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Factors Associated with Collaborative Attitudes Among Health Professions Students in Interprofessional Education: A Systematic Review

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ABSTRACT

Interprofessional education (IPE) aims to strengthen collaboration among health professions students. This systematic review examined factors associated with collaborative attitudes and related interprofessional outcomes among students participating in IPE. A systematic literature search was conducted using PubMed, ScienceDirect, and Taylor & Francis. Of the 1,159 records identified, 108 duplicates were removed, 1,051 records underwent screening, and 10 studies were included in the narrative synthesis. The factors investigated encompassed demographic characteristics, personality traits, learning styles, psychological needs, team related characteristics, and educational approaches. Structured IPE activities generally demonstrated favorable interprofessional outcomes. However, variations in study designs, assessment instruments, and outcome constructs limited the comparability of findings across studies

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INTRODUCTION

Interprofessional education (IPE) is a core part of health professions education. Students from two or more professions learn together, learn from one another, and come to understand what each profession contributes to patient care. The goal is to prepare them for collaborative practice across disciplines (Bogossian et al., 2023; Mattiazzi et al., 2023). Collaboration among professions has been linked to better quality of care, greater patient safety, and higher satisfaction among patients and healthcare staff (Morgan et al., 2020; Pomare et al., 2020). Students still differ in how they respond to interprofessional learning and collaboration, and individual, psychological, educational, and contextual characteristics may shape those responses (Wilhelmsson et al., 2011).

Earlier studies examined many factors in relation to students' collaborative and interprofessional attitudes. Age and gender, personality traits, learning styles, psychological factors, and previous clinical experience all received attention (Ganjitsuda et al., 2022; Jerntorp et

al., 2026; Olsson et al., 2020; Shen et al., 2025; Zhang et al., 2024). Olsson et al. (2020) tested personality characteristics and learning styles against attitudes toward IPE, and Zhang et al. (2024) studied learning styles together with demographic and educational characteristics. Jerntorp et al. (2026) and Shen et al. (2025) turned to psychological needs and collaborative self-efficacy. Other researchers evaluated educational strategies within IPE, including team-based learning, problem-based learning, simulation, and virtual learning (Chan et al., 2026; Chu et al., 2023; Hamada et al., 2020; Liaw et al., 2020).

The Introduction provides relevant evidence regarding factors associated with attitudes and readiness toward interprofessional education. However, the research gap and novelty of the present systematic review have not yet been articulated sufficiently**.** The discussion of Olsson et al. (2020), Zhang et al. (2024), and Jerntorp et al. (2026) mainly demonstrates inconsistent findings across studies, but does not clearly establish what remains unresolved in the existing literature.

The authors should explicitly explain why a new systematic review is necessary, particularly by identifying whether previous systematic reviews have examined the same population, outcomes, and range of influencing factors. The authors should also clarify what distinguishes the present review from previous reviews in terms of scope, population, outcome, conceptual framework, or synthesis approach.

Furthermore, the novel contribution of this review should be stated explicitly. For example, the review may provide an integrated synthesis of demographic factors (e.g., age and gender), psychological or personality factors, learning characteristics, team-related characteristics, and characteristics of IPE design or learning environments as potential factors associated with collaborative attitudes among health professions students. If this is the intended novelty, the authors should formulate it clearly and support the claim by citing relevant previous systematic reviews and demonstrating the specific gap that remains unaddressed.

The final part of the Introduction should therefore conclude with a clear statement of (1) what is already known, (2) what remains unclear, (3) what previous reviews have not adequately addressed, (4) what this systematic review aims to examine, and (5) how the review contributes to the existing body of knowledge**.**

This systematic review aimed to identify and synthesize the factors associated with collaborative and interprofessional attitudes among health professions students who take part in IPE. We examined evidence from different health professions, study designs, and educational contexts to build an integrated picture of what shapes students' attitudes toward interprofessional learning and collaborative practice.

METHOD

Review question and framework

We built the review question on the Population–Exposure–Outcome (PEO) framework. Health professions students formed the population, participation in IPE was the exposure, and collaborative or interprofessional attitudes were the outcome. The question read: "What factors are associated with collaborative attitudes among health professions students participating in interprofessional education?" The review set out to identify and synthesize evidence on the individual, psychological, educational, and IPE-related factors associated with these attitudes.

1. Eligibility criteria

We included studies of undergraduate or prelicensure students in medicine, nursing, pharmacy, dentistry, midwifery, public health, physiotherapy, occupational therapy, and other allied health disciplines. A study with a mixed population qualified when its report gave the findings for health professions students on their own. The study also had to involve an interprofessional learning activity in which students from at least two professions learned together, include a quantitative measure of a collaborative or interprofessional outcome, such as attitudes toward interprofessional learning, teamwork, collaboration, or collaborative practice, and examine at least one factor in relation to that outcome.

Established instruments or suitable subscales had to measure the outcomes. Examples include the Readiness for Interprofessional Learning Scale (RIPLS), the Interdisciplinary Education Perception Scale (IEPS), the Jefferson Scale of Attitudes Toward Interprofessional Collaboration (JeffSATIC), the Students' Perceptions of Interprofessional Clinical Education-Revised (SPICE-R), and other measures that fit the construct under study. Earlier work applied these instruments to different student populations and educational settings (Ganjitsuda et al., 2022; Jerntorp et al., 2026; Olsson et al., 2020; Zhang et al., 2024).

We accepted cross-sectional, cohort or longitudinal, randomized controlled, non-randomized controlled, quasi-experimental, and other quantitative comparative designs. Eligible articles were original, peer-reviewed, full-text reports in English, published between January 2016 and the final search date in 2026.

We excluded studies that did not involve health professions students or whose student findings could not be separated from those of other populations. We also excluded studies in which students from at least two professions did not learn together. A study without a quantitative evaluation of a relevant collaborative or interprofessional outcome was out as well. That group covered studies of knowledge, clinical skills, academic performance, satisfaction, patient outcomes, or other outcomes beyond the scope of the review, and studies that gave descriptive outcome scores without examining an associated factor, predictor, exposure, intervention, or group comparison.

Further exclusions applied when the outcome measures were not well established or were unclear, or when we could not extract quantitative factor-outcome data. Qualitative-only research, case reports and case series, reviews, meta-analyses, protocols, editorials, letters, commentaries, conference abstracts without adequate quantitative data, duplicate datasets, articles without full text, non-English articles, and studies published before January 2016 also did not qualify.

b. Information sources and search strategy

We searched PubMed, ScienceDirect, and Taylor & