADS classification, TBS categories, comprehensive risk levels, and abnormality indicator variables, making them directly applicable to SPSS statistical analysis.

Table 1
Variable definitions and coding schemes.

Dimension	Variable Symbol	Variable Type	Coding / Range	Coding Description
Age dimension	Age	Numerical	55–80	Actual age (years)
	AgeGroup	Numerical	1, 2, 3, 4, 5	1 = 55–59 years; 2 = 60–64 years; 3 = 65–69 years; 4 = 70–74 years; 5 = 75–80 years
Breast ultrasound dimension	BIRADS_Max	Numerical	0–5	0 = No result; grades 1–5 are clinical classifications
	BIRADS_Class	Numerical	1, 2, 3	1 = Negative/Benign; 2 = Probably benign; 3 = Suspicious abnormality
LBC dimension	TBS_Code	Numerical	1, 2	1 = NILM; 2 = ASC-US and above
	TBS_Class	Numerical	1, 2	1 = NILM (no abnormality); 2 = Positive (lesion and above)
Composite risk dimension	Risk_Level	Numerical	1, 2, 3	1 = Both negative; 2 = Single abnormality; 3 = Dual abnormality
Binary abnormality dimension	BIRADS_Abnormal	Binary	0, 1	0 = No (Negative/Benign); 1 = Yes (Probably benign + Suspicious abnormality)
	TBS_Abnormal	Binary	0, 1	0 = No (NILM); 1 = Yes (ASC-US and above)

2.3 Data Preprocessing Workflow

The data preprocessing was completed in three steps: First, sample screening was conducted to retain subjects aged 55–80 who completed both examinations. Second, text encoding was performed to standardize the extraction and assignment of BI-RADS classifications and TBS results. To ensure accuracy, two trained researchers independently extracted key diagnostic phrases (e.g., "BI-RADS 3",

"ASC-US") from the free-text reports and assigned the corresponding numerical codes; disagreements were resolved through discussion.

Third, the organized data were imported into SPSS 27.0 to generate derived variables such as age groups and risk levels, forming the final analytical dataset.

2.4 Analytical Methods

The study employed SPSS 27.0 for statistical analysis, with specific methods including: (1)Descriptive statistics: Analyzing the age distribution of the sample and the overall composition of screening results. (2)Cross-tabulation and chi-square tests: Examining the statistical associations between age and screening results, as well as comprehensive risk levels.(3)Trend analysis and correlation analysis: Presenting age-related trends in abnormal detection rates and testing correlations between age, abnormal indicators, and the two screening methods.Given the mixed nature of continuous (age) and binary (abnormality) variables, Pearson correlation coefficients were used to examine linear associations between variables.The significance level was set at $\alpha = 0.05$, with $P < 0.05$ considered statistically significant.

2.5 Summary

This chapter systematically details the study's data sources, sample screening process, variable definitions and coding rules, data preprocessing steps, and statistical analysis methods. Grounded in "two-cancer" screening data from 810 women aged 55–80 in Guilin, the variable configurations adhere to clinical norms and research design specifications. The analytical approach is methodologically sound, providing a robust basis for further empirical analysis and demand assessment.

3. Result

3.1 Basic Information of the Sample

3.1.1 Age Distribution

The study included a total of 810 valid samples, with an age range of 55 to 80 years. The age distribution of the samples is shown in Table 2.

Table 2
Age Distribution of Samples (n = 810)

Age Group	Frequency (n)	Percentage (%)	Cumulative Percentage (%)
55–59 years	391	48.3	48.3
60–64 years	260	32.1	80.4
65–69 years	89	11.0	91.4
70–74 years	55	6.8	98.1
75–80 years	15	1.9	100.0
Total	810	100.0	—

The sample age was concentrated between 55 and 80 years old, showing a general trend toward younger older adults individuals. There were 391 cases (48.3%) aged 55–59 and 260 cases (32.1%) aged 60–64, together accounting for 80.4% of the total. Additionally, there were 89 cases (11.0%) aged 65–69, 55 cases (6.8%) aged 70–74, and only 15 cases (1.9%) aged 75–80. This distribution indicates that younger older adults individuals have stronger health awareness and mobility, leading to significantly higher participation rates in health check-ups compared to older age groups.

3.1.2 Overall Distribution of Breast Ultrasound Results

Breast ultrasound examinations were classified according to the BI-RADS grading standard, and the results are shown in Table 3.

Table 3
Overall Distribution of Breast Ultrasound BI-RADS Classification (n = 810)

BI-RADS Classification	Frequency (n)	Percentage (%)
Negative/Benign	723	89.3
Probably Benign	77	9.5
Suspicious Abnormality	10	1.2
Total	810	100.0

The breast ultrasound BI-RADS classification results showed that 723 cases (89.3%) were negative/benign, 77 cases (9.5%) were probably benign, and 10 cases (1.2%) were suspicious abnormalities. The overall screening status was good, but 10.7% of the examinees still had varying degrees of abnormalities, which need to be included in the health monitoring scope.

3.1.3 Overall Distribution of Liquid-Based Cytology Results

The liquid-based cytology results were classified according to the TBS reporting system, as shown in Table 4.

Table 4
Overall Distribution of TBS Classification in Liquid-Based Cytology (n = 810)

TBS Classification	Frequency (n)	Percentage (%)
NILM	770	95.1
ASC-US and above	35	4.3
Other	5	0.6
Total	810	100.0

The liquid-based cytology results were predominantly NILM, totaling 770 cases (95.1%); there were 35 cases (4.3%) of ASC-US or higher positive results, and 5 cases (0.6%) of unsatisfactory specimens or other outcomes. The overall positive rate was at a relatively low level, indicating that the cervical screening results were generally under control [22].

3.1.4 Overall Distribution of Comprehensive Risk Levels

By combining the results of breast color Doppler ultrasound and liquid-based cytology, a comprehensive risk level variable was generated, as shown in Table 5.

Table 5
Overall Distribution of Comprehensive Risk Levels (n = 810)

comprehensive risk level	Frequency (n)	Percentage (%)
Both negative	683	84.3
Single abnormality	118	14.6
Dual abnormality	4	0.5
Unclassified	5	0.6
Total	810	100.0

Double-negative results were found in 683 cases (84.3%), single abnormality in 118 cases (14.6%), double abnormalities in 4 cases (0.5%), and unclassified in 5 cases (0.6%). A total of 15.1% of the examined individuals had at least one screening abnormality, indicating a need for ongoing health management in this population.

3.2 Age Distribution of Breast Ultrasound Results

3.2.1 Distribution of BI-RADS Categories by Age Group

To explore the relationship between age and breast ultrasound results [23], a cross-analysis was conducted with age groups as the row variable and BI-RADS categories as the column variable [24]. The results are shown in Table 6.

Table 6
Distribution of BI-RADS Categories by Age Group [n (%)]

Age Group	n	Negative/Benign	Probably Benign	Suspicious Abnormality
55–59 years	391	339 (86.7)	46 (11.8)	6 (1.5)
60–64 years	260	241 (92.7)	17 (6.5)	2 (0.8)
65–69 years	89	82 (92.1)	7 (7.9)	0 (0.0)
70–74 years	55	48 (87.3)	6 (10.9)	1 (1.8)
75–80 years	15	13 (86.7)	1 (6.7)	1 (6.7)
Total	810	723 (89.3)	77 (9.5)	10 (1.2)

The negative/benign detection rate across all age groups remained between 86.7% and 92.7%. The highest rate of probable benign detection was observed in the 55–59 age group (11.8%), which then declined to 6.5%–7.9% in the 60–69 age group before rising again after age 70. The suspicious abnormality rate was generally low, peaking at 6.7% in the 75–80 age group, higher than in other age groups.

3.2.2 Chi-Square Test of Age and BI-RADS Classification

To examine whether there was a statistically significant association between age groups and BI-RADS classification, a Pearson chi-square test was conducted, with the results shown in Table 7.

Table 7
Chi-square test results of age groups and BI-RADS classification

Test Statistic	Value	df	p-value
Pearson Chi-square	11.325	8	0.184
Likelihood ratio	10.787	8	0.214
Linear-by-linear association	0.670	1	0.413
Valid cases	810	—	—
Note: The expected count for 6 cells (40.0%) is less than 5, with the minimum expected count being 0.19.			

The Pearson chi-square value is 11.325, with $P = 0.184 > 0.05$, indicating no statistically significant association between age and BI-RADS classification. Due to the small sample size in the older age group and the overall low rate of suspicious abnormalities, some cells have insufficient expected counts,

limiting the test's power. However, the higher rate of suspicious abnormalities in the older age group still holds certain clinical significance.

3.3 Age Distribution of Liquid-Based Cytology Results

3.3.1 Distribution of TBS Classification by Age Group

A cross-analysis was performed with age group as the row variable and TBS classification as the column variable [25][26]. The results are shown in Table 8.

Table 8
Distribution of TBS Classification by Age Group [n (%)]

Age Group	n	NILM	ASC-US and above	Other
55–59 years	391	372 (95.1)	18 (4.6)	1 (0.3)
60–64 years	260	250 (96.2)	7 (2.7)	3 (1.2)
65–69 years	89	84 (94.4)	5 (5.6)	0 (0.0)
70–74 years	55	54 (98.2)	1 (1.8)	0 (0.0)
75–80 years	15	10 (66.7)	4 (26.7)	1 (6.7)
Total	810	770 (95.1)	35 (4.3)	5 (0.6)
Note: For the convenience of the chi-square test, the "Other" category (5 cases) was combined with "NILM" to form the negative group for statistical analysis.				

The positive rate of liquid-based cytology in the 55–74 age groups remained between 1.8% and 5.6%, while it surged to 26.7% in the 75–80 age group, significantly higher than in other age groups, demonstrating a clear high-risk clustering characteristic in this very small subsample.

3.3.2 Chi-square test of age and TBS classification

Table 9
Chi-square test results of age groups and TBS classification

Test Statistic	Value	df	p-value
Pearson Chi-square	23.222	8	0.003
Likelihood ratio	13.511	8	0.095
Linear-by-linear association	0.016	1	0.899
Valid cases	810	—	—
Note: The expected count is less than 5 in 8 cells (53.3%), with the minimum expected count being 0.09.			

The Pearson chi-square value [27] is 23.222, P = 0.003 < 0.01, indicating a highly significant association between age and liquid-based cytology classification, suggesting that advanced age is an important risk factor for a positive liquid-based screening result.However, caution is warranted because the statistical significance may be heavily influenced by the small 75–80 subgroup $n=15$, and the chi-square test assumptions are violated for multiple cells.

3.4 Age Distribution of Comprehensive Risk Levels

3.4.1 Distribution of Comprehensive Risk Levels Across Age Groups

By combining the results of breast color Doppler ultrasound and liquid-based cytology, the distribution of comprehensive risk levels across age groups is shown in Table 10.

Table 10
Distribution of Comprehensive Risk Levels by Age Group [n (%)]

Age Group	n	Both Negative	Single Abnormality	Dual Abnormality	Unclassified
55–59 years	391	322 (82.4)	66 (16.9)	2 (0.5)	1 (0.3)
60–64 years	260	228 (87.7)	30 (11.5)	1 (0.4)	1 (0.4)
65–69 years	89	76 (85.4)	11 (12.4)	0 (0.0)	2 (2.2)
70–74 years	55	47 (85.5)	8 (14.5)	0 (0.0)	0 (0.0)
75–80 years	15	10 (66.7)	3 (20.0)	1 (6.7)	1 (6.7)
Total	810	683 (84.3)	118 (14.6)	4 (0.5)	5 (0.6)

In the 75–80 age group, the double-negative rate was only 66.7%, the lowest in the entire group; the single-abnormality rate was 20.0% and the double-abnormality rate was 6.7%, both the highest in the entire sample, showing characteristics of multiple risk overlaps. The other age groups were predominantly double-negative, with relatively stable risks.

3.4.2 Chi-square test of age and comprehensive risk level

Table 11
Chi-square test results of age groups and comprehensive risk levels

Test Statistic	Value	df	p-value
Pearson Chi-square	31.248	12	0.002
Likelihood ratio	16.926	12	0.152
Linear-by-linear association	0.834	1	0.361
Valid cases	810	—	—

Note: The expected count for 11 cells (55.0%) is less than 5, with the minimum expected count being 0.07.The small sample size in the oldest age group (n = 15) and the low prevalence of dual abnormalities limit the reliability of this result and warrant cautious interpretation.

The Pearson chi-square value is 31.248, with P = 0.002 < 0.01, indicating a highly significant correlation between age and comprehensive risk level. When combining the two screening indicators, the age-related risk differences become more pronounced, suggesting that comprehensive assessment is superior to a single indicator.

3.5 Age Trend Analysis of Abnormal Detection Rates

3.5.1 Summary of Abnormal Detection Rates by Age Group

To visually present the age-related trends in abnormal detection rates, the color ultrasound abnormality rate and liquid-based positive rate for each age group are summarized in Table 12.

Table 12
Summary of Abnormal Detection Rates by Age Group (%)

Age Group	Sample Size (n)	Breast Ultrasound Abnormality Rate (%)	LBC Positivity Rate (%)	Single Abnormality Rate (%)	Dual Abnormality Rate (%)
55–59 years	391	13.3	4.6	16.9	0.5
60–64 years	260	7.3	2.7	11.5	0.4
65–69 years	89	7.9	5.6	12.4	0.0
70–74 years	55	12.7	1.8	14.5	0.0
75–80 years	15	13.3	26.7	20.0	6.7

The abnormal rate of breast color Doppler ultrasound shows a U-shaped distribution, with both the 55–59 and 75–80 age groups at 13.3%; the positive rate of liquid-based cytology exhibits a J-shaped increase, surging to 26.7% in the 75–80 age group. The oldest group appears to display the "three highs" characteristics (high LBC positivity, high dual-abnormality, and high ultrasound abnormality) in our data, but these estimates are based on only 15 individuals and should be considered preliminary.

3.5.2 Trend Chart of Abnormal Detection Rates

As shown in Figs. 1 and 2, the abnormal rate of color Doppler ultrasound is high at both ends and low in the middle, while the positive rate of liquid-based cytology rises sharply in the older adults stage. The two curves intersect in the 75–80 age group, with advanced age becoming a critical node for increased risk in this sample.

3.5.3 Correlation Analysis Between Age and Abnormal Detection Rate

To examine whether there is a linear correlation between age and the abnormal detection rate, a Pearson correlation analysis was conducted, and the results are shown in Table 13.

Table 13
Correlation Analysis Results Between Age and Abnormal Detection Rate

Variable	Statistic	Age	Breast Ultrasound Abnormality	LBC Positivity
Age	Correlation coefficient	1	-0.043	0.021
	p-value	—	0.226	0.556
Breast ultrasound abnormality	Correlation coefficient	-0.043	1	-0.004
	p-value	0.226	—	0.920
LBC positivity	Correlation coefficient	0.021	-0.004	1
	p-value	0.556	0.920	—

Age and ultrasound abnormalities (r=-0.043, P = 0.226), as well as age and liquid-based cytology positivity (r = 0.021, P = 0.556), showed no significant linear correlation, suggesting that the age effect is primarily characterized by threshold mutations rather than linear progression. Ultrasound abnormalities and liquid-based cytology positivity were independent of each other (r=-0.004, P = 0.920), and combined assessment could enhance the completeness of risk identification.

3.6 Summary

The overall screening status of the sample was good but exhibited a clear bias toward younger ages, with lower coverage among older age groups. Age was significantly correlated with liquid-based cytology results and comprehensive risk levels but showed no significant association with breast ultrasound results. The 75–80 age group displayed preliminary evidence of prominent characteristics of high-risk clustering and low participation in health checkups. The two screening indicators were independent of each other, and combined assessment better reflected the differences in health risks among older women, providing reliable data support for inferring age-specific older adults care service needs.

4. Discussion

4.1 From Screening Results to Older adults Care Needs: Mapping and Inference

Drawing on ERG theory and Andersen’s behavioral model of health, this study constructs a transmission chain of "screening results → health risk → older adults care needs". Screening outcomes were stratified into three risk levels using clinical criteria: low risk (both tests negative, indicating stable health requiring routine maintenance); medium risk (one abnormal finding, mostly benign or inconclusive, requiring surveillance and follow-up); and high risk (both tests abnormal or suspicion of malignancy, requiring further diagnosis and concentrated care). Correspondingly, older adults care needs were classified into three categories: health management, regular follow-up, and medical care.

Based on the age-specific screening patterns presented in Chap. 3, differentiated care needs were further inferred (Table 14).

Table 14
Age-specific risk profiles and inferred older adults care needs

Age group	Core risk characteristics	Risk level	Primary need type	Core service content
55–59	Relatively high breast ultrasound abnormality rate, mostly benign; moderate liquid-based cytology positivity rate	Low-medium risk	Health management, screening education	Health education, menopause management, lifestyle guidance
60–64	Lowest abnormality rates across the sample; stable health status	Low risk	Health maintenance	Routine check-ups, lifestyle guidance
65–69	Rising liquid-based cytology positivity rate; emerging cervical lesion risk	Medium risk	Health monitoring, community follow-up	Scheduled follow-up, test result tracking, medical visit guidance
70–74	Breast ultrasound abnormality rate markedly rebounds; increased risk of organic lesions	Medium risk	Health monitoring, convenient referral	Community-embedded monitoring, referral coordination
75–80	Highest liquid-based cytology positivity and dual-abnormality rates; lowest participation rate	High risk	Medical care, integrated medical and older adults care	Home-based screening, accompanied medical visits, case management, caregiver support

Overall, the younger age group mainly requires health management and preventive interventions, the middle-aged group emphasizes health monitoring and access to medical care, while the oldest group concentrates medical care and integrated care needs, exhibiting a progressive hierarchy of care demands with advancing age.

