

Characteristics and influencing factors of health literacy in elderly patients with knee osteoarthritis: a latent profile analysis

Li Cheng

Honghui Hospital, Xi'an Jiaotong University

Xiaoming Cao

Honghui Hospital, Xi'an Jiaotong University

Ying Xin

965547913@qq.com

Honghui Hospital, Xi'an Jiaotong University

Hong Zhang

Honghui Hospital, Xi'an Jiaotong University

Zhanhua Zhang

Honghui Hospital, Xi'an Jiaotong University

Xiaoli Li

Honghui Hospital, Xi'an Jiaotong University

Feng Qiao

Honghui Hospital, Xi'an Jiaotong University

Research Article

Keywords: Elderly people, Osteoarthritis, knee, Health literacy, Influencing factors, Latent profile analysis

Posted Date: September 2nd, 2026

DOI: <https://doi.org/10.21203/rs.3.rs-10504746/v1>

License:   This work is licensed under a Creative Commons Attribution 4.0 International License.

[Read Full License](#)

Additional Declarations: No competing interests reported.

Characteristics and influencing factors of health literacy in elderly patients with knee osteoarthritis: a latent profile analysis

Li Cheng, Xiaoming Cao, Ying Xin, Hong Zhang, Zhanhua Zhang , Xiaoli Li, Feng Qiao

Honghui Hospital ,Xi'an Jiaotong University, Xi'an ,Shaanxi ,China.710054

No. 555 Youyi East Road, Beilin District, Xi 'an City, Shaanxi Province

Corresponding author : 1.Ying Xin2. Hong Zhang,

Senior author: Li Cheng

E-mail: 33863435@qq.com

Abstract

Background Health literacy ability is a very important foundational skill for elderly people to achieve effective self-care of their health. However, there are differences in health literacy abilities among elderly patients with knee osteoarthritis, and various factors that affect this ability have not been fully studied. This study explores the potential cross-sectional characteristics and influencing factors of health literacy in elderly patients with knee osteoarthritis.

Method This study analyzed cross-sectional survey data on health literacy of 330 elderly patients with knee osteoarthritis. Latent profile analysis was used to identify potential categories of elderly knee osteoarthritis, and binary logistic regression analysis was used to explore the influencing factors of health literacy potential profiles in elderly knee osteoarthritis patients.

Result The health literacy of elderly patients with knee osteoarthritis was divided

into two potential profiles: low acquired health literacy group (22.0%) and high acquired health literacy group (78.0%). Logistic regression analysis showed that household per capita income, household per capita income, family members with arthritis, comorbidities with chronic diseases, family support, and general self-efficacy were the influencing factors of health literacy in different categories of elderly patients with knee osteoarthritis.

Conclusion Elderly patients with knee osteoarthritis have good health literacy and exhibit group heterogeneity. Medical staff can develop targeted intervention measures based on the characteristics of different categories, with a particular focus on patients in the low acquisition health literacy group, to improve their health literacy abilities and promote their health.

Keyword Elderly people; Osteoarthritis, knee; Health literacy; Influencing factors; Latent profile analysis

Background

Knee osteoarthritis (KOA) is a chronic degenerative joint disease that is common among middle-aged and elderly people. It is also a chronic non inflammatory and disabling joint disease [1] . There are approximately 635 million KOA patients worldwide, with a prevalence rate ranging from 16% to 40% [2-3]. The number of KOA patients in China has exceeded 100 million, the prevalence of KOA is 15%~50%, and the incidence rate of KOA among the elderly over 60 years old is more than 30%. The disease has also become one of the major public health problems in the world[4]. Long term recurrent knee joint pain, swelling, stiffness, and functional impairment in patients

may lead to knee joint deformities, loss of flexion and extension functions, and have a serious impact on their quality of life and work. With the increasing aging population, the incidence of knee osteoarthritis is rising year by year, causing a huge economic burden on patients, families, and society[5]. However, patients with knee osteoarthritis are a chronic disease that requires long-term self-management. Promoting the formation of good health concepts and lifestyles among chronic disease patients largely depends on their level of health literacy [6-7] .

Health Literacy (HL) refers to an individual's ability to understand, acquire, and utilize health information, and make appropriate health decisions [8] . Related studies have shown that health literacy is closely related to disease knowledge, self-management, and health outcomes of chronic disease patients [9-10] . Elderly knee osteoarthritis (KOA) is a degenerative joint disease that mainly causes chronic pain, reduced physical function, and decreased self-care ability in the elderly. Its health outcomes exhibit multidimensional and progressive worsening characteristics. Research shows that the higher the level of health literacy, the stronger the patient's ability to cope with diseases, and the higher their access to health and support, which in turn promotes the development of healthy behaviors. On the contrary, the lower the health literacy, the lower the patient's self-awareness and self-care ability, leading to a deterioration of psychological and social health outcomes, which may progress to severe physical disability in the long run, increasing the risk of caregiving and adverse survival outcomes, and increasing the economic burden on families and society [11-12] . Therefore, elderly KOA patients need to have good health literacy

knowledge to promote healthy behavior, maintain their own health, and reduce the harm of diseases to health.

Previous studies have shown that the health literacy of elderly KOA patients is closely related to social demographics, disease factors, and psychological factors, such as gender, age, marital status, education level, income, employment status, health behavior, chronic diseases, and disease course, which affect the level of health literacy of patients [13-15]. A mixed study of health literacy among patients with knee osteoarthritis by Syllander et al. showed [16] The education level, lifestyle, and health status of patients are related to the health literacy of KOA patients. In the structural equation modeling study conducted in Thailand, education level as an individual determinant directly affects health literacy by influencing cognitive function and social support [17].

The concept of general self-efficacy was proposed by Albert Bandura, referring to an individual's belief in their ability to successfully complete a task [18]. Research has shown that self-efficacy is significantly positively correlated with health literacy ($r=0.479$, $P<0.01$), and high self-efficacy individuals are more inclined to actively acquire and apply health information to improve their health literacy abilities; Low self-efficacy individuals are prone to information avoidance behavior, thereby weakening their level of health literacy [19]. Therefore, improving self-efficacy can promote the health literacy ability of elderly KOA patients.

Previous studies have shown that family support for elderly KOA patients has a promoting effect on health literacy [20]. The causal model of elderly KOA health

literacy constructed by Pa in et al. shows [17], Social support has a direct positive impact on health literacy, and family support is one of the important factors in social support. A cross-sectional study (n=460) on elderly hypertensive patients showed that [21] There is a significant positive correlation between health literacy and family support ($r=0.895$, $P<0.01$), and structural equation modeling analysis further confirms that health literacy has a positive impact on family support. Social support has been proven to be an important factor in promoting health literacy. The study also found [22] that poor social support is an independent risk factor for poor self-efficacy in elderly patients with osteoarthritis, and self-efficacy has been proven to be a psychological variable that affects health literacy. Therefore, the application relationship between general self-efficacy, family support, and health literacy in elderly KOA patients is crucial. Previous studies have mostly explored the independent effects of self-efficacy or family support, but there is still a lack of empirical research on their impact on the health literacy of KOA patients.

This study uses the Health Belief Model (HBM) as the theoretical framework[23], which states that an individual's adoption of health behaviors depends on their perception of disease threats and evaluation of action outcomes, while self-efficacy and action cues are key factors driving behavior transformation. This study suggests that general self-efficacy can promote patients' confidence in their KOA management behavior, which is an intrinsic driving force for the transformation of health literacy into actual health behavior; Family support comes from the encouragement, information transmission, and medical companionship of family members. It serves as

an external action clue that continuously triggers and strengthens health management behavior, and the two work together to influence the level of elderly health literacy.

However, existing HBM applications mostly focus on direct prediction of health behaviors and have not yet extended to heterogeneity analysis of health literacy [24] . Research on the health literacy of elderly KOA patients often focuses on a single variable, only understanding the overall level of health literacy and ignoring the heterogeneity within the group[13] .Potential Profile Analysis (LPA) may be a more suitable method, as LPA is a statistical approach centered around individual characteristics. Potential profile analysis divides research subjects into different potential categories based on their response patterns to external variables, which facilitates further analysis of the characteristics of various subgroups [25] , And promote the development of precise interventions tailored to the characteristics and needs of each subpopulation. Therefore, this study uses latent profile analysis to explore the potential profile and influencing factors of health literacy in elderly KOA patients, in order to provide reference for developing targeted intervention measures for different characteristic groups.

Method

Research Object

Using convenience sampling method, 330 patients with knee osteoarthritis who visited the Orthopedic Outpatient Department of the Honghi Hospital of Xi'an ,Xian Jiaotong University from January to April 2026 were selected as the research subjects. Inclusion criteria: (1) Age $\geq$ 60 years old; (2) The diagnostic criteria comply with the

Chinese Guidelines for the Diagnosis and Treatment of Osteoarthritis (2024 edition)[26]; (3) Voluntarily participate in this study and sign an informed consent form. Exclusion criteria: (1) History of knee surgery or secondary osteoarthritis (2) Severe physical or cognitive impairment; (3) Merge with serious diseases (malignant tumors or severe organ damage).

Sample size

The prevalence of knee osteoarthritis in elderly people aged 60 and above is over 30%[4]. The allowable error is controlled at 5%. According to the literature, the incidence rate is 30%, about $\pi=0.30$, $\delta=0.05$, taking $\alpha=0.05$, $u_{0.05/2}=1.96$, and an invalid questionnaire of 10%, this study requires at least 180 patients and ultimately includes 330 cases.

Ethical considerations

This study was approved by the Ethics Committee of the Honghui Hospital, Xi'an Jiaotong University (Ethical approval number: 202106016).

Investigation Tools

General Information Survey Form

The general information survey form is designed based on literature review and revised according to the survey results after preliminary investigation. This includes two parts: general information and patient medical treatment. General information includes 9 items: gender, age, education level, marital status, occupation, place of residence, per capita household income, form of medical payment, and body mass index. The second part of medical treatment includes four items: genetic history of

osteoarthritis, duration of illness, pain score, and comorbidities of chronic diseases.

Chronic Disease Health Literacy Scale

The Chronic Disease Health Literacy Scale was developed by Sun Haolin in 2012[27]. The revised Chronic Disease Patient Health Literacy Scale has been validated to have good reliability and validity. This scale consists of 24 items in four dimensions: information acquisition ability, communication and interaction ability, willingness to improve health, and willingness to pay. Using the Likert 5-point rating system: from "completely impossible" to "no difficulty", the score ranges from 1 to 5, with a score of ≥ 4 points for each question, indicating a correct answer. The total score ranges from 24 to 120 points, with higher scores indicating higher levels of patient health literacy. Patients with a total health literacy score equal to or higher than 96 points are considered to have good health literacy, while those with a total score less than 96 points are considered to lack health literacy. The Cronbach's α coefficient of this scale is 0.894.

General Self Efficacy Energy Meter(GSES)

The General Self Efficacy Scale (GSES) was developed by Schwarzer et al[28]. Compiled by Wang Caikang and others[29] Sinicization. This scale is a single dimensional scale consisting of 10 items, all of which are scored on a Likert 4-point scale from "completely incorrect" to "completely correct", with a total score of 10-40 points. The higher the score, the higher the individual's general self-efficacy level. The Cronbach 's α coefficient of the scale was 0.876.

