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Research article

Needs of health education for community residents – A survey across difference types of community in Hangzhou of China

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ABSTRACT

Background: Community-based health education is widely recognized as a cost-effective means to improve public health. However, current research on health education needs lacks a framework that accounts for variations across different community types, limiting understanding of diverse health education needs in urban settings.
Objective: This study examines health education needs across various community types, aiming to identify significant differences that can inform community health education strategies.
Methods: Conducted in Hangzhou from April to June 2024, this mixed-method study used purposive sampling to select residents from heterogeneous, transformed, homogeneous, and system-based communities for interviews exploring health education needs and existing practices. Qualitative data from 14 interviews and 21 policy documents were coded at three stages and analyzed using Nvivo 12.0, resulting in themes that informed a survey design. In the quantitative phase, 299 residents completed a questionnaire assessing health education needs on a 5-point Likert scale. Descriptive statistics, non-parametric tests, and multivariate logistic regression models were employed to assess health education needs and analyze differences across community types.
Results: Eight primary health education topics were identified: major disease prevention, healthy lifestyles, maternal and child health, mental health, environmental health, medication safety, emergency response, and sexual health education, with 23 sub-topics. First aid knowledge education showed the highest demand [5 (4,5)], followed by cancer prevention education [4 (4,5)]. Non-parametric tests indicated significant influences on health education needs by education attainment, income, and community type ($P < 0.05$). Multivariate logistic regression model analysis revealed significant variation in needs based on education for diabetes prevention and life safety education, income for cardiovascular and infectious disease prevention, and community type for natural environmental pollution prevention, infectious disease prevention, diabetes and cardiovascular education, and first aid knowledge, life safety education ($P < 0.05$).
Conclusion: Differences in health education needs are shaped by factors such as residents' education attainment, income, and access to community health resources. Targeted health education should be developed to address specific needs of each community type while promoting equitable resource distribution.

Under the Healthy China 2030 Plan, improving public health literacy and advancing health promotion have become focal points in the national strategy.[1] In this context, health education, valued for its cost-effectiveness in improving population health,[2] is gaining increasing attention. Community health centers, as primary facilitators of health education, face challenges in meeting the diverse health needs of residents across varied demographic backgrounds. Given limited resources, achieving comprehensive community health education coverage remains difficult, underscoring the need to allocate resources effectively based on local needs. Therefore, it is essential to optimize the allocation of health education resources based on community circumstances and residents' needs, laying the foundation for more targeted health knowledge dissemination.[3]

Current studies on community health education needs often target specific patient groups with chronic diseases,[4] infectious diseases,[5] or cancer,[6] as well as on single population groups such as older adults,[7] women,[8] or parents of young children.[9] These studies typically analyze the health behaviors and educational needs of these groups to recommend targeted health education interventions. However, focusing only on specific groups may create resource allocation imbalances within the community.

In recent years, the role of community characteristics in shaping residents' health has gained prominence in public health and epidemi-

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Table 1
Classification criteria for community types (ZHU Jinghui, 2019).

Community-type	Classification criteria
Homogeneous community	(1) Housing Form: Primarily low-rise buildings, often early welfare housing provided by work units. (2) Geographical Location: Located in central urban areas. (3) Construction Date: The majority of the buildings were constructed prior to 2000. (4) Social Characteristics: Close-knit resident relationships, mutual assistance among neighbors, and a strong sense of familiarity, with a prominent aging population. (5) Community Characteristics: Space constraints, including issues such as limited parking and road congestion. Buildings generally show signs of aging, and most buildings lack elevators.
Heterogeneous community	(1) Housing Form: New commercial housing developments, purchased through the market. (2) Geographical Location: Located in city centers or emerging urban areas. (3) Construction Date: Built after 2015. (4) Social Characteristics: Diverse backgrounds among residents with high levels of unfamiliarity and mobility. (5) Community Characteristics: Well-developed infrastructure, ample green spaces, and focus on the provision of public space.
System-based community	(1) Housing Form: Suburban villages. (2) Geographical Location: Located near the urban-rural fringe. (3) Social Characteristics: Primarily a residential area for low-income groups with a high concentration of migrant populations. (4) Community Characteristics: Presence of illegal extensions or additions to buildings.
Transforme community	(1) Housing Form: Resettlement-type communities. (2) Geographical Location: Located in new urban areas or urban-rural interface areas. (3) Social Characteristics: Former villagers reside here with some retention of rural lifestyles and governance methods. (4) Community Characteristics: Diverse public spaces within the community, often focusing on gathering places for discussion.

ology research.[10] Key community attributes, including the availability of health facilities and the organization of health-promoting activities, are significant factors that may influence the health education needs of residents.[11] Recognizing the importance of community characteristics, this study focuses on three core questions: (1) What are the primary health education topics of interest to residents? (2) How do health education needs vary among residents across different community types? (3) What factors could potentially underlie these differences?

