Risk Management and Healthcare Policy

Dovepress
Taylor & Francis Group

Open Access Full Text Article

ORIGINAL RESEARCH

Health Risks Among Rural Aging Populations in China: A Cross-Sectional Study of Knowledge, Attitudes, and Practices in Chronic Disease Management

Wusi Zhou[1,2], Shishi Jin[3], Feiwei Shen[2], Xiangjing Zhang[3]

[1]Fudan Institute on Ageing, Fudan University, Shanghai, 200437, People's Republic of China; [2]Institute for Chinese Path to Modernization, Hangzhou Normal University, Hangzhou, 311121, People's Republic of China; [3]School of Public Administration, Hangzhou Normal University, Hangzhou, People's Republic of China

Correspondence: Xiangjing Zhang, Email 20030117@hznu.edu.cn

Background: Chronic diseases are a leading cause of morbidity and mortality worldwide, creating significant health risks and adding strain to healthcare systems, particularly within rapidly aging societies. Rural older adults are especially vulnerable due to limited healthcare resources, lower socioeconomic status, and weaker support networks. Guided by the Knowledge, Attitude, and Practice (KAP) framework, this study aims to investigate chronic disease management behaviors among older patients in rural China and identify factors shaping their KAP dimensions to inform risk-responsive interventions.

Methods: A cross-sectional survey was conducted with 1320 older adults with chronic conditions across three rural regions in Zhejiang Province. Descriptive analyses were used to assess demographic characteristics, health status, daily health-related behaviors and social support structures, while multinomial logistic regression models identified different predictors significantly associated with the KAP dimensions.

Results: Overall, participants demonstrated relatively low levels across KAP dimensions, showing a pattern of attitude > practice > knowledge, with notable discrepancies among the three dimensions. Although attitudes toward chronic disease management were generally positive, deficiencies in health knowledge and proactive practices persisted. Lower educational attainment and poorer healthcare policy awareness were significantly associated with lower knowledge levels. Inactive medical care-seeking and irregular exercise habits were both associated with higher levels of indifference. For practices, respondents with weak neighborhood interactions or lack of routine health monitoring were significantly less likely to engage in proactive health behaviors, while those with minor psychological distress and low family support showed markedly greater engagement in village-level care.

Conclusion: These findings highlight the need for context-sensitive policy interventions to mitigate health risks among rural aging populations. Expanding insurance coverage, strengthening health literacy, and enhancing access to community-based and family-centred support could help improve chronic disease management. Moreover, sustained health education and regular screenings should be prioritized to close gaps between knowledge and practice in chronic disease management.

Keywords: health management, rural areas, older adults, chronic conditions, healthcare policy

Introduction

Advancements in medical technology and improvements in living standards have significantly increased global life expectancy. According to the World Population Prospects 2024,[1] average life expectancy is projected to exceed 77 years in most regions worldwide by 2054. This demographic transition is particularly evident in China, which is experiencing population aging. By the end of 2023, individuals aged 60 and above accounted for 21.1% of the total population, placing the country among the fastest-aging nations worldwide.[2] While increased longevity represents social progress, it simultaneously heightens vulnerability to age-related health risks, particularly chronic diseases. The World Health

Received: 18 October 2025
Accepted: 5 January 2026
Published: 14 January 2026

Organization (WHO) defines healthy aging as the process of developing and maintaining the functional ability that enables well-being in older age.[3] It depends on the dynamic interaction between individuals' intrinsic capacity and their physical, social, and policy environments. Aging is associated with declines immune function and physical resilience. These changes contribute to an increased prevalence of chronic diseases.[4] Mitchell et al[5] reported significant decreases in blood cell counts after age 70, which heighten susceptibility to illnesses and complications. Similarly, Franceschi et al[6] identified a robust correlation between aging and the onset of chronic diseases. According to the National Council on Aging, approximately 95% of older adults suffered from at least one chronic disease, while around 80% lived with two or more.[7] Beyond age itself, demographic factors such as gender, educational attainment, and genetic susceptibility play important roles in shaping chronic disease prevalence.[8] Health literacy is another critical determinant of chronic disease outcomes. Low health literacy often leads to inadequate disease knowledge, poor medication adherence and ineffective self-management, which in turn exacerbate health risks.[9] Unhealthy lifestyle behaviors, including smoking, sedentary activity, and poor dietary patterns, further elevate risks of obesity, diabetes, and cardiovascular diseases.[10,11] Regular physical activity is a fundamental non-pharmacological strategy to prevent and improve cardiovascular problems among older adults. Beyond its physiological benefits, exercise contributes to psychological well-being, functional autonomy, and overall quality of life.[12] Therefore, promoting physical activity tailored to individual capacities is essential for supporting active, healthy, and participatory aging.

In addition to biological and behavioral factors, social factors strongly shape chronic disease outcomes. Family support offers essential emotional and practical assistance for older individuals with mobility or health limitations.[13] Broader social networks, including friends, neighbors, and community resources, have also been shown to reduce chronic disease risks and improve well-being.[14] Therefore, it is crucial to design exercise promotion programs that consider sociodemographic differences, by adapting interventions to the characteristics, interests, and resources of each group, in order to promote active, equitable, and inclusive aging and foster health among older adults.[15] Chronic diseases profoundly affect social functioning and independence. Difficulties in performing activities of daily living increase disability severity[16] and compromise both quality of life and autonomy.[17] As a result, many older adults become increasingly dependent on home-based services, institutional care, or long-term care arrangements.[18,19] This rising dependency imposes substantial financial and operational pressures on healthcare systems. Rodrigues et al[20] found that patients with multiple chronic conditions required more frequent outpatient visits and hospital admissions. In the United States (US), chronic disease management costs exceed $1 trillion annually.[21] Although these figures are international, they reflect the broader and universal economic impact of multimorbidity.

Despite nationwide improvements in health outcomes, substantial disparities persist between rural and urban areas in China. Rural residents exhibit higher rates of hypertension, diabetes, and disability than their urban counterparts.[22] They also face poorer access to healthcare, delays in treatment-seeking, and lower utilization of preventive services. Compounding these issues, rural older adults generally have lower health literacy due to limited education, restricted access to health information, and digital exclusion. These disparities underscore the need to prioritize chronic disease management in rural settings. China has introduced a range of policies to strengthen chronic disease management at the primary care level. Key initiatives include *the Guidelines for Prevention and Treatment of Chronic Diseases in China (2017–2025), the 14th Five-Year Plan for National Health (2021–2025), and the Guiding Opinions of Strengthening Primary-Level Chronic Disease Health Management Services (2025)*. These frameworks aim to enhance comprehensive chronic disease health management, improve health literacy, and promote healthy behaviors among both urban and rural community residents. However, the effectiveness of these initiatives depends fundamentally on individuals' knowledge, attitudes, and self-management practices.

Globally, various chronic disease management strategies, such as the US Chronic Care Model and the WHO's Innovative Care for Chronic Conditions Framework, emphasize proactive and preventive care, patient engagement, and integrated support systems involving governments, communities, families, and patients.[23,24] They underscore the necessity of transitioning from reactive to proactive care by improving health-related knowledge, developing positive attitudes, and promoting healthy behaviors.[25] Preventive behaviors are significantly influenced by individuals' knowledge and attitudes,[26,27] whereas negative attitudes can hinder effective self-management.[28] These insights align with the Knowledge, Attitude, and Practice (KAP) model, developed by Custer in the 1960s, which conceptualizes health behavior adoption as a progression from knowledge acquisition to attitude formation and ultimately to practice.[29] This model provides a valuable framework for

identifying gaps between what individuals know, how they feel, and what they do regarding disease management. For example, Long et al[30] found that KAP-based interventions improved health awareness and self-care behaviors among hypertensive patients. Xu et al[31] showed that a 3H nursing model, combining health guidance, psychological support and lifestyle interventions, improved disease management among patients with chronic obstructive pulmonary disease and depression.

Given the established relevance of the KAP model in understanding health behaviors, examining its applicability among rural older adults in China becomes essential. Rural populations face a unique combination of high chronic disease burden, limited healthcare access, and low health literacy.[32] However, little is known about how rural older adults in China understand, perceive, and act upon chronic disease management. There is a lack of evidence on baseline KAP levels and the determinants shaping these behaviors. To bridge this gap, this study conducted a cross-sectional survey across three rural regions in Zhejiang Province, China. Specifically, this research aims to answer the key research questions: (i) What are the current levels of KAP regarding chronic disease management among rural older adults? (ii) What factors significantly influence these KAP dimensions? Ultimately, this study seeks to provide empirical evidence to inform targeted public health interventions aimed at improving chronic disease management among rural aging populations.

Methods

Study Design and Setting

A cross-sectional design was selected to capture a snapshot of KAP levels and their associated determinants among older adults living in rural settings. The survey was carried out across three rural areas in Zhejiang Province: TX Village in Lishui City, SF Village in Ningbo City, and HW Village in Jinhua City. TX, SF, and HW are anonymized abbreviations for the study sites, and the selection of these villages was guided by three primary considerations. First, Zhejiang Province represents one of the earliest and most rapidly aging regions in China, making it an appropriate setting for examining health risks associated with population aging.[33] The selected villages also reflect varying levels of population aging, allowing for comparative analyses. As of 2024, the aging rates were 20.8% in TX Village, 18.5% in SF Village, and 21.4% in HW Village. Second, each village has made notable advancements in chronic disease management and elderly care service infrastructure. TX Village operates a three-star home-based elderly care center that provides comprehensive healthcare and support services. SF Village runs a specialized elderly care facility, while HW Village has established a public elderly care institution that integrates artificial intelligence technologies to enhance service quality. Third, support from local administrative authorities facilitated efficient coordination and reliable data collection. Health authorities assisted in identifying and recruiting older residents, ensuring broad participation and high-quality survey responses.[34]

Sampling and Participants

A census-based approach was used, including all eligible older adults within the selected villages. Participants were required to meet the following inclusion criteria: (i) aged 60 years or older; (ii) diagnosed with at least one chronic disease; (iii) cognitively capable and physically able to complete the questionnaire; and (iv) residing locally for at least six months. Eligible individuals were first identified through village registration lists and then supplemented by using a snowball sampling method to minimize omissions resulting from delays in updating official records.

Before data collection, ethical approval was obtained from the Research Committee of the School of Public Administration (No. 2025000015). All procedures adhered to the ethical principles of the Declaration of Helsinki and relevant institutional guidelines. Informed consent was obtained from all participants after they received a clear explanation of the study's purpose, procedures, confidentiality measures, and the voluntary nature of participation. Participants were explicitly informed of their right to withdraw at any time. All data were anonymized and securely stored to protect participants' privacy and confidentiality.

Data Collection Procedures

The questionnaire was developed based on previous KAP instruments used in chronic disease studies and adapted to the rural Chinese context. Prior to the main survey, a pilot test was conducted with 30 older adults from a different administrative

village to validate the clarity, relevance, and appropriateness of the questionnaire. Feedback from the pilot led to minor revisions in wording and structure to improve comprehension. The finalized instrument contained 35 items, covering demographic characteristics, health status, health-related behaviors, and social support. Demographic characteristics captured essential background information; health status assessed overall physical and mental conditions; health-related behaviors examined key lifestyle and self-management practices such as care–seeking, diet, exercise and health monitoring; and social support measured the availability and quality of assistance from family, neighborhood and village sources.

To maximize the response rate and data quality, face-to-face interviews were conducted between July 2023 and February 2024. Trained voluntary workers read the questionnaire items aloud to older participants and provided assistance when needed to ensure accurate understanding and responses. A total of 1320 older respondents were invited to village service centres, where trained volunteers administered the questionnaire. Given that the study population was clearly defined and geographically bounded, administering the survey on-site was appropriate and helped ensure comprehensive coverage. After excluding questionnaires with substantial missing data or inconsistent responses, 1170 valid questionnaires were retained, achieving an effective response rate of 89.1%, as shown in Table 1.

To assess the construct validity of the final survey instrument, an exploratory factor analysis was performed. Preliminary diagnostics confirmed that the data satisfied the preconditions for factor analysis. The KMO measure of sampling adequacy was 0.701, and Bartlett's test of sphericity produced an approximate chi-square value of 2511.265 ($P < 0.001$), indicating adequate inter-item correlations (KMO > 0.7, $P < 0.05$). Factor extraction yielded four factors with eigenvalues greater than 1, corresponding to the four conceptual dimensions of the independent variables. The cumulative variance contribution rate of these factors reached 60.76%, demonstrating good explanatory power and internal coherence. No cross-loadings were observed, each variable had a factor loading exceeding 0.40 on only one component, with no variable loading above 0.40 across multiple components. This confirms a clear and stable factor structure, supporting the structural validity of the questionnaire.

Measures

Dependent Variables

Each KAP dimension was operationalized using categorical response options that were recoded for analysis. For knowledge, the response "fully aware" was coded as 3 and used as the reference category, while "somewhat aware" and "completely unaware" were coded as 2 and 1, respectively. For attitude, "attach great importance" was coded as 3 (reference category), whereas "preventive intention" and "indifference" were coded as 2 and 1. For practice, "regular doctor visits" was coded as 3 (reference category), while "attend village check-ups" and "take no action" were coded as 2 and 1.

Independent Variables

Independent variables were measured using four dimensions, each represented by specific indicators coded for analysis. Demographic characteristics, reflecting the basic personal and socioeconomic background of older adults, included gender (0 = female, 1 = male), age (1 = 60–69, 2 = 70–79, 3 = ≥80), marital status (0 = not currently married, 1 = currently married), educational attainment (1 = primary school and below, 2 = middle school, 3 = high school and above),

Table 1 Distribution of Survey Samples and Valid Responses Across the Three Study Villages (Zhejiang Province, China)

Villages	Survey Samples		Valid Samples	
	Number	Percentage	Number	Percentage
TX	457	34.6%	443	37.9%
SF	472	35.8%	400	34.2%
HW	391	29.6%	327	27.9%
Total	1320	100%	1170	100%

Note: Valid samples exclude incomplete or inconsistent questionnaires.

economic condition (1 = very poor, 2 = barely sufficient, 3 = well-off), and awareness of healthcare policies (1 = poor, 2 = moderate, 3 = good).

Health status, capturing physical and psychological health conditions, was assessed using self-rated health (1 = unhealthy, 2 = relatively healthy, 3 = healthy), comorbidity status (0 = no comorbidity, 1 = at least one comorbidity), illness duration (1 = ≤3 years, 2 = 4–9 years, 3 = ≥10 years), and the psychological impact of chronic disease (1 = minor, 2 = moderate, 3 = major).

Health-related behaviors, representing daily actions relevant to chronic disease prevention and management, were measured using four binary variables: medical care–seeking behavior, unhealthy dietary habits, exercise habits, and health monitoring behavior (each coded as 1 = yes, 0 = no).

Social support, reflecting interpersonal and community-level support resources, included family support (1 = low, 2 = moderate, 3 = strong), neighborhood interaction (1 = rarely, 2 = sometimes, 3 = often), and awareness of village chronic disease education and village rehabilitation services (each coded as 1 = yes, 0 = no).

Statistical Analyses

Descriptive statistics were initially computed to summarize participants' demographic characteristics and provide an overview of patterns across the KAP dimensions related to chronic disease management. Given that the dependent variables of knowledge, attitude and practice were categorical with more than two unordered levels, multinomial logistic regression was chosen to examine the associations between the independent variables and each KAP outcome. All statistical analyses were performed using SPSS Statistics version 26.0 (IBM Corp., Armonk, NY, USA). Accordingly, the regression analysis identified factors influencing each KAP dimension as follows:

$$\text{Logit}\left(\frac{P_1}{P_3}\right)=\alpha_1+\sum_{i=1}^{n}\beta_{1k}\,x_k$$

$$\text{Logit}\left(\frac{P_2}{P_3}\right)=\alpha_2+\sum_{i=1}^{n}\beta_{2k}\,x_k$$

Let P1, P2 and P3 denote the probabilities of an individual falling into different categories of knowledge, attitude, and practice, respectively. In the multinomial logit model, α_i represents the intercept term, x_k denotes the vector of explanatory variables, and β_{jk} is the corresponding vector of regression coefficients. A positive coefficient ($\beta_{jk} > 0$; odds ratio/OR > 1) suggests a reduced probability of an older adult being categorized in the lower KAP levels ("somewhat aware" or "completely unaware" in knowledge, "preventive intention" or "indifference" in attitude, and "attend village check-ups" or "take no action" in practice) relative to the highest reference category. Conversely, a negative coefficient indicates a greater likelihood of classification in these lower-level categories. Since each KAP dimension was analyzed independently, six multinomial regression models were estimated to explore all category comparisons comprehensively within each dimension. To address potential endogeneity and multicollinearity among variables, diagnostic tests were performed by using tolerance and the Variance Inflation Factor (VIF). A tolerance value below 0.1 or a VIF exceeding 5 was considered indicative of problematic multicollinearity. In this study, all explanatory variables exhibited tolerance values greater than 0.5 and VIF values below 2.0 across the models, confirming that no significant multicollinearity existed. These analytical procedures enabled the identification of key demographic, behavioral, and social predictors associated with KAP dimensions among rural older adults.

Results

Table 2 summarizes the descriptive statistics for both dependent and independent variables. Among the KAP dimensions related to chronic disease management, attitudes ranked highest, followed by practices, while knowledge scored lowest. Of the 1170 rural older individuals surveyed, only 7.8% reported being fully aware of chronic diseases, while 41.9% had partial awareness, and 50.3% were completely unaware. Regarding attitudes, 52.4% attached great importance to manage their conditions, 30.0% expressed preventive intentions, and 17.6% showed indifference. In terms of practices, 33.4% visited a doctor regularly, 53.0% relied on occasional village check-ups, and 13.6% took no health-related actions.

Table 2 Descriptive Statistics of Dependent and Independent Variables

Variables	Percentage (%)	Mean	SD	Min	Max
Dependent Variables					
Knowledge		1.57	0.633	1	3
1=completely unaware	50.3				
2=somewhat aware	41.9				
3=fully aware	7.8				
Attitude		2.35	0.761	1	3
1=indifference	17.6				
2=preventive intention	30.0				
3=attach great importance	52.4				
Practice		2.20	0.657	1	3
1=take no action	13.6				
2=attend village check-ups	53.0				
3=regular doctor visits	33.4				
Independent Variables					
Demographic characteristics					
Gender		0.42	0.494	0	1
0 = female	57.7				
1 = male	42.3				
Age		1.71	0.704	1	3
1 = 60-69	43.8				
2 = 70-79	41.8				
3 = ≥80	14.4				
Marital status		0.77	0.419	0	1
0 = not currently married	22.7				
1 = currently married	77.3				
Educational attainment		1.31	0.560	1	3
1 = primary school and below	73.8				
2 = middle school	21.3				
3 = high school and above	5.0				
Economic condition		1.56	0.642	1	3
1 = very poor	52.1				
2 = barely sufficient	39.7				
3 = well-off	8.3				
Awareness of healthcare policy		1.79	0.677	1	3
1 = poor	35.3				
2 = moderate	50.0				
3 = good	14.7				
Health status					
Self-assessed health status		2.01	0.816	1	3
1 = unhealthy	32.6				
2 = relatively healthy	33.5				
3 = healthy	33.8				
Comorbidity status		0.55	0.498	0	1
0 = no	45.3				
1 = yes	54.7				
Illness duration		2.01	0.790	1	3
1 = ≤3 years	30.5				
2 = 4–9 years	37.7				
3 = ≥10years	31.8				

(*Continued*)

Table 2 (Continued).

Variables	Percentage (%)	Mean	SD	Min	Max
Psychological impact of chronic disease		2.03	0.856	1	3
1 = minor	35.4				
2 = moderate	26.7				
3 = major	37.9				
Health-related behaviours					
Medical care-seeking behaviour		0.67	0.470	0	1
0 = no	33.0				
1 = yes	67.0				
Unhealthy dietary habits		0.38	0.485	0	1
0 = no	62.1				
1 = yes	37.9				
Exercise habits		0.45	0.498	0	1
0 = no	55.0				
1 = yes	45.0				
Health monitoring behaviour		0.48	0.500	0	1
0 = no	52.1				
1 = yes	47.9				
Social Support					
Family support		2.04	0.796	1	3
1 = low	29.9				
2 = moderate	36.6				
3 = strong	33.5				
Neighborhood interaction		1.74	0.734	1	3
1 = rarely	43.3				
2 = sometimes	39.4				
3 = often	17.3				
Village chronic disease education		0.37	0.484	0	1
0 = no	62.6				
1 = yes	37.4				
Village rehabilitation services		0.20	0.402	0	1
0 = no	79.7				
1 = yes	20.3				

Regarding independent variables, females represented 57.7% of the sample, and 56.2% of respondents were aged 70 years or older, while 77.3% were currently married. Educational attainment was notably low, with 95.1% having completed primary education or less. Economically, more than half (52.1%) described their financial situation as very poor, while only 8.3% reported being well-off. Awareness of healthcare policies was generally limited; merely 14.7% of participants demonstrated good understanding, whereas 35.3% reported poor awareness. Self-rated health status was evenly distributed across the three categories, but a majority (54.7%) reported at least one comorbidity, and 31.8% had been living with their chronic condition for more than ten years. Psychological burden varied, with 37.9% experiencing a major impact, 26.7% moderate impact, and 35.4% minor impact. Concerning health-related behaviors, 67.0% sought medical care when feeling unwell. However, 37.9% reported unhealthy dietary habits and 55.0% did not engage in regular exercise. Less than half (47.9%) used home health-monitoring devices. In terms of social support, 33.5% reported strong family support, while 29.9% indicated a lack of such support. Neighborhood interactions were generally weak, with 43.3% rarely engaging with neighbors and only 17.3% interacting frequently. Finally, although village health centers offered basic services, only 37.4% of respondents received chronic disease education, and just 20.3% had access to rehabilitation services.

Table 3 illustrates the regression results for factors influencing respondents' knowledge levels regarding chronic disease management. M1 and M2 show the likelihood of being completely unaware or somewhat aware of chronic disease management compared against the reference category of "fully aware". The results reveal that differences in education, economic status, policy literacy, psychological adjustment, and family or community support significantly affected how well older adults understand chronic disease management concepts. Educational attainment showed a strong association with knowledge levels. Respondents with primary education or below were 6.060 times more likely to exhibit limited knowledge than those with high school education or above. Economic vulnerability further amplified disparities in health knowledge. Participants in very poor economic conditions exhibited markedly lower awareness compared with their well-off peers. Those with poor understanding of healthcare policies had almost 12-fold higher odds of limited knowledge (OR = 11.930, $P < 0.001$).