Family Support Scale

The Family Support Scale (PSS Fa) is a self-assessment tool developed by Procianno and Helle in the United States[30] The Family Support Self Assessment Scale has been modified based on the national conditions of our country. The revised scale consists of 15 simple questions, with answers of "yes" and "no". A yes answer earns 1 point, a no answer earns 0 points, and questions 3, 12, and 15 are reverse scoring questions. Before calculating the total score, convert the score of the reverse scoring item, which ranges from 0-15 points. The higher the score, the higher the level of family support. The Cronbach's α coefficient of this scale is 0.793.

1 Data collection and quality control methods

Firstly, obtain the consent and support of the hospital and relevant departments, and provide unified training for the investigators. Use unified guidance language to explain the purpose, content, and filling requirements of this survey to patients, and sign an informed consent form after obtaining their consent. Patients are required to complete the form on their own. If they encounter difficulties during the filling process, the investigator should guide them to complete it, and suggestive answers are prohibited. To ensure the authenticity and quality of the questionnaire, a quiet clinic was selected for the survey. The questionnaire was distributed on the spot and collected half an hour later. For incomplete questionnaire answers and answers that are all fixed options, they will be deleted. Using Epidata 3.2 software to establish a database, all collected questionnaires were entered by two people. This study distributed 330 questionnaires, removed 12 invalid questionnaires, and collected 318 valid questionnaires, with an effective response rate of 96.4% (Fig.1) .

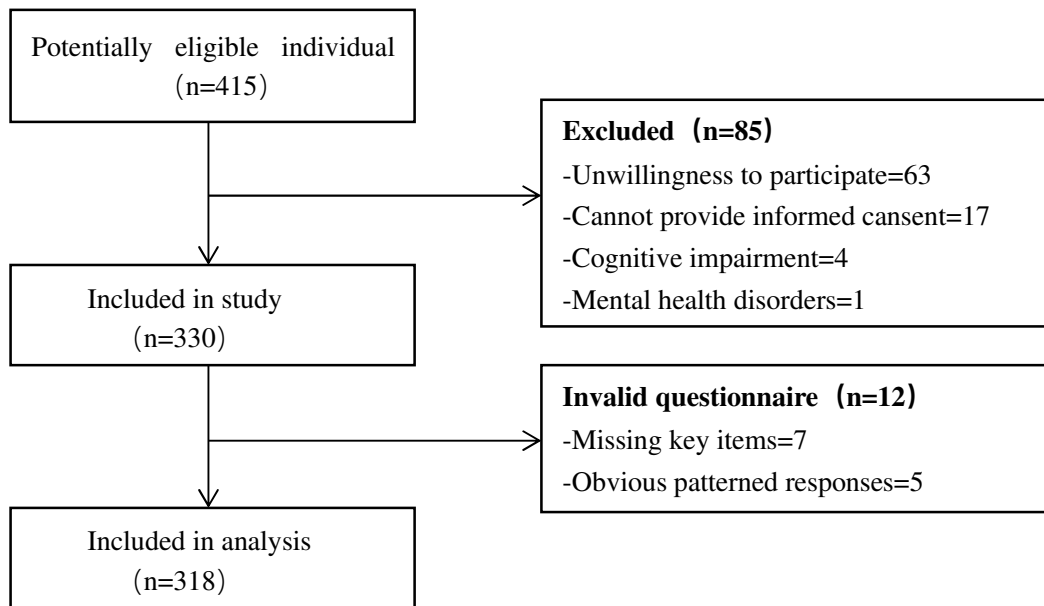


Fig.1 Flow diagram of participant recruitment and inclusion

Date analysis

Using Mplus 8.3 software, a potential profile analysis was conducted on the four dimensions of health literacy in elderly patients with knee osteoarthritis, gradually increasing the profiles to test the adaptability of the model. The model was evaluated using the AIC, BIC, aBIC, Entropy, LMRT, and BLRT based on Bootstrap. Statistical analysis was conducted using SPSS 26.0 software, and t-tests were performed on quantitative data that followed a normal distribution; Qualitative data is expressed in frequency and percentage (%), and chi square test is used for inter group comparison. Using logistic regression analysis to explore the influencing factors of health literacy in elderly patients with knee osteoarthritis. The difference is considered statistically significant with $P < 0.05$.

Results

Latent profile analysis of health literacy in elderly patients with knee

osteoarthritis

The 318 included patients were aged 60~85 years, with a mean age of (71.35±7.82) years. The results of this study showed that the health literacy score of 318 elderly patients with knee osteoarthritis was (95.96 ± 12.20) points, including the information acquisition ability dimension score (40.24 ± 6.95) points, the interaction ability dimension score (32.13 ± 5.04) points, the health improvement intention dimension score (15.65 ± 3.00) points, and the economic intention dimension score (7.94 ± 1.78) points. Starting from the initial model, this study fitted a total of four potential profile models. As the number of categories increased from one to four, AIC, BIC, and aBIC gradually decreased, with Entropy>0.8. BLRT showed statistical significance ($P<0.001$). Further comparison of the fitting indicators of each potential profile showed that when the number of categories was 3, LMRT had no statistical significance ($P=0.1460$), indicating that the fitting effect of two categories was better. Therefore, two potential profiles were ultimately selected as the optimal models for the health

Table 1 Fitting results of potential profile analysis model of health literacy in elderly patients with knee osteoarthritis (n = 318)

Model	AIC	BIC	ABIC	Entropy	P		Class probability
					LMRT	BLRT	
1	6976.941	7007.037	6981.663	—	—	—	1.000
2	6724.735	6773.642	6732.409	0.850	<0.001	<0.001	0.220/ 0.780
3	6669.606	6737.323	6680.231	0.835	0.1460	<0.001	0.059/ 0.240/ 0.701
4	6622.232	6708.759	6635.808	0.859	0.1361	<0.001	0.057/ 0.643/0.155/ 0.144

literacy category of elderly patients with knee osteoarthritis(Table 1).

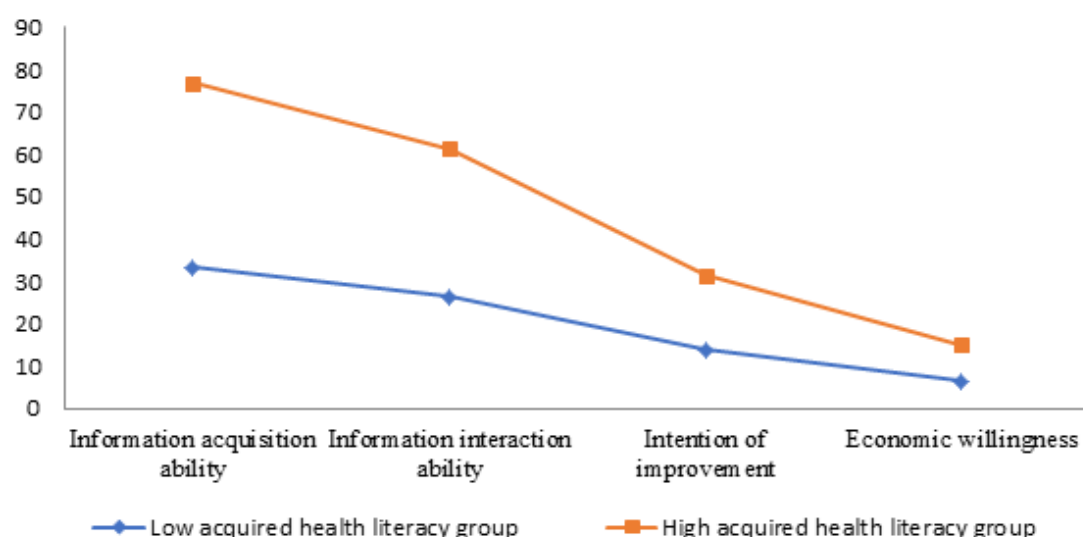


Fig.2 Potential profile characteristics of health literacy in elderly patients with knee osteoarthritis

By drawing a potential profile of health literacy in elderly patients with knee osteoarthritis (Fig. 2), analyze the characteristics of two potential categories of health literacy in elderly patients with knee osteoarthritis, and name the two categories based on the characteristics of each potential category. There are 70 cases (22.0%) in class1 (Low acquired health literacy group), and the scores in all dimensions are at a low level, especially in the information acquisition dimension, so it is named low acquisition health literacy group . There are 248 cases (78.0%) in class 2, with high scores in all four dimensions, especially in terms of information acquisition ability. Therefore, it is named as the high acquired health literacy group.

Univariate analysis of potential category influencing factors on health literacy in elderly patients with knee osteoarthritis

The research results showed that educational level, place of residence, type of medical insurance, per capita household income, family members with arthritis, comorbidities of chronic diseases, family support, and general self-efficacy were the potential profile categories affecting the health literacy of elderly patients with knee osteoarthritis (Table

2), and the differences were statistically significant ($P<0.05$)

Table 2 Single factor analysis of potential category influencing factors of health literacy in elderly patients with knee osteoarthritis

Item	Categories	Total (%)	Low acquired Health literacy type (n=70)	high acquired health literacy type (n=248)	Test statistic	<i>P</i> (T/χ^2)
Sex	Male	84	15 (21.43)	69 (27.82)	1.148	0.284
	Female	234	55 (78.67)	179 (72.28)		
Age	60~69	148	30 (42.86)	118 (47.6)	0.490	0.783
	70~79	102	24 (34.28)	78 (31.5)		
	≥80	68	16 (22.86)	52 (21.4)		
Educational level	Primary school and below	81	30 (42.86)	51 (20.56)	17.503	0.001
	Junior school	109	24 (34.29)	85 (34.27)		
	Secondary or high School	74	10 (14.29)	64 (25.81)		
	College or higher	54	6 (8.56)	48 (19.36)		
Marital status	Married	283	64 (91.43)	219 (88.31)	0.543	0.461
	Others	35	6 (8.57)	29 (11.69)		
Occupation	Farmer	176	39 (55.72)	137 (55.24)	1.170	0.557
	Retire	94	18 (25.71)	76 (30.65)		
	Others	48	13 (18.57)	35 (14.11)		
Residence	Rural district	212	59 (84.29)	153 (61.69)	12.539	<0.001
	City	106	11 (15.71)	95 (38.31)		
Family average income (CNY)	<1000	77	26 (37.14)	51 (20.57)	18.907	0.001
	1000~2999	87	26 (37.14)	61 (24.59)		
	3000-4999	79	9 (12.86)	70 (28.23)		
	≥5000	75	9 (12.86)	66 (26.61)		
Types of insurance	Private expense	46	10 (14.29)	36 (14.52)	7.228	0.027
	Residents' health insurance	178	48 (68.57)	130 (52.42)		
	Employee medical insurance	94	12 (17.14)	82 (33.06)		
family heredity	Yes	120	42 (60.00)	78 (31.45)	18.936	<0.001
	No	198	28 (40.00)	170 (68.55)		
Pain score	Mild pain	167	34 (48.57)	133 (53.63)	2.331	0.312
	Moderate pain	138	31 (44.29)	107 (43.15)		
	Severe pain	13	5 (7.14)	8 (3.22)		
Years of illness	1-3 years	106	24 (34.29)	82 (33.06)	0.178	0.915
	4~9years	110	25 (35.71)	85 (34.28)		
	≥10years	102	21 (30.00)	81 (32.66)		
Chronic diseases	Yes	152	50 (71.43)	102 (41.13)	20.086	<0.001
	No	166	20 (28.57)	146 (58.87)		
BMI	Normal	156	35 (50.00)	121 (48.79)	1.059	0.589
	Overweight	126	25 (35.72)	101 (40.73)		