Methods

This study used a mixed-methods design, integrating both qualitative and quantitative analyses to assess residents' health education content needs. In the qualitative phase, a three-level coding process was used to categorize residents' specific health education needs. In the quantitative phase, descriptive statistics, nonparametric tests, and multivariate logistic regression models were applied to analyze the differences in health education needs among residents in various community types and to explore underlying factors influencing these variations.

Study population

This study explores health education needs and disparities among urban community residents, examining both community residents and health policy texts. To address variations in educational needs across community types, a composite classification model was adopted, following the criteria set by Wenzhou Medical University.[12] This model, which considers both physical and social community environments, offers a comprehensive view that surpasses single-dimensional approaches based on demographics or community function.[13,14]

The classification includes four community types (Table 1):

(1) Homogeneous communities: older unit-based urban neighborhoods, primarily featuring low-rise buildings with limited facilities and significant aging populations.
(2) Heterogeneous communities: modern residential complexes with standardized green spaces, prioritizing environmental quality and services, and predominantly occupied by middle- to high-income residents.
(3) System-based communities: located on urban fringes, these communities have been integrated spatially into urban areas but retain village-like structures, serving as gathering areas for low-income groups and migrant populations.
(4) Transformed communities: comprising relocation housing for former village residents affected by urban development, these communities maintain rural governance elements and are mainly inhabited by original village residents.

For health policy documents, this study analyzed notifications, guidelines, and action plans issued by the State Council and the National Health Commission in China between 2014 and 2024. These documents, identified through keywords like "health education," "Healthy China," and "health action," provide insight into evolving national priorities for community health education.

Data collection

Qualitative data collection

To categorize health education content at both macro-policy and micro-individual levels, this study combined policy text analysis with resident interviews. At the macro-policy level, government-issued guidelines and regulatory documents on health education were collected as foundational references to understand essential health knowledge from a broader policy perspective. During the data acquisition phase, a relevance-based selection principle guided an initial content analysis of policy objectives outlined in these documents. This process produced a preliminary set of 63 policy documents. Following data acquisition, the documents were thoroughly reviewed to remove redundancies across years, resulting in a final selection of 21 relevant health education policy documents. These documents were recorded sequentially and labeled from Z001 to Z021.

To ensure a comprehensive and objective assessment of community residents' health education needs, as well as to supplement macro-policy insights, open-ended interviews were conducted to identify residents' actual needs in community health education. As the target population for health education, community residents naturally describe subjective needs based on personal experiences and perceptions, thus providing a bottom-up perspective on educational demands. The interview guide was structured around three main areas: desired health education content, preferred formats for education delivery, and the current state of community-based education. This approach aimed to identify specific health topics residents seek and the methods they prefer for receiving this education.

The study employed purposive sampling, with participants required to meet the following criteria: (1) permanent residency in the community, having lived there for a minimum of six months; (2) age 18 or older; and (3) basic comprehension and communication abilities. Inter-

views were conducted between April 3 and April 17, 2024, involving a total of 14 residents across different community types: 3 from heterogeneous communities, 4 from transformed communities, 3 from homogeneous communities, and 4 from system-based communities. Each interview lasted approximately 20 min. The transcribed interviews were standardized, resulting in a dataset of 38,905 Chinese characters, with each transcript cataloged sequentially from P001 to P014.

Quantitative data collection

A health education needs survey questionnaire was designed based on the results of qualitative coding. The questionnaire included two sections: The first collected demographic information, such as gender, age, education attainment, annual household income, and community type. The second section assessed community health education needs across eight primary topics and 23 specific items (see Table 3). Each item used a 5-point Likert scale to measure the level of educational need, with scores ranging from 1 (lowest need) to 5 (highest need). Reliability analysis yielded a Cronbach's α of 0.926, a KMO of 0.787, and Bartlett's test of sphericity showed statistical significance ($\chi^2 = 913.039$, $P < 0.001$), indicating acceptable reliability and validity for this section of the questionnaire.

Sample size estimation was conducted using PASS software, with an alpha level of 0.05, power set at 0.8, and a medium expected effect size of 0.5.[15] Using a preliminary variance of 1, the minimum required sample size per group was calculated at 63 participants. To account for missing data, an additional 10 % of respondents were added to each group. Given the four community types, the total minimum sample size required was 296.

From May 30 to June 12, 2024, the research team conducted field research in Chengxiang, Shushan, and Xintang streets of Xiaoshan district, Hangzhou, Zhejiang Province. The selection of research sites involved on-site visits, discussions with community management entities (such as neighborhood committees and property management), and information collected from platforms like Anjuke. Based on the community classification criteria (Table 1), we selected two homogeneous communities, three heterogeneous communities, two system-based communities, and three transformed communities. The survey was distributed using both online and offline methods. A total of 318 questionnaires were collected, with 299 complete and valid responses retained after excluding incomplete submissions, yielding an effective response rate of 94.03 %, which met the sample size requirement.

Data analysis

Qualitative data analysis

Qualitative data analysis was conducted using Nvivo 12.0 software. Eighteen policy documents and eleven interview transcripts were randomly selected for initial coding, with the remaining samples reserved for testing theoretical saturation. To ensure reliability, two independent coders performed the initial coding separately. Their codes were then merged and compared, with any discrepancies resolved through repeated discussions until a consensus was reached. The resulting kappa value of 0.75 indicated high coding reliability.

Quantitative data analysis

Quantitative data analysis was performed using SPSS 26.0. Residents' health education needs were summarized using the median and interquartile range [$M(P_{25}, P_{75})$]. Non-parametric tests were used to evaluate the effects of different demographic characteristics and community types on health education needs. Sample data were collected from four different types of communities. Considering the potential hierarchical structure of the data, a multilevel logistic regression model could be used to explore the impact of different community types on the variation in health education needs. If the data did not exhibit a significant hierarchical structure across community types, a single-level logistic regression model could be employed for the analysis. Statistical significance was set at $P < 0.05$.

Results

Qualitative research results

The specific content requirements for residents' health education were derived from both macro-level policy documents and micro-level resident interviews. Through three stages of coding, data were systematically analyzed to identify health education needs.

Stage 1: open coding

In the initial stage, open coding was used to conceptualize 673 original statements (see Table 2). For instance, the policy document Health Literacy for Chinese Citizens — Basic Knowledge and Skills (2024 Edition) advises individuals to "strictly follow medical advice and avoid changing or discontinuing medication without consulting a doctor" (Z001). This aligned with a resident's remark, "I think it would be useful to educate us on correct dosage methods and commonly used combinations" (P008). These insights from policy and individual perspectives contributed to the node, "Proper medication use." This approach led to the identification of 78 initial concepts. After removing duplicates and non-pertinent concepts, 66 initial categories were finalized as tertiary nodes.

Stage 2: axial coding

In the second stage, axial coding clustered these initial concepts into 23 major categories, serving as secondary nodes.

Stage 3: selective coding

Selective coding was then applied to consolidate and distill the data from both macro-level policies and individual-level inputs. This process identified eight core themes as primary nodes: Major disease prevention, healthy lifestyle, maternal and child health, mental health, environmental health, medication safety, emergency preparedness, and sexual health (see Table 3).

To ensure theoretical saturation, an additional 3 policy documents and 3 interview transcripts were analyzed. No new conceptual nodes emerged, confirming that theoretical saturation was achieved.

Quantitative study results

Basic information of survey participants

The sample included 299 participants, distributed evenly across community types: 74 from homogeneous communities, 76 from transformed communities, 74 from heterogeneous communities, and 75 from system-based communities. Gender distribution was balanced, with 49.8 % male (149 participants) and 50.2% female (150 participants). The majority of participants were aged 18–30 and 31–40, together comprising 57.2 % of the sample. Most respondents reported an annual household income between 100,000 and 200,000 Chinese Yuan (CNY), accounting for 39.5 % of the sample. Education levels were predominantly at or above the college level, with 77.3 % holding a diploma or higher.

Analysis of resident's health education needs rankings

An analysis of median and interquartile range values highlighted residents' significant preferences for specific health education topics, as shown in Table 4. Overall, first aid knowledge ranked as the most highly demanded topic, with a median score of 5. Other topics with strong demand included cancer prevention, infectious disease prevention, life safety education, mental health education, respiratory disease prevention, healthy diet education, and reproductive health education.

Table 2
Example of the partial opening coding process.

Level 3 Node	Initial Concept	Partial Original Statements
Correct medication methods	Adherence to medication	Z001: Adhere strictly to the doctor's instructions, refrain from stopping or switching medications on your own, and avoid alcohol during medication use to prevent interactions.
	Medication dosage and combinations	P008: I think it would also be helpful to promote knowledge about medication dosages and common combinations.
Exercise and health guidance	Children's exercise guidance	Z006: Strengthen children's exercise guidance and promote knowledge that preschool children should engage in at least 180 min of exercise a day, with 60 min or more of moderate-intensity exercise.
	Exercise intensity guidance	P014: They tell me how to control exercise intensity. For example, you can't start with high-intensity exercise right away, but I don't know how to control the amount.
Healthy diet introduction	Dietary nutrition education	Z012: Promote comprehensive nutrition knowledge and issue dietary guidelines suitable for different populations, guiding residents to form scientific eating habits. P013: Teach how to eat reasonably, such as reducing salt, oil, and sugar, and how to effectively reduce body fat.
Dietary habits advice	Healthy eating habits	Z004: Chew food slowly, avoid overeating, focus on your meal, and maintain a positive mood while eating.
Cancer prevention measures	Cancer prevention dissemination	P002: Given the increasing incidence of cancer, I believe that older individuals, particularly parents, may lack knowledge about how to prevent it, or that current preventive measures may not be sufficient.
Bedtime relaxation techniques	Improving sleep quality	P003: I really need education on how to improve my sleep quality.

Table 3
Results of selective coding.

Primary Node	Secondary Node	Tertiary Node
Major Disease Prevention	Respiratory Disease Prevention Education	Introduction to Common Respiratory Diseases, Preventive Measures for Respiratory Diseases
	Diabetes Prevention Education	Introduction to Diabetes Prevention Measures, Basic Knowledge of Diabetes
	Oral Health Education	Oral Care Recommendations, Importance of Oral Check-ups
	Cancer Prevention Education	Introduction to Early Cancer Symptoms, Preventive Measures for Cancer
	Cardiovascular Disease Prevention Education	Introduction to Cardiovascular Prevention, Basic Knowledge, Emergency Assistance
	Infectious Disease Prevention Education	Introduction to Infectious Disease Prevention, Transmission Routes, Common Infectious Diseases
Maternal and Child Health	Women's Health Education	Introduction to Gynecological Diseases, Menstrual Health Care Knowledge, Maternal Health Care Knowledge
	Children's Health Education	Infant and Toddler Care Guidance, Children's Mental Health, Prevention of Myopia and Obesity in Children
Medication Health	Drug Safety Education	Self-medication Risks, Correct Medication Methods, Medication Storage and Management, Expired Medication Disposal
	Traditional Medicine Education	Introduction to Natural Therapies, Knowledge of Common Herbs, Chinese Medicine Health Maintenance Methods
Safety and Emergency Health	First Aid Knowledge Education	Choking First Aid, CPR, Treatment of Fractures and Sprains, Wound Bleeding Control, Burns Treatment
	Life Safety Education	Traffic Safety, Water Safety, Natural Disaster Safety, Hazardous Symbols, Fire Safety
Healthy Lifestyle	Tobacco and Alcohol Education	Hazards of Alcohol Abuse, Hazards of Second-hand Smoke, Methods to Quit Smoking and Drinking
	Healthy Diet Education	Dietary Habits Advice, Healthy Diet Introduction, Relationship Between Diet and Diseases
	Physical Exercise Education	Importance of Exercise, Exercise Health Guidance, Types of Exercise
Mental Health	Sleep Health Education	Bedtime Relaxation Techniques, Symptoms of Sleep Disorders
	Interpersonal Communication Education	Family Relationship Maintenance, Social Skills
	Mental Health Education	Self-emotional Management Techniques, Introduction to Common Mental Disorders, Mental Health Treatment Resources and Methods
Environmental Health	Indoor Air Pollution Prevention Education	Methods for Detecting Pollution, Measures for Protecting Against Indoor Air Pollution
	Noise Pollution Prevention Education	Introduction to Noise Levels and Standards, Noise Control Suggestions
	Natural Environmental Pollution Prevention Education	Raising Environmental Awareness, Environmental Pollution Protection Measures, Environmental Protection Methods
Sex Health Education	Reproductive Health Education	Introduction to Puberty Changes, Reproductive System Knowledge
	Sexual Behavior Education	Risks of Sexual Behavior, Prevention of Sexually Transmitted Diseases, Contraception Methods

In homogeneous communities, residents showed a balanced demand for health education topics, with cancer prevention education receiving the highest "comparatively needed" and "very needed" ratings—90.5 % (67 cases). The lowest demand was observed for medication safety, indoor air pollution prevention, noise pollution prevention, and children's health education, each with 55 cases. In heterogeneous communities, demand was similarly balanced. First aid knowledge education and reproductive health education were jointly ranked highest, with 85.1 % (63 cases) selecting "comparatively needed" or "very needed."

In transformed communities, there was especially high demand for respiratory disease prevention education (93.4 %, 71 cases) and first aid knowledge education (90.8 %, 69 cases). By contrast, natural environmental pollution prevention education was less prioritized, with 48.7% (37 cases) expressing need.

Table 4
Need for health education in different types of communities.

Health Education Need		Total	Homogeneous Community	Transitional communities	Heterogeneous community	Integrated community	*P* value	*H* value
Environmental Health Education	Natural Environmental Pollution Prevention Education	4 (3, 4)	4 (4, 5)	3 (3, 4)	4 (3, 4)	4 (3, 5)	<.001[b]	18.552
	Indoor Air Pollution Prevention Education	4 (3, 5)	4 (3, 5)	4 (3, 5)	4 (3, 5)	4 (4, 5)	0.076	6.863
	Noise Pollution Prevention Education	4 (3, 5)	4 (3, 5)	4 (3, 4.75)	4 (3, 5)	4 (4, 5)	0.114	5.948
Healthy Lifestyle Education	Tobacco and Alcohol Education	4 (3, 5)	4 (4, 5)	4 (3, 5)	4 (3, 5)	4 (4, 5)	0.464	2.560
	Healthy Diet Education	4 (4, 5)	4 (4, 5)	4 (4, 5)	4 (4, 5)	4 (4, 5)	0.697	1.436
	Physical Exercise Education	4 (4, 5)	4 (4, 5)	4 (3.25, 5)	4 (3, 5)	4 (4, 5)	0.196	4.693
Major Disease Prevention Education	Oral Health Education	4 (4, 5)	4 (4, 5)	4 (4, 5)	4 (3.75, 5)	4 (4, 5)	0.349	3.291
	Respiratory Disease Prevention Education	4 (4, 5)	4 (4, 5)	4 (4, 5)	4 (4, 5)	4 (4, 5)	0.152	5.293
	Cancer Prevention Education	4 (4, 5)	4 (4, 5)	5 (4, 5)	4 (3, 5)	5 (4, 5)	0.324	3.479
	Cardiovascular Disease Prevention Education	4 (4, 5)	4 (4, 5)	4 (4, 5)	4 (3, 5)	5 (4, 5)	0.047[a]	7.964
	Diabetes Prevention Education	4 (3, 5)	4 (4, 5)	4 (4, 5)	4 (3, 5)	4 (4, 5)	0.025[a]	9.378
	Infectious Disease Prevention	4 (4, 5)	4 (4, 5)	5 (4, 5)	4 (3, 5)	5 (4, 5)	<.001[b]	20.010
Medication Health Education	Drug Safety Education	4 (4, 5)	4 (3, 5)	4 (3.25, 5)	4 (4, 4)	4 (4, 5)	0.320	3.509
	Traditional Medicine Education	4 (4, 5)	4 (4, 5)	4 (4, 5)	4 (3, 5)	4 (4, 5)	0.227	4.335
Mental Health Education	Interpersonal Communication Education	4 (3, 5)	4 (4, 5)	4 (3, 5)	4 (3, 5)	4 (3, 5)	0.597	1.885
	Mental Health Education	4 (4, 5)	4 (4, 5)	4 (4, 5)	4 (4, 5)	4 (4, 5)	0.258	4.028
	Sleep Health Education	4 (4, 5)	4 (4, 5)	4 (3.25, 5)	4 (3, 5)	4 (3, 5)	0.284	3.797
Safety and Emergency Education	First Aid Knowledge Education	5 (4, 5)	4 (4, 5)	5 (4, 5)	4 (4, 5)	4 (4, 5)	0.023[a]	9.529
	Life Safety Education	4 (4, 5)	4 (4, 5)	4 (4, 5)	4 (3, 5)	4 (4, 5)	0.037[a]	8.491
Sex Education	Sexual Behavior Education	4 (3, 5)	4 (4, 5)	4.5 (4, 5)	4 (3, 5)	4 (3, 5)	0.263	3.989
	Reproductive Health Education	4 (4, 5)	4 (4, 5)	4 (4, 5)	4 (4, 5)	4 (4, 5)	0.888	0.636
Maternal and Child Health Education	Children's Health Education	4 (3, 5)	4 (3, 5)	4 (4, 5)	4 (3, 5)	4 (3, 5)	0.315	3.541
	Women's Health Education	4 (3, 5)	4 (4, 5)	4 (3, 5)	4 (3, 5)	4 (3, 5)	0.504	2.345

Notes: [a] indicates P<0.05, [b] indicates P<0.01.

In system-based communities, residents showed a generally high demand across topics. The top three topics—each marked as "comparatively needed" or "very needed"—were life safety education (92.0 %, 69 cases), infectious disease prevention education (92.0 %, 69 cases), and mental health education (90.7 %, 68 cases).

Univariate Analysis of Variation in Residents' Health Education Needs by Demographic Factors

Non-parametric tests were conducted to assess variations in residents' health education needs across demographic factors, including gender, age, education attainment, income, and community type. Results indicated no significant differences in health education needs by gender or age. However, needs varied significantly by educational level, income, and community type ($P < 0.05$). When examining health education themes, statistically significant differences were observed among community types in the areas of environmental health, major disease prevention, and safety and emergency preparedness. At a more specific level, significant differences were found across community types in demand for the following education topics: natural environmental pollution prevention, cardiovascular disease prevention, diabetes prevention, infectious disease prevention, first aid knowledge, and life safety education ($P < 0.05$).

Multivariate logistic regression model analysis of variation in residents' health education needs

The results of the multilevel logistic regression showed that the intraclass correlation coefficients (ICCs) were all less than 0.1, indicating a weak hierarchical structure of the data across different community types. Therefore, a single - level logistic regression was used for the analysis, as shown in Table 5. The six educational topics served as dependent variables, while education attainment, income, and community type (factors identified as significant in univariate analysis) were used as independent variables.

The results revealed that, in education attainment, compared to residents with a master's degree or higher, those with middle school or lower education expressed significantly higher demand for diabetes prevention education [*OR*(95%*CI*)=3.974(1.718,9.192)] and life safety education [*OR*(95%*CI*)=5.133(2.051,12.846)]. In income level, relative to those with over 200,000 CNY annually income, residents with annual incomes between 50,000 and 100,000 CNY [*OR*(95%*CI*)=2.003(1.102,3.639)] and 100,000–200,000 CNY [*OR*(95%*CI*)=2.246(1.286,3.921)] showed greater demand for cardiovascular disease prevention education. In infectious disease prevention, demand decreased as income increased, with *OR*(95%*CI*) values of 2.717 (1.034, 7.136), 1.921 (1.061, 3.480), and 1.839 (1.044,3.238) across lower to higher income levels ($P < 0.05$).

At the community level, different types of communities significantly impacted demand for natural environmental pollution education, cardiovascular disease prevention, diabetes prevention, infectious disease prevention, first aid knowledge, and life safety education ($P < 0.05$).

Pairwise comparisons between community types (see Table 6) further clarify differences in health education needs. For natural environmental pollution prevention education, residents in homogeneous communities showed a significantly higher demand than those in transformed and heterogeneous communities. Additionally, system-based communities exhibited a higher demand than transformed communities.

Table 5
Multivariate logistic regression of factors influencing differences in residents' health education needs.

Variable	Natural Environmental Pollution Prevention		Cardiovascular Disease Prevention		Diabetes Prevention	
	OR	95 % *CI*	*OR*	95 % *CI*	*OR*	95 % *CI*
Individual Level Factor: Education Level (reference: Master's Degree or Higher)						
Junior High School or Below	1.100	0.503~2.404	1.644	0.744~3.634	3.974[a]	1.718~9.192
High School/Vocational School	1.386	0.687~2.279	0.849	0.411~1.755	1.729	0.868~3.446
Associate Degree/University	0.971	0.590~1.598	0.722	0.433~1.203	1.272	0.774~2.089
Individual Level Factor: Annual Family Income (reference: > 20,000 CNY)						
≤5000 CNY	1.788	0.756~4.230	1.066	0.444~2.560	1.755	0.722~4.262
5000–10,000 CNY	0.980	0.555~1.731	2.003[a]	1.102~3.639	1.259	0.699~2.267
10,000–20,000 CNY	0.785	0.458~1.345	2.246[a]	1.286~3.921	1.144	0.659~1.988
Community Level Factor: Community Type (reference: Mixed Community)						
Homogeneous Community	1.513	0.836~2.737	0.571	0.307~1.061	0.634	0.348~1.153
Transitional communities	0.434[a]	0.237~0.794	0.574	0.309~1.068	0.747	0.404~1.381
Heterogeneous Community	0.681	0.373~1.243	0.382[a]	0.203~0.717	0.402[a]	0.218~0.739
Variable	Infectious Disease Prevention		First Aid Knowledge		Life Safety	
	OR	95 % *CI*	*OR*	95 % *CI*	*OR*	95 % *CI*
Individual Level Factor: Education Level (reference: Master's Degree or Higher)						
Junior High School or Below	1.654	0.732~3.740	2.096	0.896~4.903	5.133[a]	2.051~12.846
High School/Vocational School	1.250	0.603~2.592	1.157	0.554~2.419	1.675	0.829~3.385
Associate Degree/University	1.554	0.927~2.606	1.233	0.736~2.067	1.282	0.776~2.118
Individual Level Factor: Annual Family Income (reference: > 20,000 CNY)						
≤5000 CNY	2.717[a]	1.034~7.136	0.803	0.327~1.970	1.384	0.565~3.393
5000–10,000 CNY	1.921[a]	1.061~3.480	0.893	0.484~1.647	1.371	0.767~2.453
10,000-20,000 CNY	1.839[a]	1.044~3.238	1.229	0.691~2.186	1.463	0.837~2.557
Community Level Factor: Community Type (reference:Integrated Community)						
Homogeneous Community	0.736	0.396~1.366	0.937	0.507~1.733	0.635	0.346~1.165
Transitional communities	1.001	0.535~1.871	1.789	0.934~3.426	0.675	0.365~1.246
Heterogeneous Community	0.287[a]	0.153~0.538	0.654	0.353~1.210	0.382[a]	0.205~.0710

Notes: [a] indicates P<0.05, [b] indicates P<0.01.

Table 6
Significance analysis of differences in health education needs among different types of communities.

Community Pair Comparison	Natural Environmental Pollution Prevention	Cardiovascular Disease Prevention	Diabetes Prevention	Infectious Disease Prevention	First Aid Knowledge	Life Safety
Homogeneous Community vs. Transitional Community	0.006[c]	0.926	0.616	0.573	0.220	0.642
Homogeneous Community vs. Heterogeneous Community	0.028[b]	0.612	0.750	0.028	0.638	0.573
Homogeneous Community vs. Integrated Community	0.186	0.498	0.344	0.640	0.834	0.472
Transitional Community vs. Heterogeneous Community	0.360	0.356	0.145	0.005	0.018	0.375
Transitional Community vs. Integrated Community	0.030[a]	0.685	0.481	0.755	0.280	0.538
Heterogeneous Community vs. Mixed Community	0.486	0.030[b]	0.024[b]	0.006	0.678	0.024[c]

Notes: [a] indicates P<0.05, [b] indicates P<0.01, [c] indicates P<0.001.