It must be stressed that these inferences are indirect mappings with the following caveats: abnormal screening results only indicate elevated risk, not actual care needs; the indicators are limited to breast and cervical cancer screening and do not capture overall health status; the sample overrepresents younger older adults and is cross-sectional, thus cannot reflect dynamic changes; and findings are primarily applicable to similar populations in Guilin, warranting caution in generalization.

4.2 The "High-Risk, Low-Participation" Paradox and Gaps in Service Accessibility Among the Oldest Old

The 75–80 age group exhibited the highest liquid-based cytology positivity rate (26.7%) and dual-abnormality rate (6.7%), yet its screening participation rate was only 1.9%, creating a striking "high-risk, low-participation" paradox. However, we must interpret this with extreme caution: because this group includes only 15 individuals who were healthy enough to attend a hospital-based check-up, the observed high abnormality rates may be substantially inflated by selection bias (i.e., the "healthy worker" effect). It is equally plausible that the true, community-dwelling oldest-old population has different risk profiles,

and many frail elders were simply not captured. This finding echoes Dickson Swift et al.'s research on breast cancer screening among women over 75[27], where limited mobility and health awareness are key barriers[29]. Chen Kuiyang et al.'s systematic review further identifies socioeconomic status and health capability as core social determinants of under-participation[30]. These results suggest that current community-based "two-cancer" screening services remain largely passive and fail to adequately cover the mobility-impaired oldest old, revealing pronounced accessibility shortfalls [31][32] —a pattern consistent with evidence that healthcare and social needs in underserved communities are frequently mediated by structural barriers rather than individual choice alone [28]. Therefore, the most important lesson from our data is not that the oldest-old are inherently high-risk, but that our current screening model systematically excludes them. Proactive delivery models such as home-based screening and mobile health services are thus essential to close this gap [33].

4.3 Independence of Screening Indicators and the Necessity of Combined Risk Assessment

Breast ultrasound and liquid-based cytology results were independent (r=-0.004, P = 0.920), reflecting distinct health dimensions (breast vs. cervical). However, the combined risk grade derived from both indicators showed a stronger association with age (P = 0.002), demonstrating superior discriminatory power over single-indicator assessments. This finding supplements the existing literature, which predominantly focuses on the clinical value of individual tests, and aligns with Zhu Shenghong et al.'s conclusion that multi-indicator combined assessment improves risk identification efficiency. It implies that community-based older adults care needs assessments should integrate multidimensional screening data rather than relying on a single health indicator, thereby reducing evaluative blind spots.

4.4 Stratified Heterogeneity of Care Needs and Supply-Demand Alignment

The inferred care needs reveal clear heterogeneity across age strata: from health management in the younger older adults, to health monitoring in the middle-aged older adults, to medical and integrated care in the oldest old. This stratification aligns with Bai Weijun et al.'s proposition of tiered and categorized older adults care provision[34] and with Tan Mei et al.'s empirical findings based on Andersen's model that health risk differentials are a core driver of demand stratification. Lu Xiaoling et al.'s work on community-based integrated care also confirms that stratified health management better matches older adults' differentiated needs. These congruences underscore that community older adults care should abandon uniform supply models and instead adopt precision-oriented, risk-stratified service delivery.

4.5 Value of Routine Health Screening Data for Secondary Analysis

This study demonstrates the feasibility and efficiency of using routine "two-cancer" screening data to assess older adults care needs without additional large-scale surveys, offering low cost and enhanced objectivity. This approach overcomes limitations of traditional questionnaire-based assessments,

resonating with Zhu Shenghong et al.'s note that vast amounts of screening data accumulated in primary care remain underutilized for secondary analysis[35] and with Ju et al.'s use of health data and machine learning to construct more accurate prediction models[36]. In the context of the Healthy China strategy, promoting data interoperability between health screening systems and older adults service platforms can open a novel technical pathway for precision-oriented community care delivery.

5. Conclusion and Recommendations

5.1 Conclusions

Drawing on the "two-cancer" screening data of 810 older women across 6 districts and 12 counties in Guilin, this study verifies the feasibility of inferring older adults care needs from physical examination data. The main conclusions are as follows:

First, the overall screening results are favorable, yet the oldest age group exhibits a clustering of high risk alongside low screening coverage. The overall health status of the sample is relatively good: the negative/benign rate of breast ultrasound is 89.3%, and the NILM rate of liquid-based cytology is 94.6%, with 15.1% of participants having at least one abnormal finding. However, the sample age structure skews markedly toward the younger older adults, with those aged 55–64 accounting for 80.4%, while those aged 75–80 comprise only 1.9%. This oldest group records the highest liquid-based cytology positivity rate (26.7%) and dual-abnormality rate (6.7%), forming a striking paradox of concentrated health risk and minimal screening participation.Nevertheless, the extremely small sample (n = 15) in this group means these risk estimates are unstable and likely subject to selection bias; the more robust conclusion is that the current screening system fails to reach the oldest-old.

Second, age is significantly associated with combined risk grade, and joint assessment of both indicators yields superior discriminative power. Significant statistical associations exist between age and liquid-based cytology classification ($P = 0.003$) as well as combined risk grade ($P = 0.002$), whereas no significant association was found with BI-RADS classification alone ($P = 0.184$). Breast ultrasound and liquid-based cytology results are independent ($r=-0.004$, $P = 0.920$), indicating that they reflect different health dimensions. Combined assessment is therefore more effective than single-indicator evaluation in capturing health risk variation among older women.

Third, older women across different age brackets present stratified and differentiated care needs. The young-old (55–64) are generally in stable health and primarily require health management, preventive interventions, and regular screening. The middle-old (65–74) exhibit gradually emerging health risks and mainly need health monitoring, regular follow-up, and improved convenience of medical visits. The oldest-old (75–80) show a pronounced clustering of high risks and represent the key target group for medical care, integrated medical and older adults care, and home-based services. Their demand fulfillment is notably constrained by limited service accessibility.

Fourth, routine physical examination data can serve as an effective supplementary source for older adults care needs assessment. Using existing "two-cancer" screening data enables cost-effective and efficient need identification without additional large-scale surveys, offering a feasible pathway for the precise allocation of community-based older adults care resources.

5.2 Recommendations

5.2.1 Establish a stratified and categorized older adults care supply system to enhance resource allocation precision

For the young-old, prioritize preventive services such as health education, dissemination of breast and cervical health knowledge, and lifestyle guidance. For the middle-old, strengthen health management services including regular follow-up, screening result reminders, and referral coordination, and embed health monitoring into community older adults care. For the high-risk oldest-old, establish a service loop of proactive case finding, in-home assessment, and individualized case management, giving priority to essential needs such as medical care, accompanied medical visits, and rehabilitative nursing.

5.2.2 Promote data interoperability between physical examination systems and older adults care information platforms

Under the preconditions of data anonymization and privacy protection, facilitate the interface between medical institutions' examination data and civil affairs' older adults care service platforms. Incorporate standardized indicators such as BI-RADS classification and liquid-based cytology results into the health risk labeling system of older adults, enabling automated risk alerts, targeted service delivery, and rapid resource matching, thereby shifting older adults care from reactive response to proactive prediction.

5.2.3 Enhance health service accessibility for the oldest old and address gaps in integrated medical and older adults care

For those with limited mobility, living alone, or of advanced age, promote convenient service models such as home-based screening, mobile screening vehicles, and community-based rotating screening sites to lower physical participation barriers. Establish a bidirectional referral mechanism between community health centers and older adults care institutions to ensure timely follow-up diagnosis and treatment for individuals with abnormal screening results. Incorporate "two-cancer" screening and follow-up management for older women into the basic public health services for older adults, and strengthen financial and policy support.

5.2.4 Build a cross-sectoral coordination mechanism between health and civil affairs departments to promote healthy aging

Strengthen regular collaboration between health and civil affairs authorities, unify standards for health risk assessment and older adults care needs evaluation, and promote the integrated delivery of health screening, chronic disease management, rehabilitative care, and daily living assistance. At the street and community levels, drive resource integration and functional alignment between community health service centers and older adults care service stations, forming a continuous service chain of "prevention-screening-follow-up-care".

5.3 Limitations and Future Directions

This study has several limitations. The sample was drawn from a single medical institution’s physical examination population, resulting in selection bias and a small sample size for the oldest age group, which constrains the generalizability of the findings. In particular, the 75–80 age group (n = 15) is too small to support robust statistical inference; the observed "high risk" pattern may be an artifact of the healthy worker effect. Therefore, our conclusions about this group should be treated as hypothesis-generating rather than confirmatory. Moreover, only two core indicators from "two-cancer" screening were included; comprehensive health dimensions such as chronic disease status and physical functioning were not incorporated, indicating room for indicator system refinement. Future research should conduct multicenter, large-sample empirical studies, expand the set of health indicators, and leverage longitudinal tracking combined with machine learning models to further advance the application of health data in precision older adults care supply.

