

Professional values among nursing students: a systematic review and meta-analysis

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Abstract

Background

To systematically assess the level of professional values among nursing students and synthesize professional values scores using meta-analysis, while exploring sources of heterogeneity to inform nursing education strategies.

Methods

Two reviewers independently searched relevant databases and selected eligible studies according to predefined criteria. The methodological quality of included studies was assessed using the AHRQ tool. Studies evaluating nursing students' professional values with the NPVS, NPVS-R, or NPVS-3 and reporting sufficient data for meta-analysis were included. Data were analyzed using Stata 15.0, and a random-effects model was applied to pool the mean professional values scores.

Results

A total of 72 cross-sectional studies from 18 countries involving 32,538 nursing students were included. Three instruments (NPVS, NPVS-R, and NPVS-3) were identified, with NPVS-R being the most frequently used. The pooled mean score of professional values was 101.25 (95% CI: 99.64–102.85) using a random-effects model. Subgroup analysis showed different pooled scores across instruments, with NPVS, NPVS-R, and NPVS-3 scores of 93.95, 101.44, and 112.25, respectively.

Conclusions

The professional values of nursing students have shown an overall upward trend in recent years and have generally remained at a relatively positive level. Nursing educators should pay close attention to variations in the development of professional values across different cultural and educational contexts, integrate professional values education throughout the entire nursing curriculum, and implement targeted educational strategies tailored to students from different regions and at different stages of training.

Introduction

Professional values constitute an important ethical foundation for nursing practice, guiding nurses' moral judgement, clinical decision-making, and professional conduct, and are closely associated with the delivery of safe, high-quality, and person-centred care ^[1] Professional values also provide a conceptual basis for guiding professional conduct and practice and are reflected in a range of

competency statements related to professional nursing practice^[2] Previous studies have shown that professional values influence nurses' behaviours in clinical practice and provide an important basis for moral judgement, professional responsibility, and accountable practice^{[3][4]} Within nursing, professional values encompass key dimensions including caring, trust, justice, professionalism, and activism^[5] An integrative review by Antoniou et al. ^[3] reported that professional values are embedded within nursing standards, professional guidelines, and healthcare policies across different countries and are regarded as an essential component of safe and professional nursing practice.

Nursing education represents a critical period for the formation, development, and internalisation of professional values among nursing students ^[6] As future members of the nursing workforce, nursing students begin to develop and internalise the values of the nursing profession upon entering nursing education through classroom learning, clinical practice, faculty role modelling, and interactions with practising nurses. Previous studies ^{[6][7]} have shown that the development of professional values among nursing students is influenced by multiple factors, including educational experiences, clinical practice, cultural context, and individual characteristics, with education and professional experience, cultural environment, and learner-related characteristics emerging as particularly important influences. As students progress through their nursing programmes and gain clinical practice experience, their understanding and interpretation of professional nursing values may continue to evolve ^[8]. Well-developed professional values may contribute to the development of professional identity and a sense of professional responsibility among nursing students and may further support their engagement in learning, commitment to the nursing profession, and ethical conduct in future nursing practice. Therefore, a comprehensive understanding of the level of professional values among nursing students is important for identifying potential gaps in nursing education, informing the development of professional values education, and facilitating students' professional socialisation.

In recent years, numerous cross-sectional studies have investigated professional values among nursing students across different countries and settings, commonly using the Nurses Professional Values Scale (NPVS), the Nurses Professional Values Scale-Revised (NPVS-R), and the Nurses Professional Values Scale-3 (NPVS-3) to assess professional nursing values. However, the levels of professional values reported among nursing students have varied considerably across studies ^[9]. Studies also differ substantially with regard to country and cultural context, nursing education systems, year of publication, and measurement instruments, all of which may contribute to between-study variability. Consequently, findings from individual studies alone may be insufficient to provide a comprehensive estimate of the overall level of professional values among nursing students or to characterise how these values vary across populations and study contexts.

To date, research on professional values among nursing students has largely been conducted within individual countries, regions, or educational institutions, with previous studies primarily describing the level of professional values and examining their associated factors. In contrast, evidence quantitatively synthesising the level of professional values among nursing students across countries remains limited

[10]. Moreover, no previous meta-analysis has quantitatively estimated the overall level of professional values among nursing students or examined potential sources of heterogeneity across studies. Therefore, a systematic review and meta-analysis is warranted to synthesise the available evidence, obtain a more robust overall estimate of professional values among nursing students, and further explore potential sources of between-study heterogeneity.

Methods

2.1. Design

This systematic review and meta-analysis was reported according to the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) 2020 statement and was registered on the PROSPERO website (registration number: CRD420261475886).

2.2. Eligibility and exclusion criteria

Inclusion criteria:(1)Studies were eligible if the participants were nursing students enrolled in formal nursing education programmes, including diploma, undergraduate, or other recognised nursing programmes. Studies including mixed populations were eligible only when data for nursing students could be extracted separately.¶2¶Study design: Only cross-sectional studies reporting the level of professional values among nursing students were included.¶3¶Professional values were required to be assessed using the original Nurses Professional Values Scale (NPVS), the Nurses Professional Values Scale-Revised (NPVS-R), or the 28-item Nurses Professional Values Scale-3 (NPVS-3).¶4¶Studies were required to provide sufficient quantitative data for meta-analysis, including sample size, mean total professional values score, and standard deviation, or other statistical information from which these values could be derived.

Exclusion criteria

- Studies that did not involve nursing students were excluded. Studies including nursing students together with nurses, students from other health professions, or other populations were excluded when data for nursing students could not be extracted separately.(2)Studies were excluded if they did not use the original NPVS, NPVS-R, or NPVS-3, or if they used modified or adapted versions involving item addition or deletion, structural alteration, or redevelopment, particularly when the number of items differed from that of the corresponding original scale.¶3¶Studies were excluded if they did not report the total professional values score or did not provide sufficient data, such as sample size, mean, and standard deviation, and these values could not be derived from the reported statistics.¶4¶When multiple publications were based on the same or substantially overlapping samples, only the report with the largest sample size, the most complete data, or the greatest relevance to the review objective was retained to avoid double-counting participants.¶5¶Studies published in languages other than English or Chinese.