	Obesity	36	10 (14.28)	26 (10.48)		
Family support			9.80 ± 1.45	12.43 ± 1.70	-11.799	<0.001
General self-efficacy			20.89 ± 4.55	23.29 ± 5.66	-3.263	0.001

Multivariate analysis of influencing factors on potential categories of health

literacy in elderly patients with knee osteoarthritis (Table 3)

Table 3 Variable assignment method

Variable	Assignment criteria
Educational level	Primary school and below =1; junior high =2; Secondary or high school =3; college or higher =4
Residence	Rural district =1; city=2
Family average income(CNY)	<1000=1; 1000-2999=2; 3000-4999=3; ≥ 5000 =4
Types of insurance	Private expense=1; Residents' health insurance =2; employee medical insurance =3
family heredity	Yes=1; No=2
Chronic diseases	Yes=1; No=2
Family support	Substitute the original value
General self-efficacy	Substitute the original value

Perform binary logistic regression analysis with statistically significant variables in univariate analysis as independent variables and potential profile categories of health literacy as dependent variables. The variable assignment method is shown in Table 4. The results of logistic regression analysis showed that per capita household income, arthritis in family members, comorbidities of chronic diseases, family support, and general self-efficacy were the potential influencing factors on the profile of elderly patients with knee osteoarthritis.

Table 4 Multivariate analysis of influencing factors of potential categories of health literacy in elderly patients with knee osteoarthritis

Category	Item	β	SE	Wald	P	OR	95% CI
Low Access to Health Literacy type	constant	-11.069	2.513	19.395	<0.001		
	Residence	-0.726	0.566	1.642	0.200	0.484	[0.160,1.468]
	Family average income	0.464	0.227	4.190	0.041	1.590	[1.020,2.478]
	Types of insurance	-0.180	0.329	0.298	0.585	0.863	[0.439,1.592]
	Educational level	0.172	0.214	0.647	0.421	1.188	[0.781,1.807]
	Hereditary history	-1.160	0.389	8.887	0.003	0.314	[0.164,0.672]
	Chronic diseases	0.975	0.404	5.822	0.016	0.377	[0.171,0.833]
	Family support	0.884	0.124	51.156	<0.001	2.420	[1.899,3.083]
	General self-efficacy	0.098	0.038	6.660	0.010	1.103	[1.024,1.188]

Highly acquired health literacy group was used as a reference

Discussion

Population heterogeneity in health literacy among elderly patients with knee osteoarthritis

The results of this study showed that the health literacy score of elderly patients with knee osteoarthritis was (95.96 ± 12.20) points, which is close to the level of good health literacy, which is higher than previous related research results [10] slightly high This may be related to the continuous promotion and improvement of public health literacy by the country, as well as the increase in channels for obtaining patients' health literacy and information, which increases personal awareness of diseases and thus enhances patients' health literacy level[31] Medical staff should use easy to understand language to popularize science, demonstrate health education methods such as using pictures, and increase education on the ways and channels of acquiring diseases. This study shows that the potential profiles of health literacy in elderly patients with knee osteoarthritis are divided into two categories: low acquisition health literacy and high acquisition health literacy, accounting for 22.0% and 78.0% of the

surveyed population, respectively. This indicates that there is heterogeneity in the health literacy of elderly patients with knee osteoarthritis, and most patients have good health literacy, which is consistent with Syllander et al [32]. The reported 71% of patients are basically consistent, indicating that most elderly patients have basic disease management abilities, while only a small portion (22%) of patients have low health literacy individuals with health factors, and heterogeneity is significant. Patients may exhibit a separation between information acquisition and understanding abilities. Therefore, medical staff should identify different types of patients, focus on health education for patients with per capita family income, family members with arthritis, and those with chronic diseases, implement different intervention measures, and help patients improve their health promoting behaviors and skills.

Potential cross-sectional factors influencing health literacy in elderly patients with knee osteoarthritis

Patients with higher per capita household income are more likely to be classified as the group with high acquired health literacy. This study shows that the higher the per capita income of a family, the higher the level of health literacy of patients, and the greater the likelihood of entering the high acquisition health literacy group, which is consistent with Wang et al [33]. The research results are consistent, indicating a significant correlation between patients' family income and their susceptibility to osteoarthritis. On the one hand, the higher the family income of patients, the more inclined they are to use websites, health portals, etc. for online health search to obtain health information and knowledge[34]. Thereby improving the level of health literacy;

On the other hand, Wang et al[35-36]. Research has shown that income contributes up to 62.53% to the behavior of seeking health information, and the higher the income, the more inclined they are to seek information from medical professionals. Health literacy is a key mediating variable that connects economic resources with health behavior, allowing elderly KOA patients with high family income not only to have a wider range of channels for obtaining health information, but also to have access to more authoritative and personalized sources of information, and to have the ability to transform information into health behavior. Therefore, they will have more advantages in obtaining health literacy information and disease management. Therefore, medical staff should pay more attention to elderly KOA patients from low-income families, and should not simply repeat procedures in intervention strategies. Instead, they should focus on improving free, convenient, and easy to understand health support services, and actively reduce economic barriers during their medical treatment process.

There is a greater likelihood of merging patients with chronic diseases into the group with high acquired health literacy. The results of this study showed that the presence of chronic diseases is one of the influencing factors for elderly patients with knee osteoarthritis. Among 152 patients with chronic diseases, 102 were in the high acquired health literacy group, accounting for 67.1%. Patients with chronic diseases are more likely to belong to the high acquired health literacy group, which is consistent with Tomita's findings[37]. The similar research results may be due to the frequent medical visits of patients with chronic diseases, which have accumulated rich disease management experience and the ability to obtain health information, indirectly

promoting patients' awareness and improving their health literacy level. Therefore, medical personnel should focus on identifying health knowledge of patients with chronic diseases, truly improving their health literacy level. At the same time, experienced elderly KOA patients with chronic diseases should be invited to share their self-management abilities, setting an example and thereby enhancing their health literacy ability.