Declarations

Ethics approval and consent to participate

This study retrospectively analyzed anonymized routine physical examination data without direct contact with participants. In accordance with Article 32 of China’s *Ethical Review Measures for Biomedical Research Involving Humans* (National Health Commission Order No. 11, 2023), research using lawfully obtained existing anonymous data that does not involve identifiable private information is exempt from formal ethics review. The study protocol was voluntarily submitted to and acknowledged by the Medical Ethics Committee of Guilin Medical University. Informed consent was waived due to the retrospective and anonymized nature of the data.

Consent for publication

Not Applicable

Availability of data and materials

The original contributions presented in the study are included in the article. Further inquiries can be directed to the corresponding author.

Competing interests

The authors declare that the research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.

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Authors' contributions

S.H., X.W. and Y.H.: Data curation, Formal analysis, Software, Validation, Writing – original draft. T.J., Y.C. and W.M.: Conceptualization, Data curation, Formal analysis, Investigation, Methodology, Writing – original draft. Z.W.: Conceptualization, Funding acquisition, Project administration, Resources, Supervision, Writing – review & editing. All authors contributed to the article and approved the submitted version.

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Human Ethics and Consent to Participate declarations

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Clinical trial number

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Figures

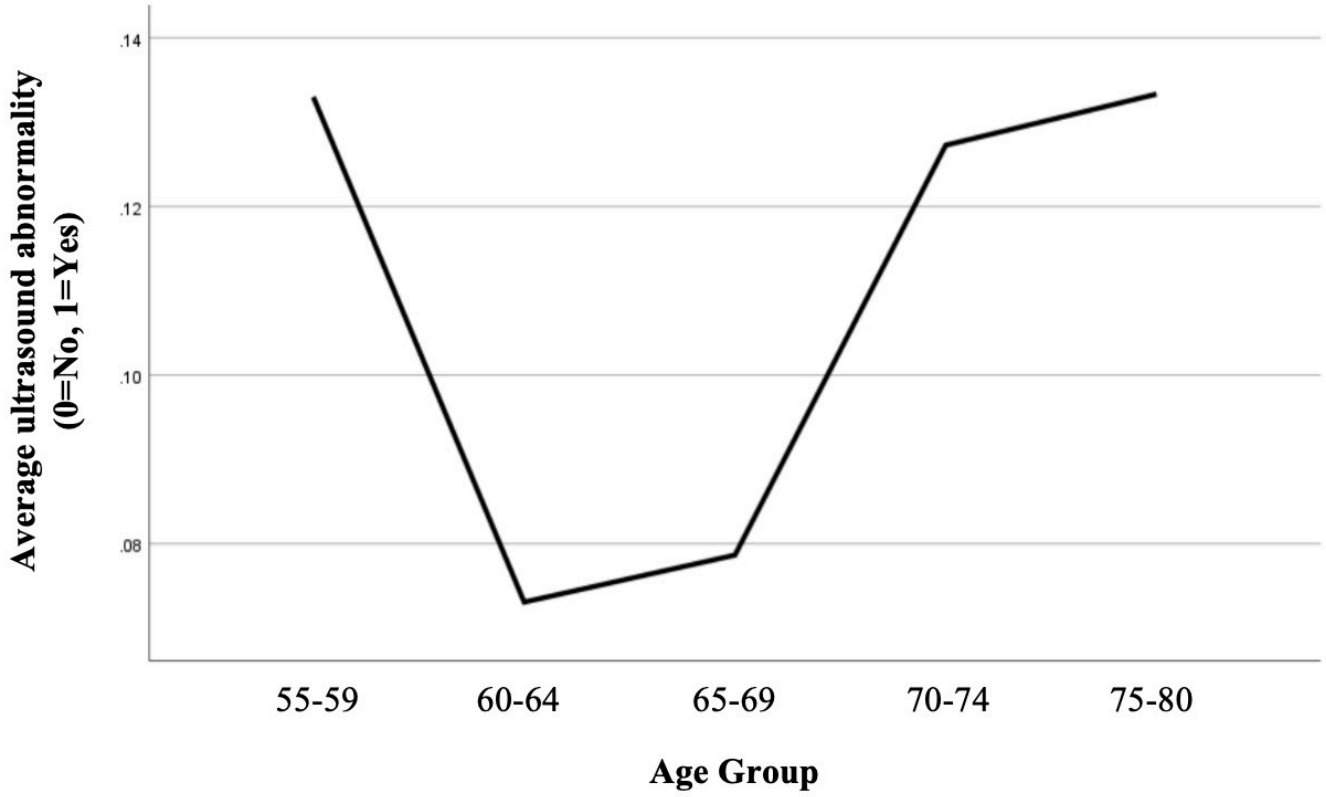


Figure 1

Abnormal rate of breast color ultrasound

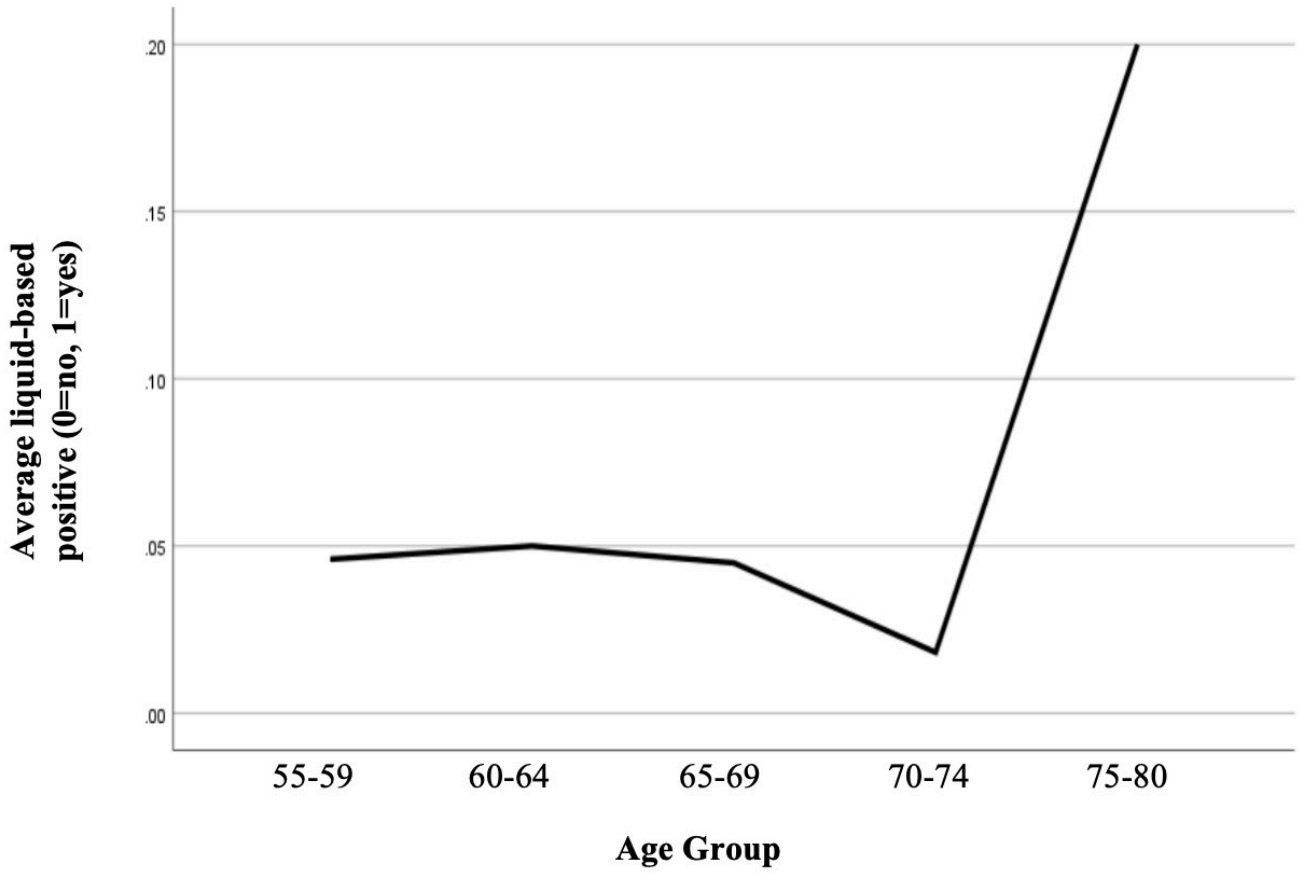


Figure 2

Liquid-based cytology abnormality rate