2.3 Study search and selection

A comprehensive literature search was conducted in eight electronic databases, including China National Knowledge Infrastructure (CNKI), Wan Fang Database, VIP Database, Chinese Biomedical Literature Database (CBM), PubMed, Embase, Web of Science, and CINAHL, from database inception to August 2026.

The search strategy was developed by two reviewers and adapted according to the characteristics of each database. A combination of controlled vocabulary and free-text terms was used to maximize the sensitivity and comprehensiveness of the literature search. The search strategy mainly focused on two core concepts: (1) nursing students and (2) professional values.

For the nursing student concept, relevant controlled vocabulary and free-text terms were used, including “Students, Nursing”, “nursing student*”, “student nurse*”, “undergraduate nursing student*”, “baccalaureate nursing student*”, and “prelicensure nursing student*”. For the professional values concept, Medical Subject Headings (MeSH) terms and free-text terms were combined, including “professional values”, “professional nursing value*”, “nursing professional value*”, “nurse professional value*”, and “nursing value*”. To improve retrieval comprehensiveness, specific names and abbreviations of professional values assessment instruments were also included, including “Nurses Professional Values Scale”, “Nurses Professional Values Scale-Revised”, “Nurses Professional Values Scale-3”, “NPVS”, “NPVS-R”, and “NPVS-3”.

Two reviewers (SXJ and YY) independently screened the retrieved records by title, abstract, and full text according to the predefined eligibility criteria. Any disagreements during the study selection process were first resolved through discussion between the two reviewers and further verified by a third reviewer (DYW) when necessary. The study selection process was presented using a PRISMA flow diagram.

2.4 Quality appraisal

All studies included in this review were cross-sectional studies; therefore, the methodological quality of the included studies was assessed using the Agency for Healthcare Research and Quality (AHRQ) cross-sectional study quality assessment checklist (Zeng et al., 2015). The AHRQ checklist consists of 11 items, with a maximum score of 11 points. Each item was rated as “Yes”, “No”, or “Unclear”. A response of “Yes” indicated that the study met the quality criterion and was assigned 1 point, whereas “No” and “Unclear” responses were assigned 0 points. Higher scores indicated better methodological quality. Studies scoring 0–3, 4–7, and 8–11 points were classified as having low, moderate, and high methodological quality, respectively. The methodological quality of the included studies was independently assessed by two reviewers (SXJ and YY), and disagreements were resolved through discussion; when consensus could not be reached, a third reviewer (DYW) was consulted for verification.

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were first resolved through discussion between the two reviewers and further verified by a third reviewer (DYW) when necessary. The study selection process was presented using a PRISMA flow diagram.

2.5 Data extraction

Data extraction was independently performed by two reviewers (SXJ and YY) using a predefined Excel spreadsheet. The following information was extracted from each included study: first author, publication year, country, sample size, type of professional values assessment instrument, and professional values scores. For the quantitative synthesis, the sample size, mean score, and standard deviation of the total professional values score were extracted. When the required data were not directly reported, relevant information was calculated or converted based on the available data reported in the original studies whenever possible.

The extracted data were independently cross-checked by the two reviewers. Any disagreements were resolved through discussion; when consensus could not be reached, a third reviewer (DYW) was consulted for further verification.

2.6 Data synthesis

All statistical analyses were performed using Stata version 15.0 (StataCorp, College Station, TX, USA). As all included studies assessed nursing students' professional values using continuous measurement scales, the pooled mean score of the total professional values score was used as the effect estimate. Heterogeneity in meta-analysis can be classified into clinical heterogeneity, methodological heterogeneity, and statistical heterogeneity. Statistical heterogeneity among studies was assessed using Cochran's Q test and the I^2 statistic. An I^2 value > 50% with a P value < 0.10 was considered indicative of substantial heterogeneity. Given the expected variations in country characteristics, educational contexts, measurement instruments, and study characteristics among the included studies, a random-effects model was applied to pool the effect estimates. When substantial heterogeneity was identified, subgroup analyses and sensitivity analyses were conducted to explore potential sources of heterogeneity. Meta-regression analyses were performed to examine whether study-level characteristics, including publication year, country/region, measurement instrument, sample size, and methodological quality, explained variations in professional values scores. Sensitivity analysis was performed using a leave-one-out approach to evaluate the robustness of the pooled estimates. Publication bias was assessed using funnel plots and Egger's regression test. An Egger's test P value > 0.05 indicated no statistically significant evidence of publication bias. All statistical tests were two-sided, and P < 0.05 was considered statistically significant.

Results

3.1 Search results

A total of 1,696 records were identified through searches of eight electronic databases, including 471 records from PubMed, 270 from Embase, 336 from CINAHL, 200 from Web of Science, 52 from China

National Knowledge Infrastructure (CNKI), 28 from VIP Database, 266 from the Chinese Biomedical Literature Database (CBM), and 73 from the Wan Fang Database. After removing 726 duplicate records, 970 records remained for title and abstract screening. Following title and abstract screening, 805 records were excluded because they were irrelevant to the research topic. Subsequently, the remaining records were assessed in full text according to the predefined eligibility criteria. A total of 22 review articles and 71 studies were excluded due to unavailable full texts or insufficient data. Finally, 72 cross-sectional studies were included in the systematic review. Because some studies reported data from multiple independent samples or subgroups, 85 independent datasets involving 32,538 nursing students were extracted for quantitative synthesis. The study selection process is illustrated in the PRISMA flow diagram (Fig. 1).

3.2 Included study characteristics

A total of 72 cross-sectional studies involving 32,538 nursing students were included, contributing 85 independent datasets for meta-analysis. Because some studies reported multiple independent samples or subgroup data, 85 independent datasets were extracted for quantitative synthesis. The included studies were published between 2011 and 2026 and were conducted across 18 countries, involving a total of 32,538 nursing students. The detailed characteristics of the included studies are presented in Table 1.

The sample sizes of the included datasets ranged from 47 to 1,623 participants. All studies assessed nursing students' professional values using validated measurement instruments, including the Nurses Professional Values Scale (NPVS), Nurses Professional Values Scale-Revised (NPVS-R), and Nurses Professional Values Scale-3 (NPVS-3). Among the 85 independent datasets, 11 used the NPVS, 68 used the NPVS-R, and 6 used the NPVS-3.

The included studies varied in terms of country, educational context, and professional values assessment instruments. Detailed information regarding the authors, publication year, country, sample size, measurement instrument, and professional values scores is summarised in Table 1.

Table 1 Characteristics of included studies

study	year	country	scale	Items	n	mean	sd
Chen C ^[11]	2022	China	NPVS-R	26	204	94.47	19.08
Cui YL ^[12]	2016	China	NPVS	26	350	114.12	13.35
Deng Y ^[13]	2014	China	NPVS	26	1002	100.6	16.9
Ge LP ^[14]	2021	China	NPVS-R	26	298	96.17	14.17
Gong YY ^[15]	2011	China	NPVS-R	26	496	92.41	14.99
Guo HD ^[16]	2016	China	NPVS-R	26	271	98.54	14.26
Guo SY ^[17]	2022	China	NPVS	26	306	94.04	11.83
Hao P ^[18]	2023	China	NPVS-R	26	174	97.46	10.75
He TT ^[19]	2018	China	NPVS-R	26	506	98.28	11.44
He TT ^[19]	2018	China	NPVS-R	26	400	92.82	10.4
Jing XL ^[20]	2023	China	NPVS-R	26	811	96.64	13.84
Li M ^[21]	2018	China	NPVS-R	26	408	96.95	12.43
Liao ZH ^[22]	2018	China	NPVS-R	26	216	100.1	13.8
Liu H ^[23]	2013	China	NPVS-R	26	487	84.16	7.27
Mu X ^[24]	2012	China	NPVS	26	75	89.96	15.08
Liu CE ^[25]	2016	China	NPVS	26	200	97.24	23.14
Liu YL ^[26]	2017	China	NPVS	26	81	86.06	14.3
Mu X ^[27]	2011	China	NPVS	26	122	78.58	26.52
Su W ^[28]	2014	China	NPVS-R	26	486	89.09	16.17
Qin LL ^[29]	2013	China	NPVS-R	26	210	98.8	9.1

Tian QJ ^[30]	2021	China	NPVS-R	26	1241	97.3	18.79
Wang SS ^[31]	2012	China	NPVS-R	26	152	95.68	8.84
Wang SS ^[31]	2012	Philippines	NPVS-R	26	124	108.94	9.62
Wang XL ^[32]	2010	China	NPVS	26	94	86.51	10.4
Wei YX ^[33]	2022	China	NPVS	26	1247	93.45	15.48
Wu S ^[34]	2023	China	NPVS	26	410	93.42	15.33
Xian XM ^[35]	2011	China	NPVS-R	26	187	105.87	14.56
Xiao H ^[36]	2020	China	NPVS-R	26	615	98.28	14.89
Xu ZF ^[37]	2013	China	NPVS-R	26	227	90.74	11.56
Xu ZF ^[37]	2020	China	NPVS-R	26	585	90.7	10.88
Xu P ^[38]	2016	China	NPVS-R	26	1048	94.69	18.85
Xue G ^[39]	2019	China	NPVS-R	26	433	100.1	17.16
Yan LF ^[40]	2021	China	NPVS-R	26	1131	97.61	19.68
Yan LF ^[40]	2020	China	NPVS-R	26	1042	98.53	20.38
Yang LL ^[41]	2015	China	NPVS-R	26	201	98.54	20.02
Yang XM ^[42]	2013	China	NPVS-R	26	238	95.69	10.65
Yang Y ^[43]	2015	China	NPVS-R	26	810	100.33	16.51
ZhangJY ^[44]	2013	China	NPVS-R	26	223	83.9	13.93
ZhangZX ^[45]	2013	China	NPVS-R	26	238	95.68	10.66
Zhou YJ ^[46]	2015	China	NPVS-R	26	416	89.96	14.3

Abu-El-Noor ^[47]	2023	Jordan + Palestine	NPVS-R	26	535	100.16	18.83
Alfred ^[48]	2013	China	NPVS-R	26	94	104.27	16.81
Alfred ^[48]	2013	USA	NPVS-R	26	168	106.16	12.93
Alkaya ^[49]	2017	Turkey	NPVS-R	26	548	101.6	17
Alkaya ^[49]	2017	USA	NPVS-R	26	180	109.2	12.3
Allari ^[50]	2022	Jordan	NPVS-R	26	182	99.68	22.5
Allari ^[50]	2017	Saudi Arabia	NPVS-R	26	108	106.34	13.78
AydinAyla ^[51]	2018	Turkey	NPVS-R	26	188	103.25	16.96
Bijani ^[52]	2017	Iran	NPVS-R	26	341	101.92	13
Chen ^[53]	2021	China	NPVS-R	26	263	101.75	13.35
Cheung ^[54]	2026	China	NPVS-R	26	1623	104.37	12.93
Çöplü et al ^[55]	2018	Turkey	NPVS-R	26	619	100.38	18.89
Cosmai et al. ^[56]	2025	Italy	NPVS-3	28	358	126	20.72
Domínguez-Martís et al. ^[57]	2025	Spain	NPVS-R	26	248	112.61	16.001
Donmez & Ozsoy ^[58]	2016	Turkey	NPVS-R	26	416	99.45	1.96
Fan et al ^[59]	2025	China	NPVS	26	236	97.99	18.69
Erzincanl ^[60]	2026	Turkey	NPVS-R	26	344	103.96	17.19
Green ^[61]	2020	Israel	NPVS-R	26	91	110.5	14.82
Green ^[61]	2020	Israel	NPVS-R	26	70	119.86	11.96

Green ^[61]	2020	Israel	NPVS-R	26	100	115.44	10.66
Ozdemir ^[62]	2025	Turkey	NPVS-R	26	799	110.95	12.51
Iacobucci et al. ^[63]	2013	USA	NPVS-R	26	47	101.43	12.78
Kavradım ^[64]	2019	Turkey	NPVS-R	26	141	99.45	15.68
Kavradım ^[64]	2019	Turkey	NPVS-R	26	185	104.49	16.56
Kaya ^[65]	2023	Turkey	NPVS-R	26	189	104.26	19.37
Kaya ^[65]	2025	Turkey	NPVS-R	26	103	104.58	16.74
Korkut & Çetin ^[66]	2025	Turkey	NPVS-R	26	311	98.87	20.99
Lee & Oh ^[67]	2024	South Korea	NPVS-R	26	270	113.5	16.5
Lee et al ^[68]	2019	South Korea	NPVS-R	26	800	103.95	15.68
McHan et al ^[69]	2022	USA	NPVS-3	28	90	115.6	14.5
Nelwati ^[70]	2019	Indonesia	NPVS-R	26	391	95.8	12.93
Pang ^[71]	2025	China	NPVS-R	26	706	121.55	17.215
Paşalak ^[72]	2021	Turkey	NPVS-R	26	194	113.5	12.8
Paşalak ^[72]	2021	Tanzania	NPVS-R	26	81	105.8	16
Paşalak ^[72]	2021	Spain	NPVS-R	26	30	107.9	8.4
Podgorica ^[73]	2023	Albanian	NPVS-3	28	105	111.58	14.87
Poorchangizi ^[74]	2019	Iran	NPVS-R	26	100	100.36	4.42
Qian ^[75]	2026	China	NPVS-R	26	429	117.89	18.63

Rached et al. ^[76]	2023	Brazil	NPVS-3	28	337	124.93	11.72
Subih et al. ^[77]	2021	Jordan	NPVS-3	28	324	98.2	19.7
Türkmen ^[78]	2023	Turkey	NPVS-R	26	328	117.14	14.52
Bahadir-Yilmaz ^[79]	2018	Turkey	NPVS-R	26	275	86.4	16.2
Tran et al. ^[80]	2026	Vietnam	NPVS-3	28	530	97.2	13.8
Yağcan et al. ^[81]	2021	Turkey	NPVS-R	26	505	106.2	15.9
Yang et al. ^[82]	2025	China	NPVS-R	26	791	106.97	18.93

Abbreviations: NPVS, Nurses Professional Values Scale; NPVS-R, Nurses Professional Values Scale-Revised; NPVS-3, Nurses Professional Values Scale-3.

3.3 Quality appraisal of included studies

The methodological quality of the included studies was assessed using the AHRQ cross-sectional study quality assessment checklist, and the detailed results are presented in Supplementary Table X. Among the 72 included studies, 11 (15.28%) were classified as high quality, 47 (65.28%) as moderate quality, and 14 (19.44%) as low quality. Overall, the methodological quality of the included studies was predominantly moderate.

3.4 Results of meta-analysis

A random-effects model was applied to synthesize data from 85 independent datasets to estimate the overall level of professional values among nursing students. The pooled mean score of professional values was 101.25 (95% CI: 99.64–102.85), indicating that nursing students generally demonstrated a relatively positive level of professional values (Figure 2).

Further analyses stratified by measurement instruments showed differences in pooled mean scores among the three professional values assessment tools. For the Nurses Professional Values Scale (NPVS), the pooled mean score from 11 datasets involving 4,123 nursing students was 93.95 (95% CI: 89.12–98.77). For the Nurses Professional Values Scale-Revised (NPVS-R), the pooled mean score from 68 datasets involving 26,671 nursing students was 101.44 (95% CI: 99.80–103.08). For the Nurses Professional Values Scale-3 (NPVS-3), the pooled mean score from 6 datasets involving 1,744 nursing students was 112.25 (95% CI: 100.09–124.40) (Figure 3).

Substantial heterogeneity was observed among the included datasets ($I^2=99.3\%$, $P<0.001$), indicating considerable variability in professional values scores across studies. Therefore, subgroup analyses and meta-regression analyses were subsequently performed to explore potential sources of heterogeneity. The pooled results of the overall analysis and subgroup analyses are summarized in Table 2.

Table 2 Summary of meta-analysis results of professional values among nursing students

Analysis	No. of datasets	Participants	Pooled mean score	95% CI	I^2 (%)	P value
Overall analysis	85	32,538	101.25	99.64–102.85	99.3	<0.001
NPVS	11	4,123	93.95	89.12–98.77	98.9	<0.001
NPVS-R	68	26,671	101.44	99.80–103.08	99.2	<0.001
NPVS-3	6	1,744	112.25	100.09–124.40	99.6	<0.001

Abbreviations: NPVS, Nurses Professional Values Scale; NPVS-R, Nurses Professional Values Scale-Revised; NPVS-3, Nurses Professional Values Scale-3; CI, confidence interval.

3.5 Results of subgroup analysis

Due to the substantial heterogeneity among the included datasets ($I^2=99.3\%$, $P<0.001$), subgroup analyses were conducted to explore potential sources of between-study heterogeneity. Subgroup analyses were performed according to measurement instrument, country, and methodological quality. In addition, further subgroup analyses by country and publication year were conducted among studies using the NPVS-R.

Subgroup analysis based on measurement instruments demonstrated significant differences among the three professional values assessment tools. The NPVS subgroup included 11 studies, with a pooled mean score of 93.95 (95% CI: 89.12–98.77)(Figure 3). The NPVS-R subgroup included 68 studies, with a pooled mean score of 101.44 (95% CI: 99.80–103.08). The NPVS-3 subgroup included 6 studies, with a pooled mean score of 112.25 (95% CI: 100.09–124.40). Significant heterogeneity remained within all measurement instrument subgroups, with I^2 values of 98.9%, 99.2%, and 99.6% for NPVS, NPVS-R, and NPVS-3, respectively. The between-group heterogeneity test showed significant differences among measurement instruments (Between-group $Q=11.73$, $df=2$, $P=0.003$), indicating that measurement instrument type may represent an important contributor to the observed heterogeneity.

Subgroup analysis according to country revealed significant differences in pooled professional values scores across countries (Between-group $Q=1943.71$, $df=18$, $P<0.001$). The included studies were mainly conducted in China and Turkey. The China subgroup included 44 studies and demonstrated substantial heterogeneity ($I^2=99.2\%$), while the Turkey subgroup included 15 studies with similarly high heterogeneity

($I^2=99.1\%$). The significant differences among countries suggest that cultural background, nursing education systems, and social environments may influence professional values among nursing students. Subgroup analysis based on methodological quality showed that pooled effects were statistically significant in high-, moderate-, and low-quality study groups (all $P<0.001$). However, substantial heterogeneity remained within each quality category, with I^2 values of 99.1%, 99.4%, and 99.5% for moderate-, low-, and high-quality studies, respectively. The between-group heterogeneity test indicated no significant differences among methodological quality categories (Between-group $Q=0.63$, $df=2$, $P=0.729$), suggesting that methodological quality was unlikely to be a major source of heterogeneity.

Furthermore, additional subgroup analyses were conducted among the 68 NPVS-R studies. Country-based subgroup analysis demonstrated significant differences among countries/regions ($Q_{\text{between}}=273.42$, $df=13$, $P<0.001$). Stratification by publication year also showed significant differences among different time periods ($Q_{\text{between}}=13.19$, $df=2$, $P=0.001$). The pooled mean scores increased from 96.52 during 2011–2015, to 100.92 during 2016–2020, and further to 105.26 during 2021–2026, indicating an increasing trend in nursing students' professional values over time.

3.6 Meta-regression analysis

Given the substantial heterogeneity identified in the pooled analysis ($I^2=99.3\%$, $P<0.001$), meta-regression analyses were performed to further investigate whether study-level characteristics could explain variations in reported professional values scores.

To further explore potential sources of the substantial heterogeneity observed among the included studies, univariable and multivariable meta-regression analyses were conducted. In the univariable meta-regression analyses, publication year, measurement instrument, and study country were significantly associated with the reported professional values scores among nursing students. Specifically, publication year showed a significant positive association with professional values scores ($\beta=1.005$, $P<0.001$), explaining approximately 22.01% of the between-study heterogeneity (adjusted $R^2=22.01\%$). This finding indicated that studies published in more recent years tended to report higher professional values scores. Sample size was not significantly associated with professional values scores ($\beta=-0.002$, $P=0.465$) and did not explain between-study heterogeneity (adjusted $R^2=-0.55\%$). Measurement instrument was also significantly associated with reported professional values scores ($P=0.0003$), accounting for approximately 15.95% of the heterogeneity, suggesting that differences in assessment tools may contribute to variations in reported scores. In contrast, methodological quality was not significantly associated with effect estimates ($P=0.6529$), indicating that differences in study quality were unlikely to represent a major source of heterogeneity.

Furthermore, a multivariable meta-regression model was established by simultaneously including publication year, measurement instrument, and study country. The overall model was statistically significant ($F=9.50$, $P<0.001$) and explained approximately 41.85% of the between-study heterogeneity. Publication year remained significantly associated with reported professional values scores after

adjustment for other covariates ($\beta=0.740$, $P<0.001$). Compared with studies conducted in China, studies from several other countries demonstrated significantly higher reported professional values scores, with regression coefficients ranging from 5.52 to 16.03 (all $P<0.05$). These findings suggest that differences in cultural backgrounds and nursing education contexts may partly explain variations in professional values scores across studies. However, measurement instrument type was no longer independently associated with professional values scores after adjustment for publication year and country (scale_2: $\beta=7.324$, $P=0.093$; scale_3: $\beta=3.164$, $P=0.207$). Overall, meta-regression analyses indicated that publication year and country were important moderators explaining between-study heterogeneity, whereas sample size, methodological quality, and measurement instrument differences showed limited independent explanatory effects after adjustment.

3.7 Sensitivity analysis

A leave-one-out sensitivity analysis was conducted to assess the robustness of the pooled estimates. The results showed that sequential removal of each individual dataset did not substantially alter the pooled mean score of nursing students' professional values, and no single study had a significant influence on the overall effect estimate (Figure 4). These findings indicate that the results of the meta-analysis were stable and reliable.

3.7 Publication bias

Potential publication bias was assessed using funnel plots and Egger's regression test because 85 independent datasets were included in the quantitative synthesis. Visual inspection of the funnel plot showed a generally symmetrical distribution of the included datasets, with no apparent evidence of small-study effects (**Figure 5**). Furthermore, Egger's regression test indicated no statistically significant publication bias ($P=0.151$). These findings suggest that the pooled estimate was unlikely to be affected by substantial publication bias.

Discussion

This study represents one of the most comprehensive quantitative meta-analyses examining professional values among nursing students. A total of 72 cross-sectional studies involving 85 independent datasets and 32,538 nursing students were included. The pooled results indicated that nursing students generally demonstrated relatively positive professional values, with a pooled mean score of 101.25 (95% CI: 99.64–102.85), suggesting that nursing education has effectively promoted the development of professional values among nursing students. However, substantial heterogeneity was observed among the included studies ($I^2=99.3\%$, $P<0.001$), indicating considerable variations in professional values across different populations. This finding suggests that existing nursing education systems may contribute positively to the cultivation and development of professional values among future nursing professionals.

The pooled results of this meta-analysis indicated that nursing students generally demonstrated a relatively positive level of professional values. Professional values represent fundamental beliefs and

principles that guide nurses' professional behaviors, ethical decision-making, and commitment to patient-centered care^{[74][83][84]}. The higher levels of professional values observed in this study may reflect the sustained emphasis placed on professional ethics and values education within the current nursing education system. Professional values constitute a fundamental foundation of nursing practice, guiding nurses' professional behaviors, ethical decision-making, and commitment to patient-centered care^{[85][86]}. During undergraduate nursing education, students gradually develop their understanding of the nursing profession through theoretical learning, clinical practice experiences, interactions with patients, and exposure to professional role models^{[87][88][89]}. Previous studies have suggested that professional socialization is a critical process through which nursing students develop professional identity, internalize professional values, and acquire a sense of responsibility and ethical awareness required for nursing practice^{[90][91]}. Therefore, the acquisition of nursing knowledge and experience in clinical settings may facilitate students' gradual transformation of professionally oriented values acquired through external learning into internally endorsed professional beliefs. Clinical practice may represent another important opportunity for the development of professional values among nursing students. Through direct patient care experiences, interaction with healthcare professionals, and exposure to real clinical situations, students can gradually understand and internalize core nursing values^{[92][93]}. Through direct interaction with patients and the healthcare team, nursing students can gain a deeper understanding of core nursing values such as caring, responsibility, patient advocacy, and professional accountability, thereby enhancing their recognition of the unique role of the nursing profession and facilitating the formation of their professional identity.

In this study, subgroup analysis based on measurement instruments revealed differences in pooled professional values scores among NPVS, NPVS-R, and NPVS-3. These variations suggest that measurement instruments may represent an important source of heterogeneity. Although NPVS, NPVS-R, and NPVS-3 were developed based on similar theoretical foundations, differences exist in item content, scale structure, and conceptual emphasis. The NPVS-R was developed as a revised version of the original NPVS based on updates to nursing ethical standards and was designed to capture broader dimensions of professional values, including caring, activism, trust, professionalism, and justice^[94]. The NPVS-3 was developed as an updated version of the NPVS and NPVS-R based on the 2015 American Nurses Association Code of Ethics, incorporating the evolving roles and responsibilities of nurses in contemporary healthcare practice^[95].

The findings of this meta-analysis have several important implications for nursing education. Although nursing students demonstrated relatively positive professional values, continuous efforts are still required to maintain and further strengthen the development of professional values throughout nursing education. First, professional values education should be integrated throughout the entire nursing curriculum rather than being limited to isolated courses. Professional values are not developed through a single educational intervention but gradually evolve through continuous exposure to professional knowledge, ethical discussions, clinical practice, and interactions with healthcare professionals^[96]. Therefore, nursing educators should consider embedding professional values education across different

stages of nursing training. Second, clinical practice should be recognized as a critical environment for professional values development. Clinical internships provide nursing students with opportunities to experience authentic patient care, observe professional nursing behaviors, and develop an understanding of professional roles and responsibilities^[97]. Nursing educators and clinical mentors should create supportive learning environments and serve as positive professional role models to facilitate students' professional socialization. Third, educational strategies should move beyond traditional knowledge-based teaching approaches and incorporate active learning methods. Approaches such as case-based learning, reflective writing, simulation-based education, and discussion of ethical dilemmas may help students critically reflect on nursing values and transform professional principles into personal beliefs and behaviors. Finally, given the influence of cultural and educational contexts identified in this study, professional values education should be adapted to local contexts. Nursing educators should consider students' cultural backgrounds, educational levels, and clinical experiences when designing interventions to promote professional values.

This study has several strengths. First, this is one of the largest meta-analyses examining professional values among nursing students, including evidence from 72 studies and more than 32,000 nursing students across multiple countries. The large sample size enhances the reliability and generalizability of the pooled findings. Second, this study used rigorous systematic review and meta-analysis methods and conducted subgroup analyses to explore potential sources of heterogeneity, providing a more comprehensive understanding of variations in professional values among nursing students. Third, the inclusion of studies using different validated professional values instruments allowed comparison of assessment approaches and highlighted the potential influence of measurement tools. Several limitations should also be acknowledged. First, all included studies adopted cross-sectional designs; therefore, causal relationships between nursing education factors and professional values development cannot be established. Longitudinal studies are needed to explore changes in professional values throughout nursing education. Second, professional values were mainly assessed using self-reported questionnaires, which may be influenced by social desirability bias and may not fully reflect students' actual professional behaviors. Third, considerable heterogeneity was observed among included studies. Although subgroup analyses were conducted, some unexplained heterogeneity remained due to differences in educational systems, cultural backgrounds, and sample characteristics. Finally, some regions were represented by relatively few studies, which may limit the global representativeness of the findings.

In conclusion, this meta-analysis demonstrated that nursing students generally possess relatively positive professional values. However, variations exist across different measurement instruments, cultural contexts, and educational environments. Nursing educators should continue to strengthen professional values education by integrating ethical education, clinical practice experiences, and reflective learning throughout nursing training. Future research should adopt longitudinal designs and explore the complex interactions between individual, educational, and cultural factors influencing professional values development.

Declarations

Ethics approval and consent to participate

Not applicable. This study was a systematic review and meta-analysis based on previously published studies and involved secondary analysis of publicly available literature. No direct involvement of human participants or collection of primary data was conducted.

Consent for publication

Not applicable.

Availability of data and materials

All data analysed in this study were extracted from previously published studies included in this systematic review and meta-analysis. The datasets generated and/or analysed during the current study are available from the corresponding author upon reasonable request.

Competing interests

The authors declare that they have no competing interests.

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Authors' contributions

TXW and SXJ contributed to literature searching and study identification. YY contributed to the study design. DYW was responsible for data extraction. TXW drafted the manuscript. AXM supervised the study and critically revised the manuscript. All authors read and approved the final manuscript.

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Figures

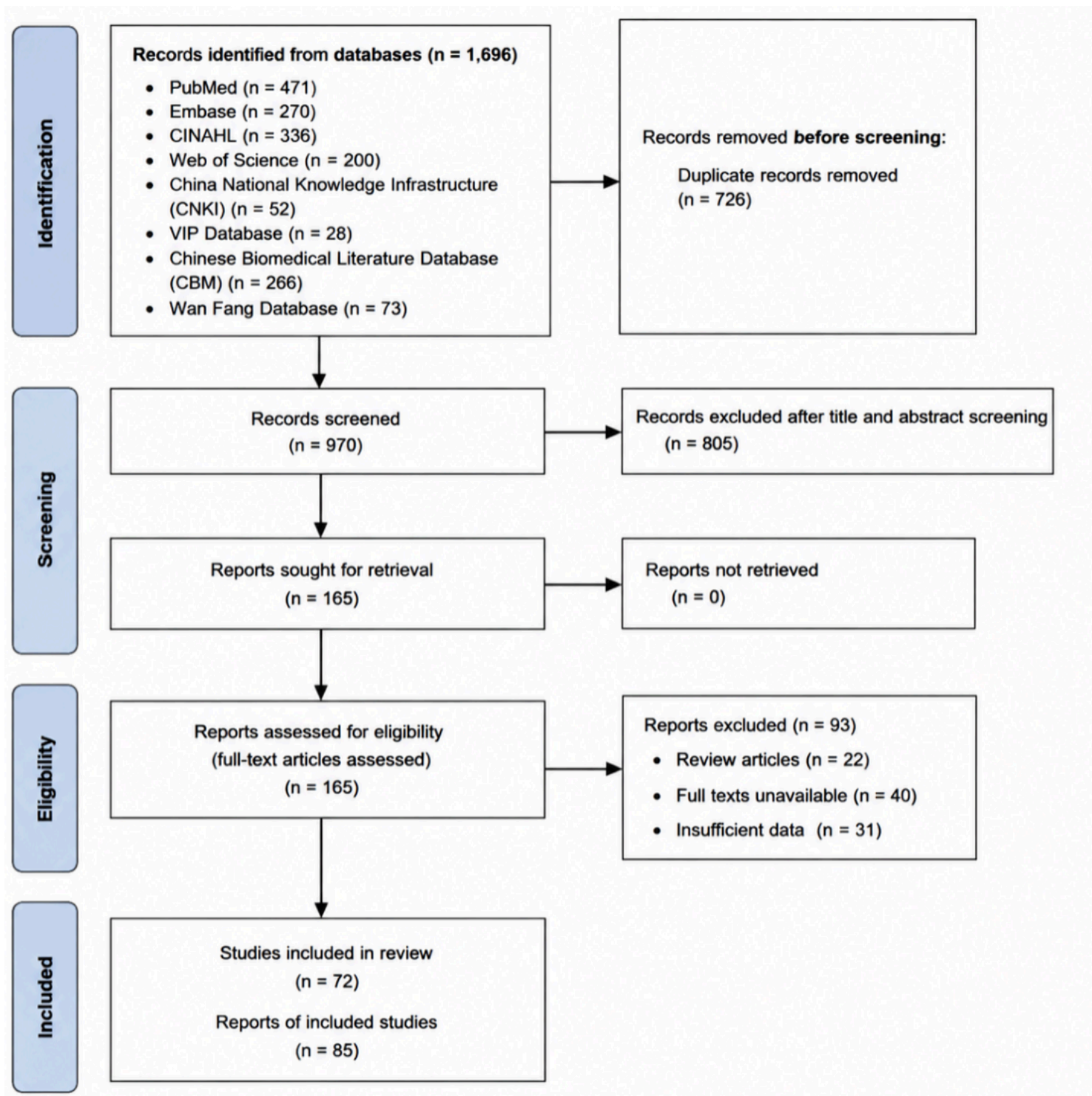


Figure 1

The literature screening flow chart

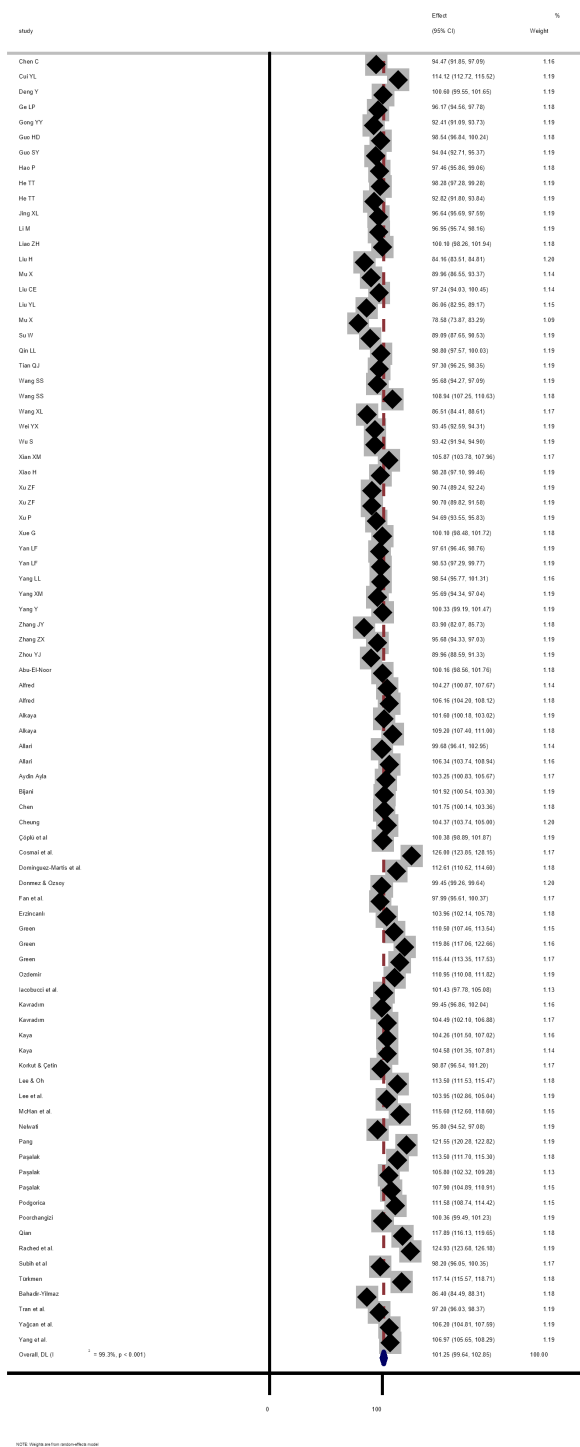
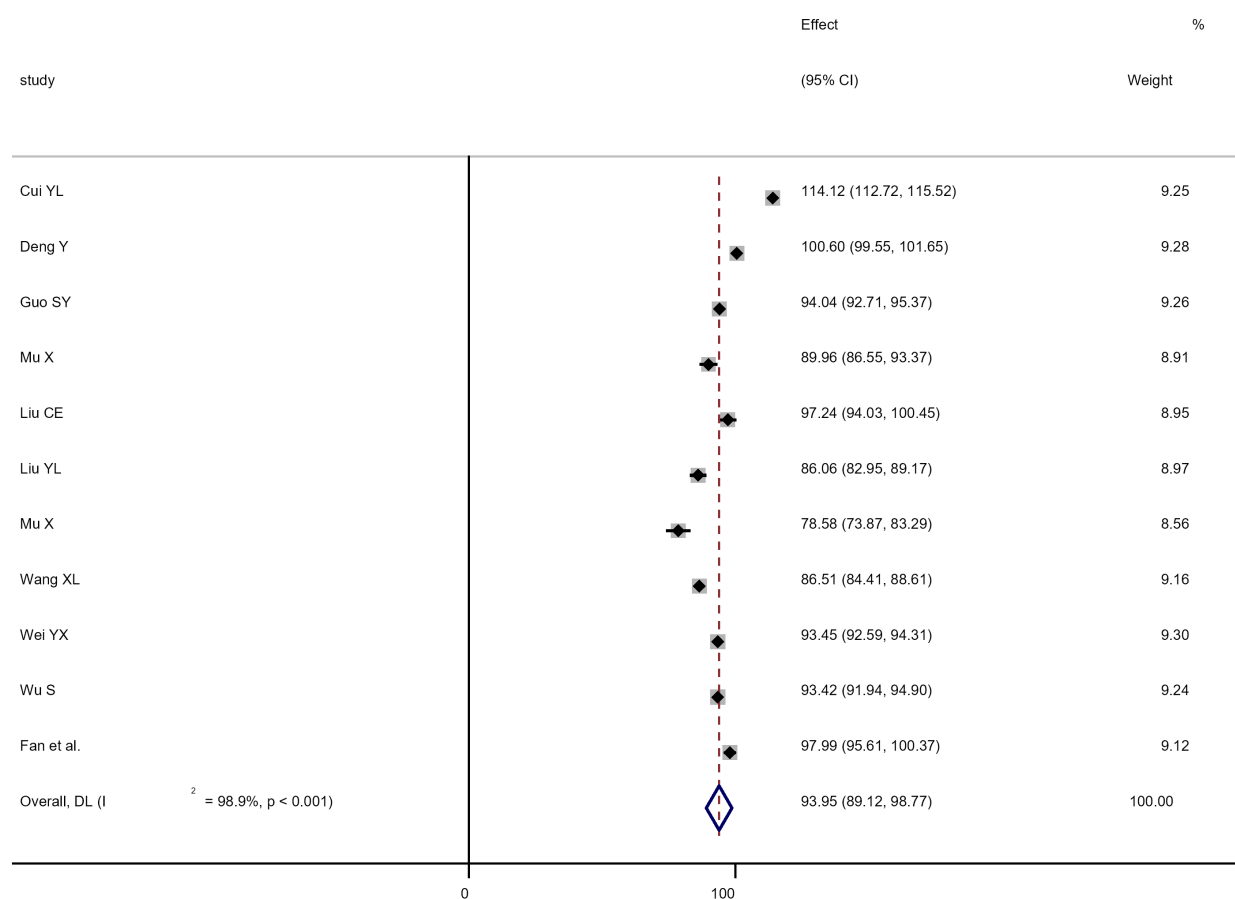


