

RESEARCH

Open Access



Approximately half of the nursing students confirmed their willingness to participate in caring for older people: a systematic review and meta-analysis

Yunhua Wang¹, Fengli Lv², Hongyu Zeng² and Jiancheng Wang^{2,3*}

Abstract

Background Global population aging poses a significant global challenge, necessitating an increased demand for proficient caregivers specialized in elderly care. In our study, a systematic review and meta-analysis were conducted to synthesize the evidence concerning nursing students' willingness to participate in caring for older people.

Methods Eligibility criteria focused on cross-sectional studies involving nursing students' willingness to participate in caring for older people and were reported in English or Chinese. PubMed, Web of Science, Embase, Cochrane Library, China National Knowledge Infrastructure (CNKI), and WANFANG databases were searched from inception until July 24, 2022. The methodological quality assessment in the included studies was evaluated using the AHRQ instrument. The pooled effects of the nursing students' willingness to participate in caring for older people were computed using a random-effects model. Funnel plots and Egger's test were employed to evaluate publication bias. Meta-regression and subgroup analysis were performed to explore the sources of heterogeneity. Sensitivity analysis was conducted to verify the robustness of the meta-analysis findings. All statistical tests were conducted with Stata 16.0 software.

Results A total of 68 studies of medium or high quality met the eligibility criteria, involving 30,328 nursing students. The rate of nursing students' willingness to participate in caring for older people was 49.0% (95% CI = 46–53%, $I^2 = 98.1%$, $P = 0.000$). The results of meta-regression analysis showed that the following four predictor variables were significantly associated with nursing students' willingness to participate in caring for older people: experience of living with and caring for older people, nursing as their first choice and their year-level in education, respectively. Subgroup analyses for these four predictor variables revealed the following pooled estimates of nursing students' willingness: having experience of living with older people (0.54, 95% CI = 0.46–0.62) vs. no such experience (0.38, 95% CI = 0.30–0.46), having experience of caring for older people (0.55, 95% CI = 0.48–0.63) vs. no such experience (0.38, 95% CI = 0.30–0.46), nursing as their first choice (0.54, 95% CI = 0.51–0.58) vs. not their first choice (0.44, 95% CI = 0.35–0.53), being in the first year of nursing education (0.44, 95% CI = 0.34–0.55), second year (0.45, 95% CI = 0.34–0.56), and third and fourth year (0.62, 95% CI = 0.53–0.71).

*Correspondence:
Jiancheng Wang
1718026407@qq.com

Full list of author information is available at the end of the article



© The Author(s) 2024. **Open Access** This article is licensed under a Creative Commons Attribution-NonCommercial-NoDerivatives 4.0 International License, which permits any non-commercial use, sharing, distribution and reproduction in any medium or format, as long as you give appropriate credit to the original author(s) and the source, provide a link to the Creative Commons licence, and indicate if you modified the licensed material. You do not have permission under this licence to share adapted material derived from this article or parts of it. The images or other third party material in this article are included in the article's Creative Commons licence, unless indicated otherwise in a credit line to the material. If material is not included in the article's Creative Commons licence and your intended use is not permitted by statutory regulation or exceeds the permitted use, you will need to obtain permission directly from the copyright holder. To view a copy of this licence, visit <http://creativecommons.org/licenses/by-nc-nd/4.0/>.

Conclusion The study found that approximately half of the nursing students confirmed their willingness to participate in caring for older people. The present study can serve as a resource for policymakers to increase the willingness of nursing students to participate in caring for older people.

Keywords Care for older people, Nursing students, Willingness, Meta-analysis

Introduction

Global aging has emerged as a critical global concern, with the older population expected to reach unprecedented levels in the forthcoming decades. As of 2022, the global population aged 65 years and older numbered 771 million, tripling since 1980 [1]. The United Nations predicts that the older population is expected to reach 994 million by 2030 and 1.6 billion by 2050 [1]. China is notably confronting a substantial challenge posed by its aging population, with over 190 million individuals aged 65 or older in 2020, constituting 13.5% of its total population [2]. This places China as the country with the largest elderly population and the fastest-growing aging demographic globally.

Health problems associated with an aging population, such as disability, dementia, depression, and chronic diseases, pose substantial challenges to health services globally. Approximately 1 billion people, constituting 15.6% of the global population, experience varying degrees of disability [3]. In Australia, half (49.6%) of all older Australians had a disability in 2019, with 1.3 million older Australians needing assistance with daily activities [4]. The rate of instrumental activities of daily living (IADL) disability among Japanese adults aged 65 and above reportedly ranges from 7.9 to 23.2% in different regions [5]. By 2040, more than 27.0% of older individuals are projected to experience limitations in performing three or more activities of daily living (ADL) and encounter restrictions in social functioning [5]. In China, the number of older people with disabilities or semi-disabilities reached 40 million in the year 2019. Further, there were 10 million individuals diagnosed with dementia [6]. The number of older individuals with disabilities and dementia is expected to further increase.

The growing population of disabled and semi-disabled older individuals, coupled with the rising prevalence of chronic diseases, has resulted in a substantial increase in demand for care services. These services encompass long-term care, medical treatment, rehabilitation, psychological support, emergency assistance, and end-of-life care for older adults [7, 8]. As such, there is a growing need for skilled service providers to deliver care services to older people. However, nursing students' willingness to participate in caring for older people as a career remains relatively low due to the perceived low degree of specialization, high labor intensity, and lack of recognition in caring for older people. The proportion of nursing students from Hong Kong (7.7%) and Mainland China

(3.6%) who are willing to take care of older people is deficient [9]. Moreover, 8.0% of nursing students in Australia [10], 5.1% of nursing students in Sri Lanka [11], and 1.6% of Baccalaureate Nursing Students in Western Pennsylvania are reportedly considering eldercare as a potential career path [12].

"Willingness" typically denotes a subjective intention to engage in an activity. Nonetheless, there is currently no universally agreed-upon definition regarding willingness to participate in caring for older people. Many experts and scholars emphasize that fostering willingness among students for employment requires close collaboration among governmental bodies, educational institutions, and the job market. Additionally, active engagement from students and their families is crucial in shaping this willingness [13]. In this study, based on the existing literature, nursing students' willingness to participate in caring for older people is defined as their intention to provide care to older people, taking into account individual, familial, and environmental factors. Related concepts such as "attitude" and "interest" are also pertinent. "Attitude" refers to a psychological construct characterized by a learned and relatively stable tendency to react to people, ideas, and situations in an evaluative manner [10]. Culture, age, gender, education, experience, and previous relationships with older people have been identified as factors that influence nursing students' attitudes toward older people [14]. "Interest," within philosophy, education, and psychology, refers to an individual's consciousness and psychological propensity that fosters learning. Ebbinghaus suggests that interest influences the objects of our attention and memory [15]. The interest in participating in eldercare reflects nursing students' inclination towards providing care for older adults. Several studies suggest that positive attitudes towards older adults play a crucial role in fostering nursing students' engagement in geriatric care post-graduation [11, 16, 17]. Cheng et al. demonstrated that personal interest among nursing students is a pivotal factor influencing their decision to pursue geriatric care as a career post-graduation [17]. Nursing students' attitudes towards older people and their interest in eldercare can reflect their willingness to participate.

Negative perceptions towards older people among care providers can lead to the formation of negative attitudes. These attitudes, in turn, can significantly impact care providers' willingness to participate in caring for older people [18]. Research has shown a positive relationship

between nursing students' attitudes toward older people and the willingness to participate in caring for older people. At the same time, positive perceptions and attitudes toward older people can be cultivated through education [19, 20]. Nursing students, with their specialized education, constitute a vital and indispensable segment of the nursing workforce dedicated to caring for older people. At this critical stage of their education, nursing students can be positively influenced and guided to cultivate empathetic attitudes towards older individuals through targeted educational initiatives. By addressing common misconceptions about older people in their education, nursing students can develop more accurate and positive perceptions of elderly individuals, enhancing their readiness to provide effective and compassionate care [21]. The willingness of nursing students to actively participate in caring for older people not only influences their post-graduation employment decisions but also significantly contributes to the quality of care delivered to older people [22].

With the global trend of population aging becoming more pronounced, researchers have increasingly focused on studying nursing students' willingness to participate in caring for older people in recent years. This has led to numerous cross-sectional studies on the topic, but findings across these studies vary. As an example, Okuyan et al. surveyed 688 nursing students in Turkey, with only 29 expressing a willingness to pursue a career in caring for older people [18]. This resulted a low willingness rate of 4.2% among nursing students to care for older people, as observed by Okuyan et al. In contrast, Carlson et al. surveyed 183 nursing students in Sweden and found that 106 expressed a willingness to work with older people [23]. This reflects a relatively high willingness rate of 57.9% among nursing students to participate in caring for older people. Yet, significant global differences exist in nursing students' willingness to participate in caring for older people, influenced by factors such as sample size, survey regions, and individual characteristics of respondents. Despite qualitative reviews of nursing students' willingness to engage in geriatric care [21], there is still a lack of comprehensive and integrated analyses of nursing students' willingness to participate in caring for older people and the related influencing factors. Understanding accurate data on willingness rates and the factors influencing them is crucial for governments and nurse educators to prioritize interventions effectively. As such, in this study, a systematic review and meta-analysis were conducted to synthesize nursing students' willingness rates to participate in caring for older people. The aim was to explore potential factors influencing nursing students' willingness to participate in caring for older people. This exploration is timely and necessary, given the anticipated surge

in demand for caregivers for older populations worldwide due to aging demographics.

Materials and methods

Registration

This meta-analysis was reported following the Preferred Reporting Items for Systematic Reviews and Meta-Analyses guidelines (PRISMA). The PRISMA 2020 checklist items are presented in Supplementary Table 1, detailing the specific reporting aspects considered in this study. The study protocol was registered with the Prospective Register for Systematic Reviews (PROSPERO) under the registration number CRD42022348244.

Search strategy

During the literature search phase, two researchers independently and comprehensively searched six English and Chinese databases, including PubMed, Web of Science, Embase, Cochrane Library, China National Knowledge Infrastructure (CNKI), and WANFANG from inception to July 24, 2022. The Medical Subject Headings (MESH) terms and keywords used in the search were as follows: ("Students, Nursing" OR "undergraduate nurs*" OR "nursing undergraduat*" OR "nursing student*" OR "student nurs*" OR "BSN student*" OR "bachelor of nursing student*" OR "baccalaureate nursing student*" OR "student nurse") AND ("Geriatric Nursing" OR "geriatric care" OR "geriatric nurs*" OR "aged care" OR "gerontology nurs*" OR "old people" OR "elderly" OR "old age" OR "older adults" OR "older population" OR "elder care") AND ("willingness" OR "intent*" OR "attitude" OR "perception*" OR "knowledge" OR "belief*" OR "opinion*" OR "preference*"). Detailed information on the complete search strategy, including the specific search terms and their combinations, can be found in Supplementary Table 2. To ensure a thorough exploration of relevant studies, a process of reference tracking was employed. This included reviewing the references cited in the included articles and consulting pertinent systematic reviews and meta-analyses to identify additional studies that met our inclusion criteria. This method helped to comprehensively gather relevant literature for the analysis.

Inclusion and exclusion criteria

The inclusion criteria for the study included: (1) cross-sectional studies; (2) studies that exclusively examined nursing students as the study population; and (3) the percentage of nursing students' willingness to participate in caring for older people was explicitly reported in the study or could be calculated using the formula: willingness to participate = (number of students willing to participate / total number of students sampled) × 100.0%. The exclusion criteria included: (1) duplicate publications; (2) studies not published in English or Chinese;

and (3) those lacking essential data. When multiple studies were available on the same population, only the most recent data were considered to avoid redundancy.

Study selection and data extraction

Two reviewers independently screened the aforementioned studies, extracted and cross-checked information, and consulted a third reviewer to resolve disagreements. For missing information from the included studies, the authors of the studies were contacted via email to obtain the necessary information. The screening process involved initial assessment through title and abstract reading, followed by exclusion of irrelevant articles, and subsequent full-text review to finalize inclusion based on predefined criteria. Two independent reviewers conducted data extraction from the selected studies, capturing key details such as first author, publication year, study location, investigation timeframe, sampling methodology, sample size, gender distribution, students' origin, only-child status, year-level in education, and the number and percentage of nursing students' willingness to participate in caring for older people.

Methodological quality assessment

The methodological quality of the included studies was assessed using the methodological checklist recommended by the Agency for Healthcare Research and Quality (AHRQ). The AHRQ methodology checklist is regarded as an exceptional tool for evaluating the quality of cross-sectional studies [24]. It is also a widely accepted tool that scholars use to assess the methodological quality of cross-sectional studies [25]. The checklist is available at <http://www.ncbi.nlm.nih.gov/books/NBK35156/> [26]. The tool comprises 11 components encompassing data sources, criteria for inclusion and exclusion, timing and sequence of patient enrollment, subjective factors influencing evaluators, quality assurance assessments, explanation of exclusions, control of confounding variables, management of missing data, response rates, and follow-up procedures. The 11th component, pertaining to potential bias from loss to follow-up, was excluded as it applies specifically to prospective studies. Hence, the present investigation assessed the included studies based on the remaining 10 components. Each component was assessed a rating of "Yes," "No," or "Unclear," with a score of 1 assigned for "Yes" and no score assigned otherwise. A cumulative score of <4 indicated "Low" methodological quality, 4 to 7 indicated "Medium" methodological quality, and >7 indicated "High" methodological quality. The evaluation was conducted independently by two reviewers, with discrepancies resolved through discussions involving a third reviewer.

Meta-regression

Univariate meta-regression analyses were used to explore potential predictors of nursing students' willingness to participate in caring for older people. In developing the review protocol, members of the research team, through a comprehensive review of the literature and several rounds of expert consultation, concluded that gender [8, 23, 27–29], origin of students [8, 29–31], year-level [23, 32–34] and only-child status [8, 30, 35–37] may serve as predictors of nursing students' willingness in caring for older people. These four predictor variables were predefined for analysis. The findings from numerous empirical studies suggest that several factors may influence nursing students' willingness to participate in caring for older people. These factors include the experience of caring for older people [8, 38–41], the experience of living with older people [8, 30, 31, 42], have taken courses on elderly care [29, 38, 42, 43], nursing as their first choice [29, 44–47] and geographical location [8, 10, 19, 20]. Based on these insights, the research team incorporated these five predictor variables post hoc into our analysis. As such, the meta-regression analysis ultimately included nine predictor variables: gender (male vs. female), students' origin (urban vs. rural), only-child status (yes vs. no), the experience of living with older people (yes vs. no), the experience of caring for older people (yes vs. no), have taken courses on elderly care (yes vs. no), nursing as their first choice (yes vs. no), year-level (first, second, third and fourth), country (China vs. others). Data on the sub-groups' willingness to participate in caring for older people were extracted from the publications included in the study.

Subgroup analysis

Subgroup analyses focused on variables that showed statistical significance in univariate regression analyses. The goal was to ascertain pooled estimates of willingness among subgroups of students who demonstrated significant variations in their willingness to participate in caring for older people.

Data analysis and synthesis

Statistical analysis was conducted out using Stata 16.0 software. The percentage of nursing students willing to participate in caring for older people was extracted from the included studies. For studies that did not explicitly report a willingness rate, it was calculated by dividing the total number of nursing students willing to participate in caring for older people by the total number of nursing students. Moreover, 95% CIs were calculated for these proportions. The pooled results were reported using a weighted point estimate of the nursing willingness rate and 95% CIs. Heterogeneity among the included studies was assessed using the χ^2 test with a significance level

of $\alpha=0.10$, and the extent of heterogeneity was quantified using the I^2 statistic. For the meta-analysis, I^2 values $>50\%$ and P -values <0.10 indicated moderate or high heterogeneity, and the random effects model was used; otherwise, the fixed effects model was used. To test the stability of the findings, sensitivity analyses were conducted by systematically excluding one study at a time and observing the resulting changes in the pooled willingness rates from the remaining studies. Additionally, sensitivity analyses were restricted to studies of moderate quality to further validate the stability of the results. Publication bias was assessed using a funnel plot, and asymmetry in the funnel plot was determined using Egger's test. A P -value above 0.05 indicated a low risk of publication bias. A significance level of $P<0.05$ was considered statistically significant.

Results

Search results

A total of 4,961 studies were obtained by preliminary search. After removing 911 duplicates, 4,050 studies underwent further screening. Finally, 68 studies on the willingness of nursing students to participate in caring for older people were included [8, 10, 16, 19, 20, 22, 23, 27–87]. Figure 1 provides an overview of the search and selection process.

Studies characteristics [8, 10, 16, 19, 20, 22, 23, 27–87]

The characteristics of the included studies are presented in Table 1. Sixty-eight articles were ultimately included. A total of 30,328 nursing students were surveyed, and 14,495 were willing to participate in caring for older people. Xiao et al. employed two questionnaires to investigate 256 Australian nursing students and 204 Chinese nursing students, respectively. As a result, each dataset from Xiao et al. was treated as distinct records in the present meta-analysis [32]. The sample sizes ranged from 51 to 1335. Among the 68 studies included, 46 studies were conducted in China [8, 27–35, 37–41, 43, 44, 47, 49, 50, 52, 57–62, 65–72, 76–80, 82–87], and eight studies originated from other countries [10, 16, 19, 20, 22, 23, 32, 48], such as Australia, Italy, Israel, Sweden, Nepal, and Turkey. For the remaining studies, while the geographic area was not explicitly reported, the countries were determined based on the affiliations of the first authors' institutions [36, 42, 45, 46, 51, 53–56, 63, 64, 73–75, 81]. Sixteen studies reported the willingness rates for first-year-level nursing students to participate in caring for older people [23, 30–33, 37, 42, 44, 56, 58, 63–65, 68, 73, 76], 13 reported rates for second-year-level nursing students [30, 31, 37, 42, 44, 49, 63, 65, 68, 72, 74–76], nine reported rates for third year-level nursing students [30, 31, 37, 42, 44, 63, 65, 68, 76], and five reported rates for fourth year-level nursing students [30, 45, 58, 65, 70].

The quality assessment of all included studies exhibited a minimum score of 4 and a maximum score of 8.

Methodological quality assessment results

The study quality assessment revealed that 1 (1.5%) study had high quality [59] and 67 (98.5%) studies had medium quality. All included studies clearly defined the source of information. In the majority of included studies, assessments for quality assurance purposes (98.5%) and summaries of response rates and data completeness (97.1%) were reported. However, none of the studies described the impact of evaluators' subjective factors on their findings or detailed how missing data were handled in their analyses. Further details can be found in Supplementary Table 3.

Meta-analysis results

The random effects model analysis outcomes, conducted across the 68 included studies, indicated a nursing students' willingness rate of 49.0% (95% CI=46–53%, $I^2=98.1\%$, $P=0.000$). A forest plot is shown in Fig. 2.

Meta-regression

The outcomes of the meta-regression analyses reveal significant associations between nursing students' willingness to participate in caring for older people and four out of the nine predictor variables examined: the experience of living with older people, the experience of caring for older people, nursing as their first choice and the year-level of nursing students ($P < 0.05$). Further details are shown in Table 2.

Subgroup analysis

Subgroup analyses for the four predictor variables with significant associations in the meta-regression revealed the following pooled estimates of nursing students' willingness to participate in caring for older people: having experience of living with older people (0.54, 95% CI=0.46–0.62) vs. no such experience (0.38, 95% CI=0.30–0.46), having experience of caring for older people (0.55, 95% CI=0.48–0.63) vs. no such experience (0.38, 95% CI=0.30–0.46), nursing as their first choice (0.54, 95% CI=0.51–0.58) vs. not their first choice (0.44, 95% CI=0.35–0.53), being in the first year of nursing education (0.44, 95% CI=0.34–0.55), second year (0.45, 95% CI=0.34–0.56), and third and fourth year (0.62, 95% CI=0.53–0.71). Further details are provided in Table 3.

Sensitivity analysis

The robustness of the results was evaluated through leave-one-out analyses, where each study was individually excluded, resulting in a slight variation in the willingness rate of nursing students to participate in caring for older people, ranging from 49.0 to 49.9%. This minimal

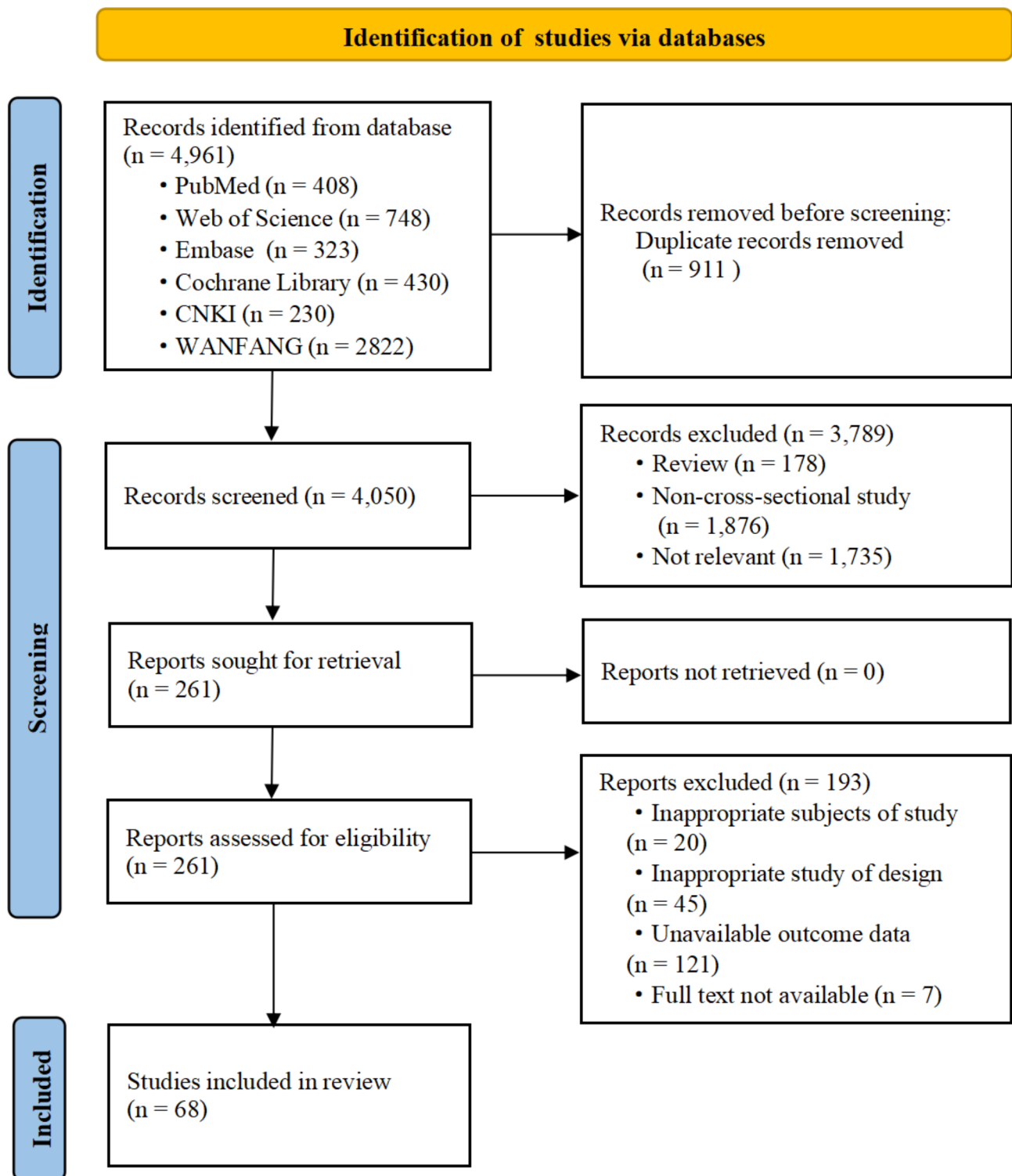


Fig. 1 PRISMA flow diagram of literature search and selection

Table 1 Summary characteristics of included studies about nursing students' willingness to participate in caring for older people

Author, year	Area	Time of survey	Sampling method	Sample size (n)	Gender		Origin of students		Methodological quality score	Willingness rate (n (%))
					Male (n (%))	Female (n (%))	Urban (n (%))	Rural (n (%))		
Carlson E et al. 2015	Sweden	2011.9-2012.12	Convenience sampling	183	37 (22.2%)	146 (79.8%)	/	/	6	106 (57.9%)
Guo YJ et al. 2021	Nantong, China	2017.5-7	Convenience sampling	853	39 (4.6%)	814 (95.4%)	351 (41.2%)	502 (58.8%)	7	325 (38.1%)
Haron Y et al. 2013	Israel	2011	/	486	61 (12.6%)	425 (87.4%)	/	/	5	188 (38.7%)
Lee ACK et al. 2005	Hong Kong, China	/	/	219	27 (12.3%)	192 (87.7%)	/	/	4	90 (41.1%)
Ghimire S et al. 2019	Nepal	2017.11-2018.3	Random sampling	385	0 (0.0%)	385 (100.0%)	/	/	7	308 (80.0%)
Neville C. 2015	Australia	2008.1-6	Convenience sampling	886	93 (10.5%)	793 (89.5%)	/	/	6	239 (27.0%)
Xiao LD et al. 2013 (1)	Australia	/	/	256	/	/	/	/	6	116 (45.3%)
Xiao LD et al. 2013 (2)	China	/	/	204	/	/	/	/	6	147 (72.1%)
Darling R et al. 2018	Turkey	/	Convenience sampling	468	61 (13.0%)	407 (87.0%)	123 (26.3%)	345 (73.7%)	6	260 (55.6%)
Galzignato S et al. 2021	Italy	/	/	383	91 (23.8%)	292 (76.2%)	/	/	6	267 (69.7%)
Lopez-Hernandez L et al. 2021	Spain	2018.2	/	377	91 (24.1%)	286 (75.9%)	/	/	7	114 (30.2%)
Bi F et al. 2016	Chengdu, China	/	/	416	/	/	161 (38.7%)	255 (61.3%)	4	127 (30.5%)
Cai LJ et al. 2020	Fujian, China	2019	Convenience sampling	719	26 (3.6%)	693 (96.4%)	194 (27.0%)	525 (73.0%)	4	150 (20.9%)
Cao YD et al. 2020	Zhengzhou, China	2018.2	/	154	18 (11.7%)	136 (88.3%)	76 (49.4%)	78 (50.6%)	5	65 (42.2%)
Zeng WN et al. 2020	Jiangxi, China	/	/	103	16 (15.5%)	87 (84.5%)	/	/	4	77 (74.8%)
Chen JJ et al. 2019	Zhengzhou, China	2019.5-7	Convenience sampling	317	45 (14.2%)	272 (85.8%)	92 (29.0%)	138 (43.5%)	6	87 (27.4%)
Chen L et al. 2019	Jiangsu, China	2016.12	Stratified random sampling	443	17 (3.8%)	426 (96.2%)	/	/	5	204 (46.1%)
Chen LY et al. 2018	Hangzhou, China	2016.3	Cluster sampling	425	/	/	/	/	7	253 (59.5%)
Cui HX et al. 2021	Hunan, China	2019.1	Stratified cluster sampling	480	117 (24.4%)	363 (75.6%)	179 (37.3%)	301 (62.7%)	6	243 (50.6%)
Huang TN et al. 2018	Hunan, China	2017.11-12	Random sampling	1302	58 (4.5%)	1244 (95.5%)	1077 (82.7%)	225 (17.3%)	7	989 (76.0%)
Ji XF et al. 2019	Fujian, China	/	Convenience sampling	380	26 (6.8%)	354 (93.2%)	57 (15.0%)	323 (85.0%)	4	97 (25.5%)
Li J. 2011	Dezhou, China	2010.7	Cluster sampling	297	60 (20.2%)	237 (79.8%)	242 (81.5%)	55 (18.5%)	4	128 (43.1%)
Li J et al. 2019	Shiyan, China	2019.3-4	/	102	17 (16.7%)	85 (83.3%)	40 (39.2%)	62 (60.8%)	7	78 (76.5%)
Li KZ et al. 2017	Qingdao; Jinan; Jining, China	/	/	491	222 (45.2%)	269 (54.8%)	/	/	5	209 (42.6%)
Li Y. 2014	Changchun, China	2013.8-11	Stratified sampling	774	52 (6.7%)	722 (93.3%)	304 (39.3%)	470 (60.7%)	8	209 (27.0%)
Li YT et al. 2022	Anhui, China	2019.12-2020.3	Convenience sampling	353	87 (24.7%)	266 (75.3%)	77 (21.8%)	276 (78.2%)	6	173 (49.0%)
Liao GX et al. 2012	Yueyang, China	2011.9	/	647	43 (6.6%)	604 (93.4%)	/	/	6	87 (13.5%)

Table 1 (continued)

Author, year	Area	Time of survey	Sampling method	Sample size (n)	Gender		Origin of students		Methodological quality score	Willingness rate (n (%))
					Male (n (%))	Female (n (%))	Urban (n (%))	Rural (n (%))		
Liu Y. 2019	Sichuan, China	/	Stratified cluster sampling	1158	70 (6.0%)	1088 (94.0%)	353 (30.5%)	805 (69.5%)	6	447 (38.6%)
Luo Y et al. 2016	Ningbo, China	2015.3-4	Stratified sampling	1176	36 (3.1%)	1140 (96.9%)	/	/	7	658 (56.0%)
Ning FY et al. 2018	Kunming, China	2018.4	Stratified random sampling	434	73 (16.8%)	361 (83.2%)	85 (19.6%)	349 (80.4%)	7	320 (73.7%)
Ran XM et al. 2021	Chongqing, China	2017.11-2018.2	Convenience sampling	393	16 (4.1%)	377 (95.9%)	87 (22.1%)	306 (77.9%)	7	225 (57.3%)
Wan J et al. 2018	Luzhou, China	/	Cluster sampling	51	3 (5.9%)	48 (94.1%)	17 (33.3%)	34 (66.7%)	4	27 (52.9%)
Wang K et al. 2017	Wuhu, China	/	Stratified cluster sampling	537	46 (8.6%)	491 (91.4%)	185 (34.5%)	352 (65.5%)	4	263 (49.0%)
Wang QL et al. 2019	Fuzhou, China	2016.9-2017.4	Stratified random sampling	563	9 (1.6%)	554 (98.4%)	94 (16.7%)	469 (83.3%)	7	294 (52.2%)
Wang SP et al. 2022	Guangdong, China	2019.10-11	Convenience sampling	973	98 (10.1%)	875 (89.9%)	283 (29.1%)	690 (70.9%)	6	424 (43.6%)
Wang XM et al. 2020	Henan, China	/	Stratified sampling	579	75 (12.9%)	504 (87.1%)	356 (61.5%)	223 (38.5%)	4	334 (57.7%)
Wu WW et al. 2016	Fujian, China	2016.6-7	Convenience sampling	240	32 (13.3%)	208 (86.7%)	77 (32.1%)	163 (67.9%)	6	98 (40.8%)
Xie H et al. 2017	Anhui, China	2016.10	Cluster sampling	500	60 (12.0%)	440 (88.0%)	99 (19.8%)	401 (80.2%)	7	202 (40.4%)
Yang Y et al. 2019	Jiangsu, China	2017.3-10	Random sampling, Stratified sampling	282	7 (2.5%)	275 (97.5%)	114 (40.4%)	168 (59.6%)	6	45 (16.0%)
Yang YJ. 2016	Anhui, China	/	Stratified sampling	732	40 (5.5%)	692 (94.5%)	71 (9.7%)	661 (90.3%)	6	409 (55.9%)
Yang ZP et al. 2020	Chongqing, China	2017.7-2018.3	/	158	6 (3.8%)	152 (96.2%)	57 (36.1%)	101 (63.9%)	7	76 (48.1%)
Zhang CC et al. 2015	Zhengzhou, China	/	Convenience sampling	298	15 (5.0%)	283 (95.0%)	105 (35.2%)	193 (64.8%)	5	207 (69.5%)
Zhang H et al. 2020	Tongling, China	2019.3-12	Stratified random sampling	312	16 (5.1%)	296 (94.9%)	125 (40.1%)	187 (59.9%)	7	91 (29.2%)
Zhang LQ. 2020	Luan, China	/	Random sampling	120	0 (0.0%)	120 (100.0%)	/	/	5	64 (53.3%)
Zhao MY et al. 2021	Changchun, China	2019.8-12	/	290	74 (25.5%)	216 (74.5%)	148 (51.0%)	142 (49.0%)	6	184 (63.5%)
Zhao YJ et al. 2021	Henan, China	2019.12-2020.2	Random sampling	121	11 (9.1%)	110 (90.9%)	24 (19.8%)	97 (80.2%)	6	56 (46.3%)
Zheng XN et al. 2017	Hunan, China	2016.5	Stratified random sampling, Cluster sampling	315	2 (0.6%)	313 (99.4%)	69 (21.9%)	246 (78.1%)	6	178 (56.5%)
Zheng XN. 2017	Hunan, China	/	Stratified random sampling, Cluster sampling	1213	30 (2.5%)	1183 (97.5%)	236 (19.5%)	977 (80.5%)	6	580 (47.8%)
Zhou XL. 2014	Xi'an, China	/	Random sampling	202	12 (5.9%)	190 (94.1%)	36 (17.8%)	166 (82.2%)	4	121 (59.9%)
Li JJ et al. 2019	Anhui, China	/	Convenience sampling	365	17 (4.7%)	348 (95.3%)	107 (29.3%)	258 (70.7%)	6	216 (59.2%)
Hu BY et al. 2014	Zhengzhou, China	2013.12-2014.1	Random sampling	200	4 (2.0%)	196 (98.0%)	17 (8.5%)	183 (91.5%)	4	105 (52.5%)
Cai KX et al. 2019	Jilin, China	/	Convenience sampling	118	25 (21.2%)	93 (78.8%)	66 (55.9%)	52 (44.1%)	5	60 (50.9%)

Table 1 (continued)

Author, year	Area	Time of survey	Sampling method	Sample size (n)	Gender		Origin of students		Methodological quality score	Willingness rate (n (%))
					Male (n (%))	Female (n (%))	Urban (n (%))	Rural (n (%))		
Deng WH et al. 2018	Beijing, Tianjin, Hebei, China	2017.12-2018.3	Stratified random sampling	999	198 (19.8%)	801 (80.2%)	333 (33.3%)	666 (66.7%)	6	440(44.0%)
Fan ST et al. 2021	Shandong, China	/	/	341	26 (7.6%)	315 (92.4%)	79 (23.2%)	262 (76.8%)	4	83 (24.3%)
Han YX et al. 2018	Sichuan, China	/	Convenience sampling	227	9 (4.0%)	218 (96.0%)	97 (42.7%)	130 (57.3%)	6	156 (68.7%)
Luo JF et al. 2015	Jinmen, China	2014.5	Random sampling	231	13 (5.6%)	218 (94.4%)	49 (21.2%)	182 (78.8%)	6	106 (45.9%)
Sun SJ et al. 2017	Tianjin, China	/	Convenience sampling	348	42 (12.1%)	306 (87.9%)	97 (27.9%)	251 (72.1%)	5	216 (62.1%)
Sun TY et al. 2021	Hebei, China	/	Convenience sampling	117	22 (19.4%)	92 (80.6%)	/	/	5	82 (71.9%)
Wang H. 2018	Sichuan, China	/	/	208	12 (5.8%)	196 (94.2%)	/	/	4	86 (41.4%)
Zhang PH et al. 2021	Henan, China	/	/	300	63 (21.0%)	237 (79.0%)	33 (11.0%)	267 (89.0%)	6	145 (48.3%)
Zhang JC et al. 2022	Binzhou, China	2019.10	Convenience sampling	147	24 (16.3%)	123 (83.7%)	12 (8.2%)	135 (91.8%)	6	120 (81.6%)
Zhu QY et al. 2020	Hangzhou, China	/	Convenience sampling	480	14 (2.9%)	466 (97.1%)	184 (38.3%)	296 (61.7%)	6	359 (74.8%)
Chen ZYY et al. 2016	Sichuan, China	/	Cluster sampling	224	20 (8.9%)	204 (91.1%)	58 (25.9%)	166 (74.1%)	4	127 (56.7%)
Fang X et al. 2021	Anhui, China	/	Stratified sampling	1335	104 (7.8%)	1231 (92.2%)	/	/	4	770 (57.7%)
Li LM et al. 2020	Zhaoqing, China	/	Convenience sampling	641	35 (5.5%)	606 (94.5%)	118 (18.4%)	523 (81.6%)	5	320 (49.9%)
Liu YN et al. 2019	Zhejiang, China	/	Random sampling	374	24 (6.4%)	350 (93.6%)	74 (19.8%)	300 (80.2%)	4	196 (52.4%)
Qi YX et al. 2021	Shandong, China	2020.4	Convenience sampling	182	24 (13.2%)	158 (86.8%)	49 (26.9%)	133 (73.1%)	6	103 (56.6%)
Tian KP et al. 2016	Changsha, China	/	Convenience sampling	190	0 (0.0%)	190 (100.0%)	50 (26.3%)	140 (73.7%)	5	57 (30.0%)
Yan LP et al. 2020	Sichuan, China	/	Convenience sampling	551	67 (12.2%)	484 (87.8%)	148 (26.9%)	403 (73.1%)	5	109 (19.8%)

/ = Not reported

fluctuation around the overall combined willingness rate suggests the stability and reliability of the study findings. Further, sensitivity analysis was performed by including only 67 studies of moderate quality. In these studies, the willingness rate of nursing students to participate in caring for older people ranged from 49.3 to 50.3%. This reaffirms the stability and reliability of the study results across studies of moderate quality.

Publication bias

Egger's test results show that publication bias was not present among the studies on the willingness rate of nursing students to participate in caring for older people ($P=0.121 > 0.05$). A funnel plot is shown in Fig. 3.

Discussion

Among the 68 studies included in the present review, the findings reveal that approximately half of the nursing students (49.0% (95% CI=46–53%)) confirmed their willingness to participate in caring for older people. The following factors can influence nursing students' willingness: the experience of living with older people, the experience of caring for older people, nursing as their first choice, and the year level of nursing students.

The subgroup analysis results reveal that nursing students with experience of living with and caring for older people tended to be more inclined to participate in caring for older people [17]. This suggests that direct interaction with older individuals positively influences nursing students' willingness to participate in caring for older people. Previous studies have consistently supported this

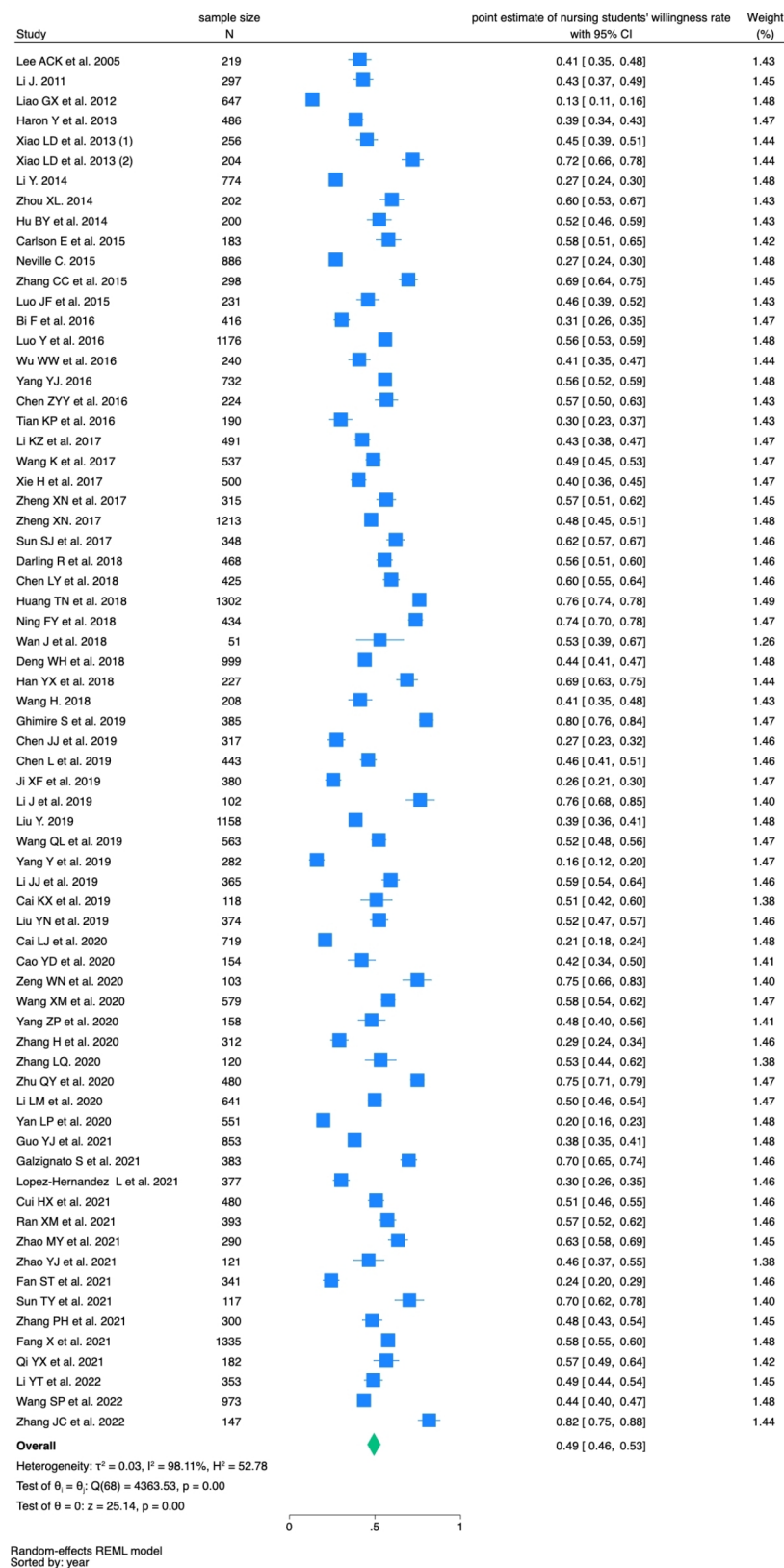


Fig. 2 Meta-analysis for the nursing students' willingness to participate in caring for older people

Table 2 Univariate meta-regression of nursing students' willingness to participate in caring for older people

Variables	Categories	Studies, n	Univariate meta-regression			
			Coefficient	SE	95% CI	P-value
Gender ^a	Male	20	Reference			
	Female	20	-0.01	0.04	-0.10-0.08	0.794
Origin of students ^b	Urban	16	Reference			
	Rural	16	0.08	0.05	-0.03-0.18	0.137
Only-child status ^c	Yes	17	Reference			
	No	17	0.02	0.05	-0.08-0.12	0.617
Have the experience of living with older people ^d	Yes	13	0.16	0.06	0.03-0.28	0.014*
	No	13	Reference			
Have the experience of caring for older people ^e	Yes	12	0.17	0.06	0.05-0.30	0.009*
	No	12	Reference			
Have taken courses on elderly care ^f	Yes	11	0.09	0.07	-0.05-0.23	0.184
	No	10	Reference			
Nursing as their first choice ^g	Yes	11	0.10	0.05	0.00-0.20	0.042*
	No	11	Reference			
Year-level ^h	First	17	Reference			
	Second	13	0.00	0.07	-0.14-0.14	0.980
	Third and Fourth	14	0.17	0.07	0.03-0.31	0.020*
Country	China	46	Reference			
	Others	8	0.01	0.06	-0.11-0.14	0.840

CI=confidence interval; * = $P < 0.05$

^a Data for one study were provided by Sweden and remaining by China

^b Data for all studies were provided by China

^c Data for all studies were provided by China

^d Data for all studies were provided by China

^e Data for all studies were provided by China

^f Data for all studies were provided by China

^g Data for all studies were provided by China

^h For first year-level, data for one study were provided by Sweden, one by Australia and the remainder by China. For second, third and fourth year-level, data for all studies were provided by China

Table 3 Subgroup analysis of nursing students' willingness to participate in caring for older people

Subgroup	Studies, n	Heterogeneity test results		Effect model	Pooled estimate (95% CI)
		I ²	P-value		
Have the experience of living with older people		96.6%	<0.001		0.46 (0.40-0.52)
Yes	13	96.9%	<0.001	Random	0.54 (0.46-0.62)
No	13	92.7%	<0.001	Random	0.38 (0.30-0.46)
Have the experience of caring for older people		97.3%	<0.001		0.47 (0.41-0.53)
Yes	12	96.1%	<0.001	Random	0.55 (0.48-0.63)
No	12	96.5%	<0.001	Random	0.38 (0.30-0.46)
Nursing as their first choice		94.7%	<0.001		0.49 (0.44-0.54)
Yes	11	79.3%	<0.001	Random	0.54 (0.51-0.58)
No	11	95.3%	<0.001	Random	0.44 (0.35-0.53)
Year-level		97.9%	<0.001		0.50 (0.43-0.57)
First	17	98.0%	<0.001	Random	0.44 (0.34-0.55)
Second	13	97.7%	<0.001	Random	0.45 (0.34-0.56)
Third and Fourth	14	93.5%	<0.001	Random	0.62 (0.53-0.71)

CI=confidence interval

perspective [7, 88]. This demonstrates the advantages of practice-based learning in nursing education. Through such approaches, nursing students actively engage in real-world situations of caring for older individuals,

allowing them to apply theoretical knowledge in clinical settings. Experiential teaching methods, like immersive simulations, role-playing, and educational games, are integral to practice-based learning. Research consistently