Patients with high levels of family support and self-efficacy are more likely to be classified as the group with high acquired health literacy. The results of this study showed that the high acquisition health literacy group had higher scores in family support and self-efficacy, compared to Agata et al [38] The research is consistent. Research also shows that [20] The better the family support, the higher the patient's health literacy level. Similarly, family support plays an important role in the health and self-management process of the elderly. The more complete the family support function, the better the elderly's health behavior and health awareness, and the more positive their health willingness and behavior can be [39]. Self efficacy is the belief in an individual's ability to successfully implement and achieve a certain goal or cope with a difficult situation, which can directly affect the patient's subsequent motivation and behavior. Good self-efficacy can better promote patients' healthy behaviors, make them more likely to live optimistically, and thus improve their health literacy level [10]. Therefore, nursing staff should pay attention to patients' family support and general self-efficacy level, identify and help patients solve obstacles and beliefs that affect the improvement of health literacy, encourage patients to communicate more with family and friends,

improve self-efficacy level, and increase disease awareness.

family heredity are more likely to belong to the low acquired health literacy group. The research results show that the B-value of family members suffering from arthritis is -1.160, and the regression coefficient is negative, indicating a higher likelihood of falling into the low acquisition health literacy group. Although multiple risk factors contribute to the occurrence and progression of KOA, genetic susceptibility is increasingly recognized to play a role [40-41]. Meanwhile, the health belief model suggests that [23] Perceived susceptibility and perceived severity together constitute a 'perceived threat'. It is generally believed that a higher perceived threat may prompt patients to take health actions. However, when the perceived threat exceeds an individual's psychological tolerance, avoidance behavior may be adopted, lacking sufficient self-efficacy and confidence to actively acquire health knowledge. On the other hand, patients may act as caregivers for elderly KOA patients, only busy taking care of family patients and weakening their own health management abilities. Therefore, medical staff should strengthen the education of knee arthritis patients with a history of genetic disease, enhance psychological communication, popularize science through videos and educational materials, understand the genetic tendency of knee arthritis, avoid negative emotions from family members and the burden of care affecting patients' health acquisition, which is not conducive to improving patients' health literacy.

Conclusion

This study divides the health literacy of elderly patients with knee osteoarthritis

into two profiles based on latent profile analysis: the low acquisition health literacy group and the high acquisition health literacy group, indicating population heterogeneity. The two profile categories are influenced by factors such as per capita household income, comorbidities of chronic diseases, family history of arthritis, general self-efficacy, and family support. Therefore, medical staff can develop targeted intervention measures based on different category characteristics, paying special attention to patients in the low acquisition health literacy group, improving their health literacy abilities, and thereby promoting their health. This study also has certain limitations. Firstly, it is a single center survey, which may have a certain risk of bias. Secondly, the influencing factors of elderly KOA patients may not be comprehensive enough. In the future, we will continue to expand the sample size and improve the exploration of influencing factors. Longitudinal studies can be conducted to further investigate the health literacy status and trajectory changes of elderly KOA patients at different times.

Declarations

Ethics approval and consent to participate

This study was approved by the Ethics Committee of Shaanxi Xi'an honghui hospital, Xi'an jiaotong university (202106016). Written informed consent was obtained from all participants prior to participation. This study was conducted in accordance with the guidelines outlined in the Declaration of Helsinki.

Consent for publication

Not applicable

Availability of data and materials

The datasets analyzed during the current study are not publicly available due to privacy and ethical concerns, but are available from the corresponding author on reasonable request.

Author contributions

L.C. was responsible for the study concept and design. L.C , Y.X,XM. C .andF.Q. carried out data collection. L.C. performed the statistical analysis and drafted the original manuscript..XL.L, ZH.Z, XM.Cand H.Zparticipated in data interpretation and critically reviewed and revised the manuscript. All authors read and approved the final manuscript.

Abbreviations

KOA: Knee osteoarthritis

HL: health literacy

GSES: General Self Efficacy Energy Meter

PSS-Fa: Family Support Scale

HBM :Health Belief Model

LPA: Latent profile analysis

AIC: Akaike information criterion

BIC: Bayesian information criterion

ABIC: Adjusted Bayesian information criterion

LMR-LRT: Lo-Mendell-Rubin likelihood ratio test

BLRT: Bootstrapped likelihood ratio test

OR: Odds ratio

CI: Confidence interval

Funding

This study was supported by the key R & D project plan of Shaanxi Provincial Department of Science and Technology (No : 2023-YBSF-675).

Acknowledgements

The authors would like to thank all patients for their participation in the study.

Authors' information

Honghui Hospital ,Xi'an Jiaotong University, Xi'an ,Shaanxi ,China.710054, All authors are from the same hospital

References

- [1]Kolasinski SL,Neogi T, Hochberg MC, Oatis C , Guyatt G, Block J,Callahan L, et al. 2019American College of Rheumatology/Arthritis Foundation Guideline for the management of osteoarthritis of the hand, hip, and knee. *Arthritis &Rheumatol.* 2020;72(2):220–33.
<https://doi.org/10.1002/art.41142>
- [2]Sun XS,Zhen XM,Hu XQ, Li YY, Gu SY, Dong HJ. Osteoarthritis in the middle-aged and elderly in china:prevalence and influencing factors.*Int J Environ Res Public Health*,2019;16(23):4701. [https:// doi.org/10.3390/ijerph16234701](https://doi.org/10.3390/ijerph16234701)
- [3] Cui A, Li H, Wang D, Zhong J, Chen Y, Lu H. Global, regional prevalence, incidence and risk factors of knee osteoarthritis in population-based studies. *E Clinical Medicine.* 2020;29–30:100587. [https://doi.org/ 10.1016/j.eclinm.2020.100587](https://doi.org/10.1016/j.eclinm.2020.100587)
- [4] Wu Y, Xu Z, Dong J, et al. Knowledge, Attitudes, and Practices of Patients with Knee Osteoarthritis Regarding Osteoporosis and Its Prevention: A Cross-Sectional Study in China. *Int J Gen Med.* 2024;17:3699-3709. [https://doi.org/ 10.2147/IJGM.S471924](https://doi.org/10.2147/IJGM.S471924)

- [5] Vitaloni M, Angie BBA, Maya CR, Deborah S, Marco B, Maritzaet Q Jordi M,et al.Global management of patients with knee osteoarthritis begins with quality of life assessment: a systematic review. BMC Musculoskelet Disord. 2019;20(1):493.
<https://doi.org/10.1186/s12891-019-2895-3>
- [6] Cabezas, MF, Nazar, G, Ranchor AV,Annema, C.The Effect of Health Literacy Interventions on Self-management in Chronic Diseases: A Systematic Review. Annals of Behavioral Medicine, 2025;59(1), kaaf073. <https://doi.org/10.1093/abm/kaaf073>
- [7] Ellis KR, Young TL, Langford AT. Family Health Equity in Chronic Disease Prevention and Management. Ethn Dis. 2024;33(4):194-199. <https://doi.org/10.18865/ed.33.4.194>
- [8] Sørensen K, Van den Broucke S, Fullam J, Doyle G, Pelikan J, Slonska Z, Brand H, Consortium Health Literacy Project E Health literacy and public health: a systematic review and integration of definitions and models.BMC Public Health.2012;12(1):80. <https://doi.org/10.1186/1471-2458-12-80>
- [9] Wang L, Xu X, Li R, Zhang Y, Cai Y, Tang J, Yang X, Han J, Chen F, Qiao X. Socioeconomic gradients and mechanisms of chronic disease health literacy: the mediating role of preventive healthcare utilization in rural Shangdong, China.Int J Equity Health. 2025;24(1):314.
<https://doi.org/10.1186/s12939-025-02677-y>.
- [10] Kania-Richmond A,Beaupre LA, Jessiman-Perreault G,Tribo D, Martyn J,Hart DA,Robert J,et al.Participants’ perceived benefits from the GLA:D™ program for individuals living with hip and knee osteoarthritis: a qualitative study.Journal of patient-reported outcomes,2024;8(1):62. <https://doi.org/10.1186/s41687-024-00740-w>
- [11]Yin HS, Johnson M, Mendelsohn AL, et al. The health literacy of parents in the United States:

a nationally representative study. *Pediatrics*. 2009;124(Suppl 3):S289–S298. <https://doi.org/10.1542/peds.2009-1162E>

[12] Berkman ND, Sheridan SL, Donahue KE, David J, Karen C. Low health literacy and health outcomes: an updated systematic review. *Ann Intern Med*. 2011;155(2):97–107. <https://doi.org/10.7326/0003-4819-155-2-201107190-00005>

[13] Cheng L, Cao XM, Xing Y, Wei W. Analysis of health literacy status and its influencing factors in elderly patients with knee osteoarthritis. *Chinese Journal of Modern Nursing*. 2023;29(02):209-214. <https://doi.org/10.12677/acm.2024.14112876>

[14] Rognsvåg T, Nordmo IK, Bergvad IB, Fenstad AM, Furnes O, Lerdal A, Lindberg MF. Digital health literacy in Norwegian patients with hip and knee arthroplasty: normative data from a cross-sectional study. *Acta Orthop*. 2024;25;95:677-684. <https://doi.org/10.2340/17453674.2024.42304>

[15] Lane, CY, Soto, SH, Cleveland, Shannon M, Paul D, Stephen M, Callahan, LF. Health literacy level associations with pain, Quality of life, and Physical performance in individuals with Knee Osteoarthritis. *Osteoarthritis And Cartilage*. 2026;S225-S226. <https://doi.org/10.3390/jcm9072294>

[16] Sylwander C, Wahl AK, Andersson MLE, Haglund E, Larsson I. Health literacy in individuals with knee pain-a mixed methods study. *BMC Public Health*. 2023;23(1):1656. <https://doi.org/10.1186/s12889-023-16585-9>

[17] Pa-in P, Wonghongkul T, Panuthai S, et al. Causal model of health literacy in Thai older adults with knee osteoarthritis. *Pacific Rim International Journal of Nursing Research*, 2023;27(2):303-316. <https://doi.org/10.60099/prijnr.2023.262040>

[18] Bandura A. Self-efficacy: toward a unifying theory of behavioral change. *Psychol Rev*.

1977;84:191–215. <https://doi.org/10.1037//0033-295x.84.2.191>

[19] American Medical Association. Health literacy: Report of the Council on Scientific Affairs.

Ad Hoc Committee on Health Literacy for the Council on Scientific Affairs, American Medical Association. JAMA. 1999; 281(6):552-7. [https://doi.org/10.281:5520;281\(6\):552-7](https://doi.org/10.281:5520;281(6):552-7)

[20] Cheng L, Xin Y, He J, Zhang H. Correlation between family support and health literacy in elderly patients with knee osteoarthritis. Chinese Journal of Practical Nursing, 2023;39 (05) : 363-369. <https://doi.org/10.69979/3029-2808.25.12.065>

[21] Yan XM, Lin YC, Li XM, Xue HM. The structural equation model based on mediating effect was used to analyze the influence of health literacy and self-care ability in elderly patients with hypertension. Jilin Medical Journal. 2026;47(1): 167-171.