Self-assessed health status did not significantly predict knowledge, but psychological well-being did. Respondents experiencing a moderate psychological impact from chronic illness exhibited lower knowledge levels (OR = 0.424, $P < 0.01$). Individuals

Table 3 Regression Results on Factors Influencing Knowledge Towards Chronic Disease Management

Variables	M1				M2			
	B	exp (B)	95%		B	exp (B)	95%	
			Lower	Upper			Lower	Upper
Demographic Characteristics								
Educational attainment (High School and above)								
Primary school and below	1.802	6.060***	2.227	16.493	0.851	2.343	0.953	5.763
Middle school	1.108	3.029*	1.059	8.663	0.726	2.067	0.812	5.258
Economic situation (Well-off)								
Very poor	1.417	4.124**	1.450	11.729	0.029	1.030	0.400	2.649
Barely sufficient	0.491	1.635	0.610	4.380	−0.489	0.613	0.251	1.498
Awareness of healthcare policy (Good)								
Poor	2.479	11.930***	5.567	25.566	1.294	3.647***	1.787	7.446
Moderate	1.672	5.321***	2.814	10.062	0.798	2.220**	1.245	3.959
Health Status								
Self-assessed health (Healthy)								
Unhealthy	−0.207	0.813	0.353	1.872	0.114	1.120	0.497	2.528
Relatively healthy	−0.007	0.993	0.477	2.068	0.166	1.180	0.573	2.431
Psychological impact of chronic disease (Major)								
Minor	0.207	1.230	0.499	3.030	−0.109	0.896	0.372	2.163
Moderate	−0.511	0.600	0.307	1.172	−0.857	0.424**	0.222	0.812
Health-related Behaviours								
Medical care-seeking behaviours (Yes)	0.678	1.969	1.122	3.457	0.217	1.243	0.716	2.157
Social Support								
Family support (Strong)								
Low	−2.246	0.106***	0.048	0.233	−1.832	0.160***	0.074	0.345
Moderate	−0.397	0.672	0.301	1.499	−0.611	0.543	0.245	1.201
Neighbourhood interaction (Often)								
Low	0.429	1.536	0.740	3.190	0.019	1.019	0.506	2.054
Sometimes	0.023	1.024	0.529	1.979	0.059	1.061	0.571	1.970
Village chronic disease education (Yes)	−0.020	0.980	0.520	1.847	−0.286	0.751	0.408	1.383
Village rehabilitation services (Yes)	1.371	3.941***	2.100	7.396	1.215	3.370***	1.855	6.124
Intercept	−2.236				0.946			
Sample size	1170							
Nagelkerke R^2	0.285							

Notes: Values in parentheses represent the reference group; *, **, and *** indicate statistical significance at the 5%, 1%, and 0.1% levels, respectively.

receiving lower levels of family support were substantially less likely to possess even some knowledge about disease management (OR = 0.160, $P < 0.001$). A lack of village rehabilitation services significantly increased the likelihood of being completely unaware of chronic disease management (OR = 3.941, $P < 0.001$).

Table 4 presents the regression results for factors influencing respondents' attitudes toward chronic disease management. M3 and M4 identify significant predictors of indifference or preventive intention compared with respondents who attached great importance to chronic disease management. Respondents with poor awareness of healthcare policies had higher odds of being indifferent (OR = 3.258, $P < 0.001$) or having preventive intention (OR = 3.424, $P < 0.001$) toward

Table 4 Regression Results on Factors Influencing Attitudes Towards Chronic Disease Management

Variables	M3				M4			
	B	exp (B)	95%		B	exp (B)	95%	
			Lower	Upper			Lower	Upper
Demographic Characteristics								
Age (≥80)								
60-69	−0.128	0.880	0.455	1.700	−0.126	0.882	0.543	1.430
70-79	−0.487	0.615	0.316	1.196	0.055	1.056	0.665	1.677
Marital status (Currently married)	−0.369	0.691	0.421	1.134	−0.009	0.991	0.677	1.449
Educational attainment (High School and above)								
Primary school and below	−0.055	0.946	0.326	2.750	0.640	1.897	0.761	4.726
Middle school	1.002	2.723	0.908	8.168	0.894	2.445	0.939	6.364
Economic situation (Well-off)								
Very poor	0.786	2.194	0.871	5.523	0.585	1.796	0.902	3.575
Barely sufficient	0.464	1.590	0.654	3.867	0.164	1.178	0.617	2.249
Awareness of healthcare policy (Good)								
Poor	1.181	3.258***	1.731	6.132	1.231	3.424***	2.044	5.736
Moderate	0.162	1.176	0.653	2.118	0.298	1.348	0.843	2.154
Health Status								
Self-assessed health (Healthy)								
Unhealthy	0.424	1.528	0.760	3.070	0.124	1.131	0.683	1.876
Relatively healthy	−0.026	0.974	0.529	1.795	−0.024	0.977	0.651	1.466
Comorbidity situation (Yes)	−0.574	0.563*	0.324	0.978	−0.303	0.738	0.506	1.077
Illness duration (≥10 years)								
≤3 years	1.001	2.720**	1.494	4.955	0.359	1.432	0.938	2.186
4-9 years	0.053	1.054	0.647	1.717	0.254	1.289	0.896	1.854
Psychological impact of chronic disease (Major)								
Minor	0.024	1.025	0.491	2.140	−0.084	0.919	0.550	1.537
Moderate	−0.127	0.881	0.497	1.561	0.223	1.250	0.817	1.912
Health-related Behaviours								
Medical care-seeking behaviours (Yes)	1.288	3.627***	2.322	5.664	0.797	2.218***	1.550	3.173
Healthy dietary habits (Yes)	−0.232	0.793	0.508	1.239	−0.873	0.418***	0.298	0.585
Exercise habits (Yes)	1.184	3.268***	2.085	5.122	0.903	2.267***	1.794	3.392
Health monitoring behaviours (Yes)	−0.857	0.425***	0.272	0.662	−0.357	0.700*	0.506	0.967
Social Support								
Family support (Strong)								
Low	2.176	8.811***	4.671	16.620	0.672	1.959**	1.242	3.090
Moderate	0.583	1.791	0.990	3.240	0.456	1.578*	1.108	2.246
Neighbourhood interaction (Often)								
Rarely	−0.632	0.536*	0.297	0.968	−0.602	0.548*	0.332	0.904
Sometimes	−1.092	0.336***	0.192	0.587	−0.867	0.420**	0.257	0.686

(*Continued*)

https://doi.org/10.2147/RMHP.S569629

Table 4 (Continued).

Variables	M3				M4			
	B	exp (B)	95%		B	exp (B)	95%	
			Lower	Upper			Lower	Upper
Village chronic disease education (Yes)	−0.357	0.700	0.406	1.206	−0.264	0.768	0.522	1.129
Village rehabilitation services (Yes)	−0.121	0.886	0.507	1.551	0.615	1.849*	1.149	2.978
Intercept	−2.961				−2.309			
Sample size	1170							
Nagelkerke R^2	0.444							

Notes: Values in parentheses represent the reference group; *, **, and *** indicate statistical significance at the 5%, 1%, and 0.1% levels, respectively.

chronic disease management. Older adults with multiple chronic conditions were significantly less likely to be indifferent (OR = 0.563, $P < 0.05$). In contrast, those with shorter illness duration (≤ 3 years) showed a greater probability of indifference (OR = 2.720, $P < 0.01$).

Inactive medical care-seeking (OR = 3.627, $P < 0.001$) and irregular exercise habits (OR = 3.268, $P < 0.001$) were both associated with higher levels of indifference, but were also associated with an increased likelihood of reporting preventive intention under certain conditions. In contrast, unhealthy dietary habits (OR = 0.418, $P < 0.001$) and lack of health monitoring (OR = 0.700, $P < 0.05$) were linked to lower odds of preventive attitudes. Family support emerge as a strong determinant of attitudes toward chronic disease management. Those with weak family support were substantially more likely to be indifferent (OR = 8.811, $P < 0.001$), while reduced neighborhood interaction was linked to lower odds of both indifference (OR = 0.536, $P < 0.05$) and preventive intention (OR = 0.548, $P < 0.05$). Access to village rehabilitation services significantly increased the likelihood of preventive intention (OR = 1.849, $P < 0.05$), indicating that availability of community-based services can translate into more proactive health attitudes.

Table 5 reports the regression results for factors associated with respondents' practices toward chronic disease management. M5 and M6 estimate the likelihood of taking no action or relying on village check-ups compared with the reference behavior of regular doctor visits. Significant associations were observed across several critical domains,

Table 5 Regression Results on Factors Influencing Practices Toward Chronic Disease Management

Variables	M5				M6			
	B	exp (B)	95%		B	exp (B)	95%	
			Lower	Upper			Lower	Upper
Demographic Characteristics								
Educational attainment (High School and above)								
Primary school and below	−0.012	0.988	0.318	3.075	−0.627	0.534	0.257	1.110
Middle school	0.625	1.869	0.563	6.206	0.290	1.337	0.608	2.940
Economic situation (Well-off)								
Very poor	1.206	3.341*	1.212	9.208	0.251	1.285	0.650	2.541
Barely sufficient	0.578	1.783	0.692	4.590	0.206	1.229	0.667	2.263
Awareness of healthcare policy (Good)								
Poor	0.543	1.721	0.832	3.558	2.131	8.426***	4.726	15.024
Moderate	0.122	1.130	0.633	2.019	0.529	1.698*	1.036	2.781
Health Status								
Self-assessed health (Healthy)								
Unhealthy	−0.989	0.372**	0.177	0.781	0.035	1.036	0.596	1.800
Relatively healthy	−0.868	0.420**	0.234	0.752	0.031	1.031	0.666	1.597

(*Continued*)

Table 5 (Continued).

Variables	M5				M6			
	B	exp (B)	95%		B	exp (B)	95%	
			Lower	Upper			Lower	Upper
Comorbidity situation (Yes)	0.722	2.059**	1.197	3.543	−0.141	0.869	0.580	1.301
Illness duration (≥10 years)								
≤3 years	0.641	1.899*	1.061	3.397	0.660	1.935**	1.239	3.022
4-9 years	0.492	1.636	0.357	2.798	0.013	1.013	0.686	1.286
Psychological impact of chronic disease (Major)								
Minor	1.395	4.037***	1.852	8.797	1.913	6.775***	3.889	11.801
Moderate	1.005	2.733**	1.425	5.243	0.936	2.551***	1.596	4.078
Health-related Behaviours								
Medical care-seeking behaviours (Yes)	1.947	7.009***	4.225	11.627	1.470	4.350***	2.851	6.637
Healthy dietary habits (Yes)	−0.622	0.537*	0.329	0.874	−0.494	0.610*	0.417	0.893
Exercise habits (Yes)	0.949	2.584***	1.610	4.148	0.553	1.738**	1.228	2.461
Health monitoring behaviours (Yes)	−0.373	0.689	0.429	1.107	−0.755	0.470***	0.329	0.670
Social Support								
Family support (Strong)								
Low	1.899	6.677***	3.468	12.856	2.036	7.657***	4.560	12.859
Moderate	0.254	1.289	0.763	2.178	0.613	1.846**	1.270	2.683
Neighbourhood interaction (Often)								
Rarely	−0.782	0.457*	0.212	0.986	−1.639	0.194***	0.106	0.354
Sometimes	−1.005	0.366*	0.169	0.793	−1.030	0.357**	0.198	0.642
Village chronic disease education (Yes)	−0.333	0.717	0.408	1.260	−0.659	0.517**	0.347	0.771
Village rehabilitation services (Yes)	−0.503	0.605	0.322	1.134	−0.195	0.823	0.507	1.334
Intercept	−2.42				−0.317			
Sample size	1170							
Nagelkerke R^2	0.484							

Notes: Values in parentheses represent the reference group; *, **, and *** indicate statistical significance at the 5%, 1%, and 0.1% levels, respectively.

including socioeconomic status, policy awareness, health condition, psychological adjustment, health behaviors, and social support. Economic vulnerability strongly discouraged proactive health management. Respondents in very poor households were far more likely to remain inactive (OR = 3.341, $P < 0.05$). Individuals with limited awareness of healthcare policies tended to rely on village check-ups (OR = 8.426, $P < 0.001$). Participants who reported poorer self-rated healthy (OR = 0.372, $P < 0.01$) or multiple chronic conditions (OR = 2.059, $P < 0.01$) were more motivated to seek regular care, suggesting that both disease complexity and perceived illness severity encourages engagement. By contrast, those with shorter illness duration (≤ 3 years) (OR = 1.899, $P < 0.05$) were less proactive, indicating that early-stage complacency can hinder sustained management. Older adults experiencing a lower psychological burden were more likely to avoid regular doctor visits or professional care (take no action: OR = 4.037, $P < 0.001$; attend village check-ups: ORs = 6.775, $P < 0.001$).

Proactive habits such as general care-seeking (OR = 7.009, $P < 0.001$) or regular exercise (OR = 2.584, $P < 0.001$) sometimes served as substitutes for formal medical visits, implying that informal health practices can replace rather than complement professional care. In contrast, unhealthy dietary habits (OR = 0.610, $P < 0.05$) and lack of home-based health monitoring (OR = 0.470, $P < 0.001$) were linked to lower participation in village check-ups, highlighting the role of self-discipline and daily routines in reinforcing care continuity. Weak family support had significantly higher odds of both inaction (OR = 6.677, $P < 0.001$) and reliance on village check-ups (OR = 7.657, $P < 0.001$). Low neighborhood interactions further reduced the motivation to seek village check-ups (OR = 0.194, $P < 0.001$). Village health education

had a clear protective effect; exposure to community-based chronic disease education notably reduced reliance on village check-ups (OR = 0.517, $P < 0.01$) and promoted formal doctor consultations.

Discussion

Overall, the study reveals that while rural older adults demonstrate generally positive attitudes toward chronic disease management, significant deficits remain in knowledge and practice. Several personal, behavioral, and structural factors collectively contribute to these gaps. From an operational perspective, this indicates a behavioral hierarchy of attitude > practice > knowledge, which indicates that attitudinal change represents the most critical and responsive entry point for optimizing chronic disease management. As shown in Table 6, even among participants who were completely unaware of chronic diseases, 50.4% still reported attaching great importance to their health. This finding suggests that positive attitudes toward health management can emerge independently of comprehensive disease-related knowledge. However, differences in practices across knowledge levels were more pronounced. Individuals with some or full awareness were less likely to take no action (10.2% and 20.9%, respectively) compared with those who were completely unaware (15.3%). Notably, village check-ups constituted the dominant health-seeking behavior across all groups, and the proportion increased with knowledge level from 48.6% among those completely unaware to 57.3% among those somewhat aware and 58.2% among those fully aware. By contrast, regular doctor visits declined as knowledge increased, appearing highest among those completely unaware (36.2%). These patterns underscore that enhanced knowledge does not uniformly translate into more proactive or medically oriented behaviors. Instead, it may reinforce reliance on accessible, low-cost services such as village check-ups. Furthermore, preventive attitudes did not consistently translate into effective health-seeking behaviors. Participants with moderate knowledge, for example, showed substantial concern about chronic disease management (54.3% attaching great importance), but still relied predominantly on passive or opportunistic service use rather than initiating regular doctor visits. Overall, the findings indicate that although many older adults recognized the importance of managing chronic illness, their understanding was fragmented and did not consistently translate into sustainable behavioral engagement. Therefore, knowledge enhancement should serve as a supportive mechanism to consolidate and refine these attitudes, ultimately fostering a stable continuum from awareness to consistent practice in chronic disease management.