Figure 2

Forest plot of pooled professional values scores among nursing students



NOTE: Weights are from random-effects model

Figure 3

Forest plot of pooled professional values scores among nursing students assessed using the Nurses Professional Values Scale (NPVS)

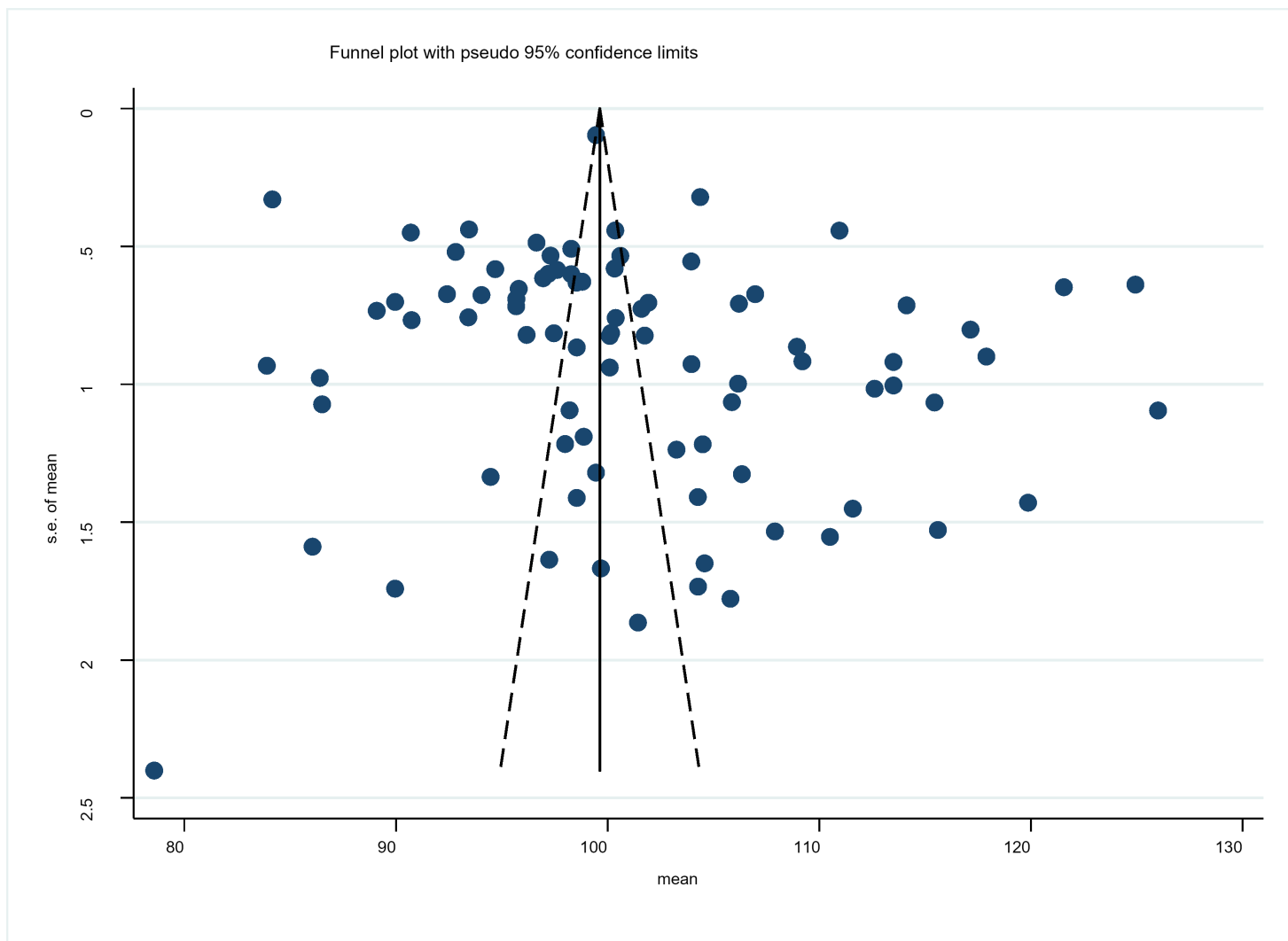


Figure 5

Funnel plot for assessment of publication bias among nursing students' professional values