<https://doi.org/10.3969/j.issn.1004-0412.2026.01.048>

[22] Chen YY, Weng LC, Li YT, et al. Mediating effect of self-efficacy on the relationship between social support and self-management behaviors among patients with knee osteoarthritis: a cross-sectional study. BMC Geriatr. 2022;22(1):635. <https://doi.org/10.1186/s12877-022-03331-w>

[23] Rosenstock I.M. The health belief model and preventive health behavior[J]. Health Educ. Monogr. 1974;2(4):354–386. <https://doi.org/10.1177/109019817800600406>.

[24] Tolera ST, Zerihun E, Hunduma G, et al. Application of health belief model (HBM) in health sciences and medical researches: systematic review on African and Asian countries. BMC Public Health. 2026 Jun 26. <https://doi.org/10.1186/s12889-026-28281-5>.

[25] Nylund-Gibson K, Choi AY. Ten frequently asked questions about latent class analysis. Transl Issues in Psychol Sci. 2018;4(4):440-461. <https://doi.org/10.1037/tps0000176>.

- [26] Chinese Osteoarthritis Diagnosis and Treatment Guidelines Expert Group, Chinese Geriatric Health Association Pain Disease Branch, Huang D, Feng ZG, Hu R, Li YH, Liang LS, et al. Chinese Guidelines for the Diagnosis and Treatment of Osteoarthritis (2024 Edition). Chinese Journal of Pain, 2024,20 (3) : 323-338. <https://doi.org/10.3760/cma.j.cn101658-20240618-00074>
- [27] Sun Haolin. Research and preliminary application of health literacy scale for patients with chronic diseases. Shanghai : Fudan University, 2012.
- [28] Scharzer R, Born A, Iwawaki S, et al. The Assessment of optimistic self-beliefs: comparison of the Chinese, Indonesian, Japanese, and Korean versions of the General Self-Efficacy Scale. *Psychologia*, 1997, 40(1): 1-13.
- [29] Wang CK, Hu ZF, Liu Y. Evidences for reliability and validity of the Chinese version of General Self Efficacy Scale. *Chin J Appl Psychol*, 2001, 7(1): 37-40. <https://doi.org/10.3785/1006-6020.2001.01.0037>
- [30] Procidano ME, Heller K. Measures of perceived social support from friends and from family: three validation studies. *Am J Community Psychol*, 1983; 11: 1-24. <https://doi.org/10.1007/BF00898416>.
- [31] Fu HY. Connotation characteristics, measurement and influencing factors of organizational health literacy in medical institutions. Yangzhou University. <https://doi.org/10.27441/d.cnki.gyzdu.2025.003285>
- [32] Sylwander C, Wahl AK, Andersson MLE, et al. Health literacy in individuals with knee pain-a mixed methods study. *BMC Public Health*. 2023; 29: 23(1): 1656. <https://doi.org/10.1186/s12889-023-16585-9>.
- [33] Wang CL, Lang JT, Xuan LX, et al. The effect of health literacy and self-management efficacy

on the health-related quality of life of hypertensive patients in a western rural area of China: a cross-sectional study. *International Journal for Equity in Health*, 2017;16:58 <https://doi.org/10.1186/s12939-017-0551-9>.

[34] Wang Z, Yu P, Yue Z, et al. Internet-based healthcare services use patterns and barriers among middle-aged and older adults in China: a cross-sectional study. 2025;2;25(1):2188. <https://doi.org/10.1186/s12889-025-23338-3>.

[35] Wang C, Wu X, Chen X, et al. Examining income-related inequality in health literacy and health-information seeking among urban population in China[J]. *BMC Public Health*. 2019 Feb 21;19(1):221. <https://doi.org/10.1186/s12889-019-6538-2>.

[36] Hong H, Goo HJ, Choi H, et al. Income-related Inequalities in Cancer Screening Among Korean Adults Aged 40 and Above: A Cross-sectional Analysis of the Age-varying Mediation of Health Literacy[J]. *J Prev Med Public Health*. 2026 Mar;59(2):184-193. <https://doi.org/10.3961/jpmph.25.866>.

[37] Tomita S, Aoki T, Ohd S., et al. Association between health literacy and multimorbidity: a nationwide, cross-sectional study of a Japanese population. *BMJ Open* 2022;12:e052731. <https://doi.org/10.1136/bmjopen-2021-052731>

[38] Agata Wojcieszek, Anna Kurowska, Anna Majda, Kołodziej K, Liszka H, Gądek A. Relationship between Optimism, Self-Efficacy and Quality of Life: A Cross-Sectional Study in Elderly People with Knee Osteoarthritis. *Geriatrics*, 2023; 8, 101. <https://doi.org/10.3390/geriatrics8050101>

[39] Liu Y, Li BY, Liu LH, Liu WJ, Yao M, Jian XH. Mental health literacy and its relationship with health-promoting behaviors of community-dwelling older adults: A latent profile

analysis. *Geriatric Nursing*. 2025;62:123-130. <https://doi.org/10.1016/j.gerinurse.2025.01.015>

[40] Boer CG, Hatzikotoulas K, Southam L. Deciphering osteoarthritis genetics across 826,690

individuals from 9 populations[J]. *Cell*, 2021, 184(18):4784-4818. [https://doi.org/](https://doi.org/10.1016/j.cell.2021.07.038)

10.1016/j.cell.2021.07.038.

[41] Hatzikotoulas K, Southam L, Stefansdottir L, Boer CG, McDonald ML, Pett JP, Park YC. et al.

Translational genomics of osteoarthritis in 196,206

individuals. *Nature*. 2025;641(8065):1217-1224. <https://doi.org/10.1038/s41586-025-08771-z>