Beyond this general trend, the regression analyses provide deeper insight into the structural, psychological, and social mechanisms underlying these disparities. Educational attainment exerted a positive impact on health literacy, echoing global findings that limited schooling restricts the ability to interpret and act upon medical information.[35] Nevertheless, its influence on attitudes and practices remained limited and inconsistent. The weak link between education and practice may reflect the "knowledge-action gap" described in behavioral health models, where awareness does not necessarily translate into sustained behavioral change. Rather, accessible and context-sensitive health education that delivered through village clinics, local networks, and community health workers is needed to ensure comprehension and applicability.[36] In addition, fostering digital inclusion among older populations is increasingly important. Overcoming

Table 6 Crosstabs Between Knowledge, Attitudes, and Practices

	Knowledge		
	Completely Unaware (n=589)	**Somewhat Aware (n=490)**	**Fully Aware (n=91)**
Attitude			
Indifference	94 (16%)	100 (20.4%)	12 (13.2%)
Preventive intention	198 (33.6%)	124 (25.3%)	29 (31.9%)
Attach great importance	297 (50.4%)	266 (54.3%)	50 (54.9%)
Practice			
Take no action	90 (15.3%)	50 (10.2%)	19 (20.9%)
Attend village check-ups	286 (48.6%)	281 (57.3%)	53 (58.2%)
Regular doctor visits	213 (36.2%)	159 (32.4%)	19 (20.9%)

technological barriers could significantly improve access to health information and empower rural older adults to engage in more informed and proactive chronic disease management.[37] Economic status also influenced both knowledge and behaviors. Limited economic resources restrict access to information channels and health education opportunities, and they also serve as a major barrier to proactive chronic disease management, consistent with the findings of Yuan et al[38] and Akalu et al.[39] Healthcare policy awareness emerged as a particularly influential determinant across all KAP dimensions. This highlights that the ability to interpret and apply policy information plays a critical role in empowering older adults to manage chronic conditions effectively. Understanding entitlement policies, reimbursement procedures, and available services empowers individuals to navigate the health system more confidently and facilitates the translation of knowledge into sustained health management practices.[40]

Beyond individual characteristics, health-related factors further shape disease management behaviors, though their influence on knowledge and attitudes appears comparatively limited. Consistent with the health belief model assumptions, those who perceived themselves as less healthy or who had multiple chronic conditions exhibited stronger perceived severity and consequently sought healthcare more actively.[41] However, respondents in the early stages of illness (≤3 years) were less proactive in their health-seeking behaviors. This suggests that early-stage complacency and limited symptom severity may lead individuals to underestimate long-term health risks.[42] The phenomenon reflects an optimistic bias, whereby individuals perceive themselves as less vulnerable despite objective risk. Addressing such bias through targeted risk communication strategies could enhance preventive engagement among apparently healthy individuals. Timely education and supportive counseling soon after diagnosis could help reinforce risk awareness and convert initial concern into sustained positive practices. Individuals experiencing mild concern about their illness demonstrated lower engagement, likely because they lack sufficient motivational arousal to initiate or maintain proactive management. This pattern also aligns with Bandura's notion that self-efficacy peaks when concern is sufficient to motivate action.[43] Accordingly, policy interventions should prioritize early prevention, expand emotional support services, and promote personalized health strategies tailored to individuals' health status, illness trajectory, and psychological needs.

Daily health behaviors were also decisive in shaping both attitudes and practices. Regular medical consultations and physical exercise were consistently associated with positive outcomes, corroborating results from Ruggeri et al.[44] Conversely, unhealthy dietary patterns and irregular health monitoring were associated with a reduced likelihood of positive attitudes or proactive health behaviors. In rural settings, home monitoring is often sporadic and weakly integrated with professional guidance or follow-up care, which limits its capacity to reinforce risk awareness or translate health information into sustained behavioral change. These results align with earlier research[45] and highlight the structural barriers that restrict health-promoting choices among older adults.[46,47] Common challenges, including long travel distances to healthcare facilities and inadequate or poorly developed rural exercise infrastructure, limit routine healthcare use and participation in physical activity. These findings highlight the necessity of place-based health policies that enhance local infrastructure, improve transportation to clinics, and develop age-friendly community fitness spaces.[46,47] In parallel, local health workers and community organizations should deliver behavioral counseling tailored to rural lifestyles, focusing on small, realistic behavioral adjustments that can be sustained despite environmental constraints.

Social support emerged as a significant determinant of KAP related to chronic disease management among rural older adults. Strong family support was positively associated with both attitudes and practices, consistent with previous evidence, where family involvement enhances emotional resilience and adherence to care plans.[48] Given the strong association between family support and KAP dimensions, integrating caregiver training into rural health policy could enhance both well-being and behavioral health outcomes. Therefore, building a multilayered support system that integrates emotional, informational, and clinical components is essential for promoting more effective and sustainable chronic disease management.[49] Neighborhood interaction revealed a nuanced pattern in its association with health behaviors. Limited neighborhood interaction appeared to weaken overall attitudinal differentiation rather than promoting either disengagement or proactive concern. More importantly, low neighborhood interaction was strongly associated with reduced motivation to seek village check-ups, indicating that social connectedness plays a critical role in encouraging even basic forms of preventive care.[50] These findings suggest that neighborhood networks function as important conduits for informal health information, normative reinforcement, and encouragement for routine health monitoring.

Strengthening neighborhood-based engagement activities and peer support mechanisms may therefore help enhance both awareness and participation in preventive health behaviors among rural older adults. Moreover, the limited availability of village-level rehabilitation and education services was significantly associated with poorer knowledge and suboptimal management practices. These findings underscore the potential of policy-driven equity mechanisms, such as subsidized health services and chronic disease reimbursement programs, to promote inclusion even among vulnerable groups. Expanding these programs through training community health workers, involving social organizations, and integrating rehabilitation into primary care delivery can enhance continuity and accessibility of chronic disease management for rural older adults.

Contributions and Limitations

This study systematically applied the KAP framework to examine chronic disease management behaviors among rural older populations. By extending the traditional application of the KAP model, it comprehensively examined influencing factors across all three dimensions. The analysis provides a nuanced understanding of how personal characteristics, health status, daily behaviors, and social support collectively shape chronic disease management outcomes. The findings identify critical gaps within the KAP continuum and offer evidence-based policy recommendations, highlighting the necessity of strengthening targeted health education, improving rural healthcare infrastructure, and fostering family involvement in chronic disease care. Findings from Zhejiang's rural context further illustrate how community-level infrastructure and family-centered interventions can be adapted and scaled to similar settings facing rapid demographic aging.

Despite these contributions, the study has several limitations. First, the data were collected from three rural villages in Zhejiang Province. While these sites are broadly representative of local rural contexts, they may not capture the full diversity of China's rural populations. Caution should be taken when generalizing the findings to areas with different socioeconomic, cultural, or healthcare contexts. Future research could therefore consider multi-provincial or nationally representative samples to validate and compare regional differences. Second, the research employed a cross-sectional design, which restricts the ability to draw causal inferences between influencing factors and KAP outcomes. Future longitudinal research is recommended to capture temporal dynamics and establish causal pathways. Besides, although factors such as digital access, gender differences and the quality of family care are recognized as important determinants of chronic disease management among older adults, they were beyond the scope of the present study and were not incorporated into the original survey design. Consequently, these dimensions could not be examined systematically. Third, data were collected through self-reported questionnaires, which may introduce response and recall biases. Some respondents might have over- or underreported their health attitudes and behaviors due to social desirability or memory limitations. Future studies could mitigate this limitation by integrating objective health indicators or triangulating survey data with clinical observations. In addition, adopting mixed-methods designs, such as combining quantitative surveys with in-depth interviews or focus groups, would allow researchers to capture contextual nuances, validate self-reported measures, and generate a more comprehensive understanding of chronic disease management among rural older adults.

Conclusion

This study provides empirical evidence on the factors shaping the KAP dimensions of rural older adults in relation to chronic disease management. Findings reveal that overall KAP levels remain relatively low, following a clear gradient of attitude > practice > knowledge. This pattern suggests that while preventive awareness is relatively strong, knowledge deficits and structural barriers constrain the translation of awareness into consistent behavioral actions. Policy literacy, proactive care-seeking and social support emerged as the most decisive enablers for bridging the gap between awareness and sustained engagement in care. Conversely, limited education, economic hardship, and poor health status heightened the likelihood of passive or inconsistent health behaviors, underscoring the compound vulnerability of older adults in rural settings.

To strengthen chronic disease management among rural aging populations, a multilevel and equity-oriented approach is required. Health education initiatives should prioritize accessibility by using simplified, culturally tailored materials and non-digital formats that accommodate the limited literacy and internet access common among older adults. At the same time, expanding social security coverage and financial assistance is essential to reduce economic barriers faced by disadvantaged groups. Encouraging active family involvement in health education and daily care routines can promote

early prevention and household-level engagement in disease management, whereas strengthening neighborhood-based engagement activities and peer support mechanisms may help translate positive attitudes into concrete preventive practices. At the structural level, sustained investment in rural healthcare infrastructure and service delivery remains critical. Importantly, equipping primary care providers with comprehensive training, adequate resources, and data-driven tools can enable more personalized care planning, which is vital for addressing determinants at different stages of the behavior-change process. Overall, this study underscores the need for integrated, equity-oriented health policies that address both informational and structural determinants of chronic disease management among rural older adults. Bridging the gap between knowledge and action will require not only education but also systemic reforms in healthcare access, social protection, and community engagement.

Abbreviations

KAP, knowledge, attitude and practice; WHO, World Health Organization; US, Unite State; VIF, variance inflation factor; OR, odds ratio.

Data Sharing Statement

The data presented in this study are available from the corresponding author on reasonable request. The data are not publicly available due to their containing information that could compromise the privacy of research participants.

Acknowledgments

The authors would like to thank all research participants who completed the questionnaire survey and shared their time.

Author Contributions

All authors made a significant contribution to the work reported, whether that is in the conception, study design, execution, acquisition of data, analysis and interpretation, or in all these areas; took part in drafting, revising or critically reviewing the article; gave final approval of the version to be published; have agreed on the journal to which the article has been submitted; and agree to be accountable for all aspects of the work.

Funding

This study was financially supported by National Office for Philosophy and Social Science of China (Grant no.: 23BRK024), by the General Program of China Postdoctoral Science Foundation (Grant no.: 2021M700796), and by the HZNU Scientific Research and Innovation Team Project (Grant no.: TD2025009).

Disclosure

The authors declared no potential conflicts of interest with respect to the research, authorship, and/or publication of this article.

References

1. Unite Nation. *World Population Prospects 2024*. New York, America: The UN Department of Economic and Social Affairs; 2024.
2. Pingping W. The total population has declined, and the high-quality development of the population has been effective. Available from: https://www.stats.gov.cn/xxgk/jd/sjjd2020/202401/t20240118_1946711.html. Accessed February 12, 2025.
3. World Health Organization. World report on ageing and health. Geneva. 2015. Available from: http//www.who.int/ageing/publications/world-report-2015-launch/en/. Accessed January 08, 2026.
4. Dai W. Is China facing the social risks associated with reliance on hospitalization for the care of the elderly with chronic diseases? *Int J Health Plann Manag*. 2019;34(2):794–805. doi:10.1002/hpm.2738
5. Mitchell E, Michael SP, Nicholas W, et al. Clonal dynamics of haematopoiesis across the human lifespan. *Nature*. 2022;606(7913):343–350. doi:10.1038/s41586-022-04786-y
6. Franceschi C, Garagnani P, Morsiani C, et al. The continuum of aging and age-related diseases: common mechanisms but different rates. *Front Med*. 2018;5:61. doi:10.3389/fmed.2018.00061
7. Al-Awar MSA, Al-Ahdal SA, Almoliky MA, et al. Knowledge, attitudes, and practices of cardiopulmonary resuscitation among anesthesia providers in public hospitals: a cross-sectional study in Sana'a City, Yemen. *Risk Manag Healthc Policy*. 2025;Volume 18:3113–3127. doi:10.2147/RMHP.S539243

8. Su W, Lin Y, Yang L, et al. Prevalence and influencing factors of chronic diseases among the elderly in Southwest China: a cross-sectional study based on community in urban and rural areas. *Preventive Med Reports*. 2024;44:102799. doi:10.1016/j.pmedr.2024.102799
9. Afni N. The role of health literacy in chronic disease management: challenges, interventions, and policies. *J Health Literacy Qual Res*. 2021;1 (2):57–68. doi:10.61194/jhlqr.v1i2.526
10. Buttar HS, Li T, Ravi N. Prevention of cardiovascular diseases: role of exercise, dietary interventions, obesity and smoking cessation. *Exp Clin Cardiol*. 2005;10(4):229.
11. Egger G, John D. Beyond obesity and lifestyle: a review of 21st century chronic disease determinants. *Biomed Res Int*. 2014;1:731685.
12. López P, Parra-Rizo MA. Effect and adequacy of exercise for cardiovascular improvement of the popu-lation over 65. *Revista de Psicologíay Salud*. 2020;12:600–614.
13. Hu L, Wang H, Tian J, Wu Y. The interplay of financial support and familial duty: adult children's contributions to healthcare for older parents in rural China. *Risk Manag Healthc Policy*. 2025;31:2875–2886. doi:10.2147/RMHP.S536055
14. Ramsey D, Kenneth B. Rural community well-being: the perspectives of health care managers in Southwestern Manitoba, Canada. *J Rural Community Dev*. 2006;2:1.
15. Parra-Rizo MA, Cigarroa I, Olivera-Sánchez S, et al. Sociodemographic profile of physically active older adults according to the type of physical activities practiced: gymnastic exercises, aquatic activities, yoga, pilates and dance. *Retos*. 2024;56:280–288. doi:10.47197/retos.v56.102223
16. Dunlop DD, Susan LH, Larry MM. Disability in activities of daily living: patterns of change and a hierarchy of disability. *Am J Public Health*. 1997;87(3):378–383. doi:10.2105/AJPH.87.3.378
17. Fried LP, Guralnik JM. Disability in older adults: evidence regarding significance, etiology, and risk. *J Am Geriatr Soc*. 1997;45(1):92–100. doi:10.1111/j.1532-5415.1997.tb00986.x
18. Massimi A, De Vito C, Brufola I, et al. Are community-based nurse-led self-management support interventions effective in chronic patients? Results of a systematic review and meta-analysis. *PLoS One*. 2017;12(3):e0173617. doi:10.1371/journal.pone.0173617
19. Knapik W. Stimulators and inhibitors of the development of social care and support for the elderly in Poland. *J Rural Stud*. 2020;76:12–24. doi:10.1016/j.jrurstud.2020.03.003
20. Rodrigues LP, de Oliveira Rezende AT, Delpino FM, et al. Association between multimorbidity and hospitalization in older adults: systematic review and meta-analysis. *Age Ageing*. 2022;51(7):afac155. doi:10.1093/ageing/afac155
21. Waters H, Graf M. *The Costs of Chronic Disease in the US*. Santa Monica, CA: The Milken Institute; 2018.
22. Foss R, Fischer K, Lampman MA, et al. Disparities in diabetes care: differences between rural and urban patients within a large health system. *Anna Family Med*. 2023;21(3):234–239. doi:10.1370/afm.2962
23. Nuño R, Coleman K, Bengoa R, et al. Integrated care for chronic conditions: the contribution of the ICCC Framework. *Health Policy*. 2012;105 (1):55–64. doi:10.1016/j.healthpol.2011.10.006
24. Oni T, McGrath N, BeLue R, et al. Chronic diseases and multi-morbidity-a conceptual modification to the WHO ICCC model for countries in health transition. *BMC Public Health*. 2014;14(1):575. doi:10.1186/1471-2458-14-575
25. Wagner EH. Chronic disease management: what will it take to improve care for chronic illness? *Effective Clin Pract*. 1998;1:1.
26. Xiong A, Li Y, Liu S, et al. Knowledge acquisition and precautionary behaviors for individual resilience to the COVID-19 pandemic: a study of rural Latin America. *J Rural Stud*. 2022;95:373–381. doi:10.1016/j.jrurstud.2022.09.015
27. Hong E, Mao J, Ke Z, et al. Knowledge, attitudes and practices towards community-acquired pneumonia and COVID-19 among general population: a cross-sectional study. *Antimicrob Resist Infect Control*. 2024;13(1):6. doi:10.1186/s13756-023-01361-6
28. Jerant AF, Von friederichs-fitzwater MM, Moore M. Patients' perceived barriers to active self-management of chronic conditions. *Patient Educ Couns*. 2005;57(3):300–307. doi:10.1016/j.pec.2004.08.004
29. Xu M, Zhang Z. Farmers' knowledge, attitude, and practice of rural industrial land changes and their influencing factors: evidences from the Beijing-Tianjin-Hebei region, China. *J Rural Stud*. 2021;86:440–451. doi:10.1016/j.jrurstud.2021.07.005
30. Long E, Ponder M, Bernard S. Knowledge, attitudes, and beliefs related to hypertension and hyperlipidemia self-management among African-American men living in the southeastern United States. *Patient Educ Couns*. 2017;100(5):1000–1006. doi:10.1016/j.pec.2016.12.011
31. Xu Y, Pan R, Zhao D, et al. Influence of 3H nursing based on knowledge-attitude-behavior mode on negative emotions and quality of life of patients with chronic obstructive pulmonary disease complicated with depression. *J Int Psychiatr*. 2019;2:371–373.
32. Chen X, Orom H, Hay JL, et al. Differences in rural and urban health information access and use. *J Rural Health*. 2019;35(3):405–417. doi:10.1111/jrh.12335
33. Chen Y, Fan X, Shen S, et al. Exploring urban–rural inequities in older adults life expectancy: a case study in Zhejiang, China for health equity. *Front Public Health*. 2025;13:1439857. doi:10.3389/fpubh.2025.1439857
34. Feng Z, Glinskaya E, Chen H, et al. Long-term care system for older adults in China: policy landscape, challenges, and future prospects. *Lancet*. 2020;396(10259):1362–1372. doi:10.1016/S0140-6736(20)32136-X
35. Rashdi PT, Surahio KS, Nadeem R, Sarfraz B. The intersection of health literacy and educational attainment: a review of global perspectives. *Int J Applied Educ Res*. 2025;3(3):141–156.
36. Khraim F, Elshatarat RA, Wolsey C, et al. Exploring influencing factors on health literacy knowledge and experience among healthcare providers: a cross-sectional study. *Risk Manag Healthc Policy*. 2025;31:2297–2311.
37. Morris BB, Rossi B, Fuemmeler B. The role of digital health technology in rural cancer care delivery: a systematic review. *J Rural Health*. 2022;38 (3):493–511. doi:10.1111/jrh.12619
38. Yuan F, Qian D, Huang C, et al. Analysis of awareness of health knowledge among rural residents in Western China. *BMC Public Health*. 2015;15 (1):55. doi:10.1186/s12889-015-1393-2
39. Akalu Y, Ayelign B, Molla MD. Knowledge, attitude and practice towards COVID-19 among chronic disease patients at Addis Zemen Hospital, Northwest Ethiopia. *Infect Drug Resist*. 2020;Volume 13:1949–1960. doi:10.2147/IDR.S258736
40. Ismail A, Mathauer I, Akweongo P, et al. Making health insurance responsive to citizens: learning from six low-income and middle-income countries. *BMJ Global Health*. 2025;7(Suppl 6):e018176. doi:10.1136/bmjgh-2024-018176
41. Zulman DM, Asch SM, Martins SB, Kerr EA, Hoffman BB, Goldstein MK. Quality of care for patients with multiple chronic conditions: the role of comorbidity interrelatedness. *J Gen Intern Med*. 2014;29(3):529–537. doi:10.1007/s11606-013-2616-9

42. Camacho F, Hwang W, Kern T, et al. Receipt of regular primary care and early cancer detection in Appalachia. *J Rural Health*. 2015;31(3):269–281. doi:10.1111/jrh.12097
43. Bandura A. *Self-Efficacy: The Exercise of Control*. Freeman; 1997:11.
44. Ruggeri SY, Emerson A, Russell CL. A concept analysis of routines for improving health behaviors. *Int J Nurs Sci*. 2023;10(3):277–287. doi:10.1016/j.ijnss.2023.06.004
45. Wu H, Wang Y, Zhang H, et al. An investigation into the health status of the elderly population in China and the obstacles to achieving healthy aging. *Sci Rep*. 2024;14(1):31123. doi:10.1038/s41598-024-82443-2
46. Ma W, Vatsa P, Zheng H, et al. Learning to eat from others: does nutritional information acquired from peers affect nutrition intake? *J Rural Stud*. 2022;95:449–457. doi:10.1016/j.jrurstud.2022.09.023
47. Lu J, Sun Y. Elderly health in rural China: characteristics, causes and responding strategies. *J Chin Agric Univers*. 2024;2:49–67.
48. Barreto MD, Marquete VF, Camparoto CW, García-Vivar C, Barbieri-Figueiredo MD, Marcon SS. Factors associated with nurses' positive attitudes towards families' involvement in nursing care: a scoping review. *J Clin Nurs*. 2022;31(23–24):3338–3349. doi:10.1111/jocn.16226
49. Shi J, Shi L, Geng J, et al. Status of evidence-based chronic diseases prevention implementation in Shanghai, China: a qualitative study. *Int J Health Plann Manag*. 2019;34(3):912–925. doi:10.1002/hpm.2863
50. Vassilev I, Rogers A, Sanders C, et al. Social networks, social capital and chronic illness self-management: a realist review. *Chronic Illness*. 2011;7(1):60–86. doi:10.1177/1742395310383338