For cardiovascular disease and diabetes prevention education, system-based communities showed a higher demand than heterogeneous communities, with medians of 5 and 4 compared to 4 for both topics. In infectious disease prevention education, heterogeneous communities ($4^{3,5}$) reported lower demand compared to both system-based ($5^{4,5}$) and transformed communities ($5^{4,5}$). In first aid knowledge education, demand in heterogeneous communities ($4^{4,5}$) was significantly lower than in transformed communities ($5^{4,5}$). Finally, for life safety education, heterogeneous communities ($4^{3,5}$) showed a significantly lower demand than system-based communities ($4^{4,5}$).

Discussion

This study integrates insights from macro-level policy documents and micro-level resident interviews to identify eight primary themes and 23 specific items for community health education. By analyzing differences in health education needs across four types of communities—homogeneous, heterogeneous, system-based, and transformed—this research clarifies potential causes for these variations and suggests targeted strategies for community health education.

Factors Influencing Differences in Health Education Demands

Residents demonstrated a strong demand for education on safety and emergency health and major disease prevention and treatment, consistent with findings from HE's study on health education needs in Sichuan Province.[16] This pronounced interest likely stems from the close connection between these themes and essential physical health, aligning with the basic physiological and safety needs outlined in Maslow's hierarchy.[17] Residents may thus prioritize health education that promotes personal safety and well-being.

Within disease prevention themes, cancer prevention education showed the highest demand. According to the National Cancer Center, approximately 4.82 million new cancer cases were reported in China in 2022.[18] This high incidence has intensified public concern and interest in cancer prevention and treatment knowledge. Additionally, awareness among Zhejiang residents about the concept that "cancer is preventable" remains relatively low, potentially increasing demand for cancer prevention education.[19]

Factors Contributing to Differences in Health Education Needs Across Communities

Significant differences in demand for health education topics emerged among residents of different community types, particularly regarding environmental health. For education on natural environmental

pollution prevention, demand varied widely across communities. Residents in transformed communities displayed a lower need for this education than those in homogeneous and system-based communities, while residents in heterogeneous communities also exhibited less demand than those in homogeneous communities.

This variation may be rooted in cultural and value differences among communities. For instance, some residents in transformed communities continue to observe rural traditions, engaging in activities like cultivating vegetables in shared green spaces. Such practices not only affect the community environment but also reflect limited awareness of the connection between environmental health and personal well-being, potentially diminishing demand for formal environmental education. CHENG's analysis of CGSS data similarly indicates that urban residents tend to score higher than rural residents on environmentally conscious behaviors.[20]

Conversely, residents of homogeneous and system-based communities expressed a higher demand for environmental health education, potentially due to limited community space, insufficient greenery, and suboptimal sanitary conditions. In older communities undergoing renovation, the tension between infrastructure needs and ecological space becomes particularly pronounced, amplifying resident demand for enhanced greenery and sanitation standards.[21] The lack of environmental quality has begun to affect residents' quality of life. As one resident commented, "Our neighborhood is quite old, and as part of redevelopment, much of the greenery has been replaced by parking spaces. But I believe greenery is important, along with environmental sanitation; I think residents need to be educated on how to maintain the environment" (P004).

In contrast, lower demand for environmental education in heterogeneous communities may result from already high greenery and environmental quality in these areas, diminishing the perceived need for additional education on environmental pollution prevention.

Significant differences in demand for education on major disease prevention were observed among different community types, particularly for cardiovascular disease, diabetes, and infectious disease prevention education. Residents in system-based communities expressed a generally higher demand for these types of education than those in heterogeneous communities, while transformed communities reported greater demand for infectious disease prevention compared to heterogeneous communities.

This discrepancy may be attributed to differences in access to healthcare resources. Heterogeneous communities, often benefiting from targeted local government investments, have access to more public resources and health services.[22] This availability facilitates resident engagement in health-related services and frequent educational activities, potentially lowering their perceived need for additional health education. In contrast, residents in system-based and transformed communities, which are in earlier stages of urbanization, face relatively limited access to health resources.[23] Interview data further confirmed this disparity: half of the respondents from integrated communities and one-third from transitional communities reported a lack of disease prevention education activities, whereas no such shortages were reported by residents of heterogeneous communities. As WANG noted, unequal distribution of health resources and services can heighten demand for major disease prevention education among certain community groups.[24]

Furthermore, logistic regression model analysis revealed that higher-income groups have a lower demand for cardiovascular and infectious disease prevention education. In this study, 67.6 % of residents in heterogeneous communities reported annual incomes exceeding 100,000 CNY, the highest proportion among the four community types. This supports the observation that higher-income groups within these communities show reduced demand for cardiovascular and infectious disease pervention education.

Education attainment also significantly influenced the demand for diabetes prevention education. Residents with a middle school education or lower expressed a higher demand for diabetes prevention education compared to those with a graduate degree or higher. Some residents indicated a preference for educational programs tailored to individuals with lower education attainment. As one resident expressed, "I didn't finish middle school, so I hope the community can offer more simplified information, like for my diabetes, such as explaining how to use and read a blood glucose meter and adjust my diet" (P001). Supporting studies show that chronic disease prevention literacy improves with higher education attainment,[25] which may in turn reduce demand for such education.

Factors Influencing Differentiated Demand for Health Education in Safety and Emergency Education

Significant demand differences were observed between heterogeneous and transformed communities for emergency response education, with transformed community residents demonstrating a notably higher need. This heightened demand may stem from the fact that these communities consist largely of residents recently relocated from rural areas to urban environments, where they are still adapting to city life and may have limited experience with emergency response skills.[26,27] As one resident expressed, "I'm particularly concerned about knowing how to administer first aid in emergencies. Although such events are rare, they are extremely urgent when they do occur" (P001). In comparison, heterogeneous communities—typically newer residential areas—often provide safer, more regulated living environments, which may result in fewer emergency situations.[28]

Additionally, the extent of community health education initiatives impacts residents' familiarity with emergency response knowledge. Interview data showed that over half of the respondents in heterogeneous communities reported participating in health lectures focused on emergency topics, suggesting that this exposure has contributed to higher public awareness and thus lower demand for further education in this area. By contrast, fewer than one-quarter of respondents in transformed communities reported similar events in their locales.

A significant discrepancy in demand for life safety education was also observed between system-based and heterogeneous communities, with system-based community residents reporting higher needs. System-based communities, often located in suburban or semi-rural areas, tend to face greater safety risks, such as aging infrastructure and unaddressed maintenance issues.[29] As one resident noted, "There's a river in front of our house with no guardrails, and a few accidents have happened there. I think it's important to educate residents on safety measures and how to implement preventative steps" (P003).

Logistic regression model analysis further suggests that differences in demand for life safety education may also relate to education attainment. Residents with a middle school education attainment or lower exhibited higher demand for life safety education compared to those with graduate-level education. This pattern may reflect the greater ability of individuals with higher education attainment to comprehend health information.[22] Given that heterogeneous communities are often inhabited by middle- and upper-class residents, who generally have higher education attainment, their residents tend to exhibit higher safety awareness and knowledge than those in other community types.

Recommendations for Optimizing Community Health Education Strategies

(1) Ensure Credibility of Health Education Content

With the rapid growth of digital media, health information sources have become increasingly varied. However, this expansion introduces challenges in ensuring consistent information quality, as residents tend to trust authoritative sources. As one resident noted, "Compared to social media posts, I prefer reading content from professional and reputable institutions" (P012). Communities can address this by collaborating with local hospitals, disease control centers, and universities to establish a comprehensive, reliable health education database that is scientifically accurate and current.[30,31] Additionally, as digital platforms have become essential for health education dissemination, incorporating digital tools into health education—such as short videos, VR, and AR—can make complex health concepts more accessible and engaging. Digital formats allow health knowledge to be presented through interactive,

immersive experiences, enhancing the appeal and reach of educational content.[32,33]

(2) Promote Equitable Distribution of Health Resources

Transformed and system-based communities, particularly those located on the outskirts of urban areas, typically face limitations in health resources compared to centrally located communities. To address these disparities, existing health resources within these communities should be optimized and supplemented by external professional resources. Partnerships with local healthcare facilities can expand the scope of health education activities, encouraging greater community engagement and helping to bridge resource gaps. This approach can reduce health disparities between community types, making health resources more accessible and balanced across different areas.[24]

(3) Implement Tailored Educational Content

Effective community health education should be customized based on each community's unique needs. By analyzing common characteristics across communities as well as individual resident differences, communities can develop targeted health education content that addresses shared needs while remaining responsive to specific demands. For instance, given the high demand for infectious disease prevention education in system-based communities, this topic could serve as a central focus. Educational materials should be segmented to comprehensively address all aspects of disease prevention, including basic knowledge, risk factors, and preventive strategies. This targeted approach would ensure that educational content is both relevant and comprehensive, increasing its impact and utility across diverse community settings.

Summary

This study explored health education needs and variations among residents across different community types, identifying significant demands for education on major disease prevention and safety and emergency education. Notably, variations in demand for environmental health, major disease prevention, and safety and emergency education were observed across communities. These differences are influenced by factors such as residents' education attainment, income levels, and community health resources, as well as geographic location. Based on these findings, it is recommended that communities customize health education strategies to align with their specific characteristics and residents' diverse needs. Ensuring both authoritative and comprehensive health education content while optimizing the distribution of educational resources is essential.

The research findings provide empirical data for community health education efforts. However, due to time, manpower, and space limitations, the survey was only conducted among residents of Xiaoshan District, Hangzhou. Future studies could expand the sample area to include multiple regions for comparative research, which would enhance the generalizability of the conclusions. Additionally, the study focused on a holistic analysis of health education content for residents from different types of communities. Future research could further explore the educational needs of specific groups, such as the elderly and patients with chronic diseases, as well as the applicability of various forms of health education. This would aim to offer more comprehensive guidance for community health education practices.

Declarations

Not applicable.

Ethical approval and consent to participate

The entire interview was recorded, strictly adhering to the ethical principles of informed consent, privacy confidentiality, and non-maleficence.

Consent for publication

Not applicable.

Availability of data and materials

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