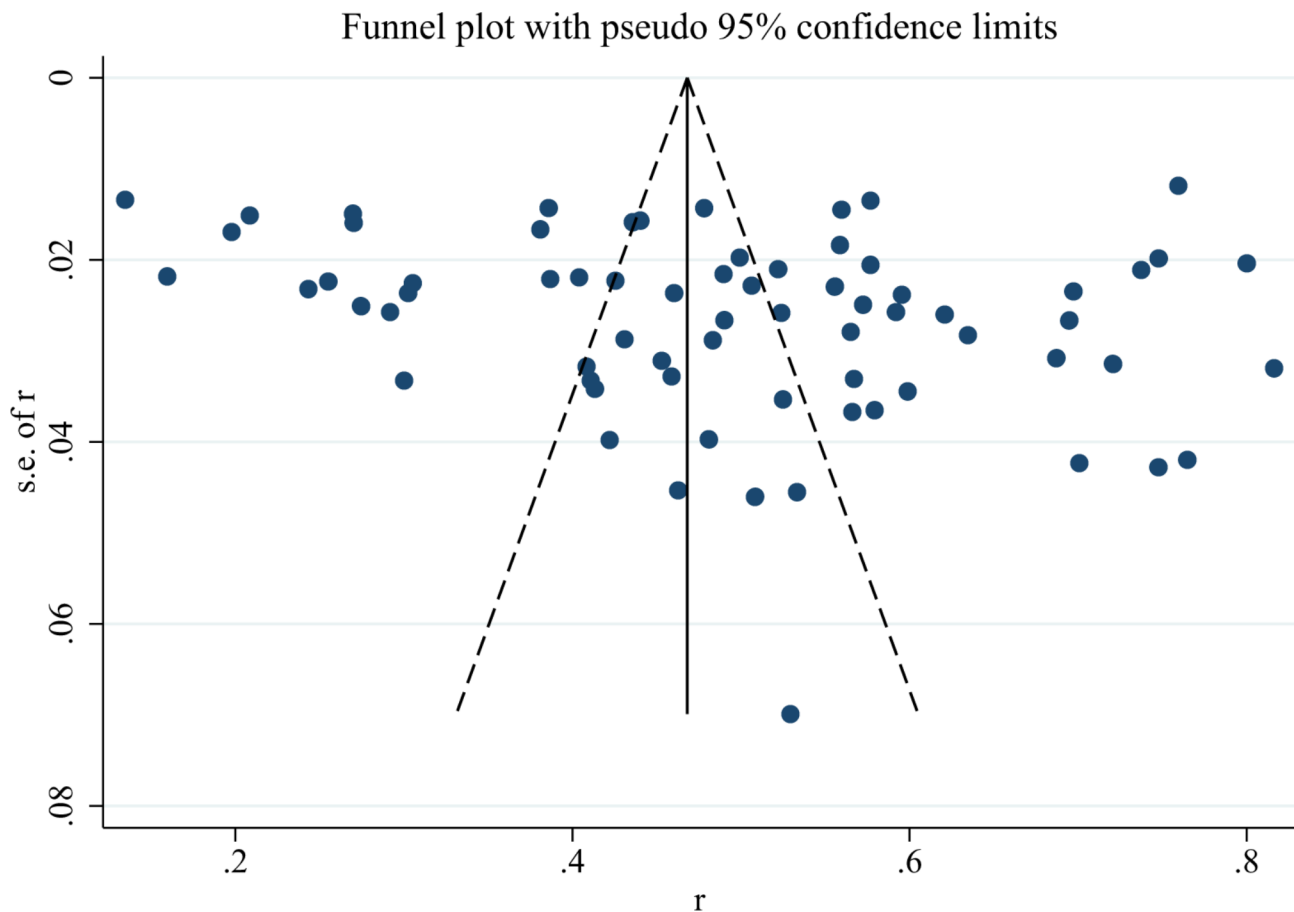


Fig. 3 Funnel plot of publication bias

supports these methods for improving nursing students' attitudes, knowledge, and willingness to participate in caring for older people, thereby fostering competent and compassionate healthcare professionals [89, 90]. In addition, nursing educators should organize voluntary service activities for nursing students in nursing homes, health service stations to increase the opportunities for nursing students to engage with older people and increase their willingness to participate in caring for older people.

Third and fourth year-level nursing students exhibited the highest inclination to participate in caring for older people, followed by second year-level students and first year-level students. In general, third and fourth-year nursing students often have prior exposure to courses on elderly care. Studies suggest that educational programs focusing on aging can significantly influence students' perceptions and willingness to participate in caring for older people [91]. A positive relationship has been observed wherein nursing students with a better grasp of aging tend to exhibit more favorable attitudes toward older people, leading to a heightened readiness to participate in caring for older people [10, 12]. Therefore, it is crucial to enhance nursing students' understanding

and mastery of aging knowledge. This includes developing comprehensive educational programs that equip students with a deeper understanding of the aging process and the complexities of eldercare. Additionally, the present review underscores that nursing students who select nursing as their primary career choice demonstrate a greater willingness to participate in caring for older people post-graduation. This inclination may stem from their inherent preference for the nursing profession and a more positive attitude towards older people [8].

Existing literature on "factors influencing students' willingness to participate in caring for older people" categorizes relevant factors into five main groups: demographics, education, experience, family, and attitude [7, 10–12, 16]. Within the domain of attitude factors, nursing students with more positive attitudes toward older individuals are more likely to participate in caring for them [11, 16, 17]. Concurrently, upon comparing the evidence regarding "factors influencing students' willingness to participate in caring for older people" and "factors influencing nursing students' attitudes towards older people," a notable similarity was identified in the influencing factors between the two. For example, positive

experiences gained through interactions with older individuals and educational strategies focused on gerontology have been linked to a beneficial impact on nursing students' attitudes towards older people [92]. Other studies have also indicated that positive attitudes were associated with education about caring for older people, knowledge about aging, contact with older family members and willingness to work with older people after graduation [93]. Based on existing evidence, nursing students with positive attitudes are more inclined to engage in caring for older individuals, and those with a strong willingness tend to develop more positive attitudes. Therefore, educators play a critical role in fostering these attributes among nursing students. They should focus on developing a comprehensive understanding of older people in nursing students through specialized courses and experiential learning. By enhancing students' knowledge and empathy towards older populations, educators can effectively cultivate positive attitudes and increase their willingness to participate in caring for older people.

The results of this study reveal that among the 68 studies included, 88.2% studies were conducted within China. This suggests an unequal geographical distribution of studies on this topic across different countries. This disparity in nursing students' willingness to participate in caring for older people across countries may stem from variations in the aging population and its growth rates worldwide. Additionally, discrepancies in levels of disability and prevalence of chronic diseases among older individuals globally could contribute to differential research emphasis on nursing students' attitudes towards eldercare. Further analysis and exploration are needed to better understand the underlying reasons for these geographic differences. Future studies should delve into these factors to provide insights into how cultural, demographic, and health-related factors influence nursing students' willingness to participate in caring for older people across diverse national contexts.

Limitations

The present meta-analysis had several limitations. The included studies in this analysis were predominantly cross-sectional and exhibited considerable heterogeneity. Uncertain confounding factors, such as survey methods, measurement instruments, timing of surveys, and geographical diversity, likely contributed to this variability. Despite analyzing various predictor variables, none effectively mitigated this heterogeneity. One possible explanation is that this study focused solely on studies explicitly reporting proportions of nursing students willing to participate in caring for older people, potentially overlooking studies employing more nuanced measurement instruments [91, 94]. However, heterogeneity is often unavoidable in meta-analyses of observational studies

and does not necessarily invalidate meta-analysis results [95]. Notably, because the included studies were cross-sectional, mediators and moderators of nursing students' willingness to participate in caring for older people could not be identified. Therefore, more studies are needed to explore this area in depth to provide guidance for future research on related concepts.

Conclusion

The findings indicate that approximately half of the nursing students confirmed their willingness to participate in caring for older people. The main predictor variables of nursing students' willingness to participate in caring for older people are the experience of living with older people, the experience of caring for older people, nursing as their first choice and year-level. However, there remains a critical need for more high-quality studies with representative samples to further validate these findings. We suggest that future research could leverage the findings of this study as a foundation to conduct more sound experimental studies aimed at evaluating the targeted manipulation of crucial factors, such as "nursing students' experience of caring for older people," and identifying predictors, mediators, moderators, and their underlying mechanisms that influence nursing students' willingness to participate in caring for older people. For example, through early supervised volunteer work of adolescents in social and care services for older people or by revising the syllabus of undergraduate nursing programmes. Furthermore, policymakers can utilize the insights from this study as a resource to develop targeted strategies aimed at increasing nursing students' willingness to participate in caring for older people. By comprehensively addressing these factors, policymakers can effectively support and enhance eldercare within the nursing profession.

Supplementary Information

The online version contains supplementary material available at <https://doi.org/10.1186/s12877-024-05321-6>.

Supplementary Material 1

Acknowledgements

We thank all members of our study team for their whole-hearted cooperation and the original authors of the included studies for their wonderful work.

Author contributions

YHW and JCW planned and designed the research; YHW and FLL provided methodological support/advice; JCW and HYZ tested the feasibility of the study; YHW and HYZ extract data; JCW performed the statistical analysis; YHW wrote the manuscript; all authors approved the final version of the manuscript.

Funding

This work was supported by the National Natural Science Foundation of China (72264002), Gansu Provincial Science and Technology Programme for Outstanding PhD Students (24JRRA503), Key Grant Project of Chinese Medicine Education Association (2022KTZ010). The funders who supported

this study had no role in study design, preparation of the paper, data collection and analysis, decision to publish.

Data availability

The datasets and any other materials of our study are available from corresponding author on request.

Declarations

Ethics approval and consent to participate

Ethics approval and participants consent are not required because this study is a meta-analysis based on the published studies.

Consent for publication

Not applicable.

Competing interests

The authors declare no competing interests.

Author details

¹School of Management, Lanzhou University, Lanzhou 730000, China

²School of Public Health, Lanzhou University, Lanzhou 730000, China

³Gansu Health Vocational College, Lanzhou 730000, China

Received: 5 October 2023 / Accepted: 21 August 2024

Published online: 09 September 2024

References

1. United Nations Department of Economic and Social, Affairs PD, World Population P. 2022: Summary of Results. https://www.un.org/development/desa/pd/sites/www.un.org.development.desa.pd/files/wpp2022_summary_of_results.pdf, 2022-11-15.
2. Central People's Government of the People's Republic of China. Bulletin of the Seventh National Census, http://www.gov.cn/guoqing/202105/13/content_5606149.htm, 2021-5-13. (in Chinese).
3. World Health Organization. World report on disability. https://www.who.int/disabilities/world_report/2011/en/, 2011-11-14
4. Australian Bureau of Statistics. Disability, Ageing and Carers, Australia: Summary of Findings, <https://www.abs.gov.au/statistics/health/disability/disability-ageing-and-carers-australia-summary-findings/latest-release>, 2019-10-24.
5. Kondo K. Progress in Aging Epidemiology in Japan: the JAGES Project. *J Epidemiol*. 2016;26(7):331–6.
6. Central People's Government of the People's Republic of China. When you are old, let us care together – China's exploration to solve the challenge of aging, http://www.gov.cn/xinwen/2019-10/07/content_5436758.htm, 2019-10-07. (in Chinese).
7. Zhang S, Liu YH, Zhang HF, Meng LN, Liu PX. Determinants of undergraduate nursing students' care willingness towards the elderly in China: attitudes, gratitude and knowledge. *Nurse Educ Today*. 2016;43:28–33.
8. Guo Y, Yang L, Zhu L, Wan Y, Zhang S, Zhang J. Willingness and associated factors of working with older people among undergraduate nursing students in China: a cross-sectional study. *BMC Nurs*. 2021;20(1):113.
9. Liu XL, Cheng HL, Lam SC. Predicting undergraduate nursing students' willingness to care for older adults: a multicenter cross-sectional study in Asia. *Nurs Open*. 2022;9(2):1402–11.
10. Neville C. A cross-sectional view of Australian undergraduate nurses' perceptions of working with older people. *Collegian*. 2016;23(3):285–92.
11. Rathnayake S, Athukorala Y, Siop S. Attitudes toward and willingness to work with older people among undergraduate nursing students in a public university in Sri Lanka: a cross sectional study. *Nurse Educ Today*. 2016;36:439–44.
12. Mattos MK, Jiang Y, Seaman JB, Nielsen ML, Chasens ER, Novosel LM. Baccalaureate nursing students' knowledge of and attitudes toward older adults. *J Gerontol Nurs*. 2015;41(7):46–56.
13. Tang T. A study of senior nursing students' willingness to engage in geriatric care in the context of the 1 + X certificate and the factors influencing them. *Nanchang Univ*. 2022. (in Chinese).
14. Lambrinou E, Sourtzi P, Kalokerinou A, Lemonidou C. Attitudes and knowledge of the Greek nursing students towards older people. *Nurse Educ Today*. 2009;29(6):617–22.
15. Ebbinghaus H, Memory. A contribution to experimental psychology[J]. *Annals Neurosciences*. 2013;20(4):155.
16. Haron Y, Levy S, Albagli M, Rotstein R, Riba S. Why do nursing students not want to work in geriatric care? A national questionnaire survey. *Int J Nurs Stud*. 2013;50(11):1558–65.
17. Cheng M, Cheng C, Tian Y, Fan X. Student nurses' motivation to choose gerontological nursing as a career in China: a survey study. *Nurse Educ Today*. 2015;35(7):843–8.
18. Okuyan CB, Bilgili N, Mutlu A. Factors affecting nursing students' intention to work as a geriatric nurse with older adults in Turkey: a cross-sectional study. *Nurse Educ Today*. 2020;95:104563.
19. Ghimire S, Shrestha N, Callahan KE, Nath D, Baral BK, Lekhak N, Singh DR. Undergraduate nursing students' knowledge of aging, attitudes toward and perceptions of working with older adults in Kathmandu Nepal. *Int J Nurs Sci*. 2019;6(2):204–10.
20. Darling R, Sendir M, Atav S, Buyukyilmaz F. Undergraduate nursing students and the elderly: an assessment of attitudes in a Turkish university. *Gerontol Geriatr Educ*. 2018;39(3):283–94.
21. Dai F, Liu Y, Ju M, Yang Y. Nursing students' willingness to work in geriatric care: an integrative review. *Nurs Open*. 2021;8(5):2061–77.
22. Galzignato S, Veronese N, Sartori R. Study of the attitudes and future intentions of nursing students towards working with older people: an observational study. *Aging Clin Exp Res*. 2021;33(11):3117–22.
23. Carlson E, Idvall E. Who wants to work with older people? Swedish student nurses' willingness to work in elderly care—a questionnaire study. *Nurse Educ Today*. 2015;35(7):849–53.
24. Zeng XT, Zhang YG, Kwong JSW, Zhang C, Li S, Sun F, et al. The methodological quality assessment tools for preclinical and clinical studies, systematic review and meta-analysis, and clinical practice guideline: a systematic review. *J Evid Based Med*. 2015;8(1):2–10.
25. Wang W, Yang J, Bai DX, Lu XY, Gong XY, Cai MJ, et al. Nurses' perceptions and competencies about spirituality and spiritual care: a systematic review and meta-analysis. *Nurse Educ Today*. 2024;132:106006.
26. Rostom A, Dub'e C, Cranney A, Saloojee N, Sy R, Garritty C, Sampson M, Zhang L, Yazdi F, Mamaladze V et al. Celiac disease. Retrieved from Evid. Rep. Technol. Assess. (Summ.). 2004; (104):1–6. <https://www.ncbi.nlm.nih.gov/books/NBK35149/>
27. Lee ACK, Wong AK, Loh EK. Score in the Palmore's aging quiz, knowledge of community resources and working preferences of undergraduate nursing students toward the elderly in Hong Kong. *Nurse Educ Today*. 2005;26(4):269–76.
28. Li KZ, Jin C. Analysis and countermeasures of nursing students' willingness to engage in old-age service industry. *Contemp Econ*. 2017;435(3):7–10. (in Chinese).
29. Li YT, Tang ZH, Shao FR. A study on influencing factors of nursing undergraduates' attitude towards the elderly and their willingness to engage in geriatric nursing. *J Mudanjiang Med Univ*. 2022;43(2):156–9. (in Chinese).
30. Ning FY, Xu KJ, Lv J, He LX, Zhang N. Investigation and analysis of undergraduate nursing students' willingness to work in geriatric nursing and its influencing factors. *Sci Technol Inform*. 2018;16(31):252–4. (in Chinese).
31. Wang SP, Yan LL, Li Y, Lu JX. Analysis of influencing factors of vocational nursing students' willingness to engage in geriatric nursing service. *Health Vocat Educ*. 2022;40(8):103–5. (in Chinese).
32. Xiao LD, Shen J, Paterson J. Cross-cultural comparison of attitudes and preferences for care of the elderly among Australian and Chinese nursing students. *J Transcult Nurs*. 2013;24(4):408–16.
33. Bi F, Li ZZ, Zhou CC, Lin Y. A study on the correlation between the willingness to care for the aged and the professional values of first-year nursing students. *Chin Nurs Res*. 2016;30(26):3237–40. (in Chinese).
34. Liao GX, Li GP. Investigation on the intention of nursing freshmen to engage in geriatric nursing. *J Community Med*. 2012;10(18):27–9. (in Chinese).
35. Ran XM, Shen J, Liu WQ, Zhang XY. A survey of vocational nursing students' demand for knowledge practice and their attitude and knowledge towards the elderly in medical and nursing institutions. *Lab Med Clin*. 2021;18(4):566–70. (in Chinese).
36. Xie H, Zhang J, Wang X, Wang J, Hou PJ, Li JZ. Willingness analysis of engaging in the elderly volunteer service and nursing geriatric in nursing undergraduates. *J Bengbu Med Coll*. 2017;42(4):521–4. (in Chinese).
37. Yang Y, Zhai XP. Investigation on the willingness of nursing students in higher vocational colleges to engage in elderly care and its influencing factors. *J Clin Nurs Pract*. 2019;5(8):72–5. (in Chinese).

38. Liu Y. Willingness to Engage in the treatment-care combination nursing homes among Student nurses in Sichuan Province and the influence factors. *Southwest Med Univ.* 2019. (in Chinese).
39. Luo Y, Cao XP, Chen L, Liang SY, Meng RT. An empirical study of nursing students' willingness to work in geriatric nursing based on the theory of planned behavior. *Prev Med.* 2016;28(1):20–3. (in Chinese).
40. Deng WH, Liu SJ, Kou HM, Wang CX, Sun S, Zhang XG. Investigation on the willingness and influencing factors of nursing students engaged in geriatric nursing in Beijing, Tianjin and Hebei. *Diet Health.* 2018;5(35):286–7. (in Chinese).
41. Zhang PH, Su XX, Liang LL. Investigation and analysis of the Career Intention of Nursing Students at different levels. *World Latest Med Inform.* 2021;21(67):278–80. (in Chinese).
42. Cui HX, Ye L. A study on senior nursing students' willingness to work and its influencing factors. *Mod Nurse.* 2021;28(20):83–6. (in Chinese).
43. Zheng XN. Research on willingness of nursing students in Hunan Province to work on geriatric nursing and influencing factor. Hunan Normal University; 2017. (in Chinese).
44. Zhao MY, Wang X, Liu Y, Zhou Q, Ren TY, Ni WZ. Investigation and research on nursing students' intention to work in geriatric nursing under the policy of combining medical and nursing care. *Contemp Med.* 2021;27(19):182–4. (in Chinese).
45. Zhao YJ, Wang SY. Investigation and analysis of the current situation of nursing students' willingness to engage in geriatric nursing. *Practical J Med Pharm.* 2021;38(3):281–4. (in Chinese).
46. Li JJ, Song YX, Tang TM, Wu Q, Jiang QQ, Hong JF. Study on the willingness of undergraduate nursing students to work in nursing home institutions and its influencing factors. *J Nurs (China).* 2019;26(13):1–5. (in Chinese).
47. Luo JF, Qi YM, Xiong LH, Yang JJ, Zhang X. Multiple correspondence analysis on affecting factors of nursing students' willingness engaging in geriatric nursing. *Chin J Practical Nurs.* 2015;31(5):327–9. (in Chinese).
48. Lopez-Hernandez L, Martinez-Arnau FM, Castellano-Rioja E, Botella-Navas M, Perez-Ros P. Factors affecting attitudes towards older people in undergraduate nursing students. *Healthc (Basel).* 2021;9(9):1231.
49. Cai LJ, Gong HR, Wang XN. The investigation and analysis of the knowledge of aging population and the willingness of nursing students in middle and higher vocational schools. *J Qiqihar Med Univ.* 2020;41(12):1530–2. (in Chinese).
50. Cao YD, Zhao JM. Investigation and analysis of undergraduate nursing students' employment intention in elderly care. *Health Vocat Educ.* 2020;38(19):132–4. (in Chinese).
51. Zeng WN, Liang GX. The intention and reason analysis of nursing students' choice of geriatric nursing career. *J Jiujiang Univ (Natural Sci Edition).* 2020;35(4):17–20. (in Chinese).
52. Chen JJ, Feng BQ, Li ZD, Yan MX, Zhang Y, Liu J. Investigation on the attitudes to the Elderly and the intention of seeking a Pension Institution at different levels of nursing graduates. *Smart Healthc.* 2019;5(19):43–5. (in Chinese).
53. Chen L, Zhang DD, Zhang LX, Gao F. Cognitive attitude and influencing factors of vocational nursing students towards geriatric nursing work. *Chin Gen Pract Nurs.* 2019;17(11):1301–4. (in Chinese).
54. Chen LY, Shen YF, Zhang LZ. Analysis on the willingness and influencing factors of nursing vocational students to choose geriatric nursing major. *Health Res.* 2018;38(5):501–4. (in Chinese).
55. Huang TN, He XL, Wang LJ, Xiang B, Yu Y, Chen ML. Analysis of vocational nursing students' cognition degree and working intention of combining medical care and nursing care. *J Nurs Rehabilitation.* 2018;17(12):61–5. (in Chinese).
56. Ji XF, Li H. A survey on the attitude of freshmen in higher vocational nursing towards the elderly and a probe into the reform plan of elderly nursing education. *J Kaifeng Vocat Coll Cult Art.* 2019;39(8):140–2. (in Chinese).
57. Li J. The intention of 297 nursing graduates to engage in geriatric nursing. *Chin J Gerontol.* 2011;31(9):1625–7. (in Chinese).
58. Li J, Wang HM. A cross-sectional study of undergraduate nursing students' willingness to work in geriatric nursing and related factors. *Health Vocat Educ.* 2019;37(21):135–7. (in Chinese).
59. Li Y. Survey and research on nursing students' attitudes, knowledge and work preferences toward older people. *Jilin Univ.* 2014. (in Chinese).
60. Wan J, Yang XL, Liu L, Zhang Q, Fu J. A survey on the attitude of nursing graduate students towards the elderly and their willingness to work in geriatric nursing. *Health Vocat Educ.* 2018;36(11):116–8. (in Chinese).
61. Wang K, Wang L, Ma X, Liu H, Zhang SJ, Wen RG, Jiang LC, Zhao X. Career intentions of nursing students at different levels for elderly care and its causative analysis. *Chin Nurs Res.* 2017;31(20):2510–2. (in Chinese).
62. Wang QL, Shen L, Cui YX, Dai TT, She JJ, Zhang Q, Wang Y. Analysis of nursing students' attitude, knowledge and employment intention towards the elderly in Fuzhou. *Mod Nurse.* 2019;26(1):12–6. (in Chinese).
63. Wang XM, Zhang XX, Zhu YM. An analysis of professional nursing students' employment intention in geriatric nursing. *J Henan Med Coll.* 2022;32(6):664–6. (in Chinese).
64. Wu WW, Wu WJ. Relationship between perceptions of gerontological nursing and intent to work in geriatrics among freshmen nursing students. *J Nurs Sci.* 2016;31(11):83–6. (in Chinese).
65. Yang YJ. Research on five-year higher Vocational College nursing students' aging knowledge, attitude towards the Elderly and Employment Intention of Engaging in the Elderly Care. *Anhui Med Univ.* 2016. (in Chinese).
66. Yang ZP, Li L, Zhu HM, Yang D. A survey on the willingness and influencing factors of college and secondary school nursing students to engage in old-age care. *J Mod Med Health.* 2020;36(5):791–4. (in Chinese).
67. Zhang CC, Liu GP, Yan B. A comparative analysis of the attitude and employment intention of nursing students of different levels towards geriatric nursing. *Health Vocat Educ.* 2015;33(11):102–4. (in Chinese).
68. Zhang H, Zhang B. Investigation and analysis of nursing students' willingness to engage in elderly care and its influencing factors under the background of 1 + X certificate pilot. *J Shenyang Med Coll.* 2020;22(5):463–8. (in Chinese).
69. Zhang LQ. Analysis of nursing professional intention and influencing factors of nursing students in higher vocational colleges. *Health Vocat Educ.* 2022;38(19):138–9. (in Chinese).
70. Zheng XN, Wang WH. A comparison of different levels of graduate nursing students' attitudes towards the elderly, their knowledge of aging and their willingness to care. *Chin Gen Pract Nurs.* 2017;15(4):476–8. (in Chinese).
71. Zhou XL. Survey and analysis on status quo of attitude and willingness of nursing undergraduates on caring the elderly. *Chin Nurs Res.* 2014;28(2):529–31. (in Chinese).
72. Hu BY, He K. Survey of nursing students in vocational colleges engaged in nursing and attitude towards the elderly. *J Front Med.* 2014;82–3. (in Chinese).
73. Cai KX, Wang X, Zhang HL. Analysis on the willingness of nursing students in school to engage in elderly care and its influencing factors. *Health Prot Promotion Health Prot Promotion.* 2019;240–1. (in Chinese).
74. Fan ST, Guo JQ. Study on vocational nursing students' employment intention and management strategy under the mode of combination of medical and nursing care. *Course Educ Res.* 2021;8(23):191–6. (in Chinese).
75. Han YX, Huang BY, He XJ, Li J, Long YJ, Su GM, Ouyang ZF. A survey of vocational nursing students' occupational cognition and employment intention. *Course Educ Res.* 2018;25:233–4. (in Chinese).
76. Sun SJ, Wang Y, Zeng Z, Zhang WJ, Bai XL, Wang QQ, Huang D. Investigation and analysis of related knowledge and career intention of geriatric nursing undergraduates. *Chin J Practical Nurs.* 2017;33(2):149–52. (in Chinese).
77. Sun TY, Zhang JW, Bu YY, Ding RR, Liu ZY. Investigation and analysis of nursing students' intention of employment in geriatric nursing and suggestions. *Shenzhen.* 2021;354–5. (in Chinese).
78. Wang H. Investigation and analysis of influencing factors of nursing undergraduates' willingness to engage in geriatric nursing. *Diet Health.* 2018;5(38):5–6. (in Chinese).
79. Zhang JC, Gao XH, Liu XJ, Han YX. Analysis of cognition, motivation to participate in training, willingness to engage in elder care work and its influencing factors of vocational nursing students with 1 + X Certificate-taking 1 + X elder care vocational skill level Certificate as an example. *Mod Vocat Educ.* 2022;92–4. (in Chinese).
80. Zhu QY, Qiu XY. Investigation and analysis of employment intention of undergraduate nursing students in geriatric nursing in Hangzhou. *Mod Vocat Educ.* 2020;234–6. (in Chinese).
81. Chen ZZY, Ju M, Sun ZKJM, Yang XL. A survey of senior nursing students' attitude towards the elderly. *Guangdong Med J.* 2016;37(22):3451–4. (in Chinese).
82. Fang X, Huang GB, Cai DD, Yang XJ. Correlation analysis of vocational nursing students' aging knowledge and attitude towards the elderly. *Health Vocat Educ.* 2021;39(17):138–40. (in Chinese).
83. Li LM, Huang DD, Zhu Y. Study on the correlation between nursing students' attitude towards the elderly, self-efficacy and knowledge level of the elderly. *Guangxi Med J.* 2020;42(18):2467–70. (in Chinese).

84. Liu YN, Yao JL, Zhang XW, Shen XH, Fang J. Nursing students' attitude towards the elderly and its influencing factors. *Sci Technol Inform*. 2019;17(28):178–80. (in Chinese).
85. Qi YX, Yu XJ, Wang RW, Zhang NN. Analysis of influencing factors of undergraduate nursing students' attitude towards the elderly. *Health Vocat Educ*. 2021;39(15):91–4. (in Chinese).
86. Tian KP, An RJ, Huang H, Yi QF, Yu X. A study on the correlation between nursing students' attitude towards the elderly and their professional values. *Chin Nurs Res*. 2016;30(06):676–9. (in Chinese).
87. Yan LP, Huang YM, Xiong ZZ. An analysis of the attitude of nursing students in different universities towards the elderly and their understanding of the knowledge of the elderly. *Mod Nurse*. 2020;27(08):24–7. (in Chinese).
88. King BJ, Roberts TJ, Bowers BJ. Nursing student attitudes toward and preferences for working with older adults. *Gerontol Geriatr Educ*. 2013;34(3):272–91.
89. Hu R, Gao H, Ye Y, Ni Z, Jiang N, Jiang X. Effectiveness of flipped classrooms in Chinese baccalaureate nursing education: a meta-analysis of randomized controlled trials. *Int J Nurs Stud*. 2018;79:94–103.
90. Torkshavand G, Khatiban M, Soltanian AR. Simulation-based learning to enhance students' knowledge and skills in educating older patients. *Nurse Educ Pract*. 2020;42:102678.
91. Cheng WL. Roles of knowledge and attitude in the willingness of nursing students to care for older adults in Hong Kong. *Int J Environ Res Public Health*. 2021;18(15):7757.
92. Magan KC, Ricci S, Hathaway E. Factors influencing baccalaureate nursing students' attitudes toward older adults: an integrative review. *J Prof Nurs*. 2023;47:1–8.
93. Venables H, Wells Y, Fetherstonhaugh D, Wallace H. Factors associated with nursing students' attitudes toward older people: a scoping review. *Gerontol Geriatr Educ*. 2023;44(1):131–50.
94. Che CC, Chong MC, Hairi NN. What influences student nurses' intention to work with older people? A cross-sectional study. *Int J Nurs Stud*. 2018;85:61–7.
95. Noubiap JJ, Balti EV, Bigna JJ, Echouffo-Tcheugui JB, Kengne AP. Dyslipidaemia in Africa-comment on a recent systematic review - authors' reply. *Lancet Glob Health*. 2019;7(3):e308–9.

Publisher's note

Springer Nature remains neutral with regard to jurisdictional claims in published maps and institutional affiliations.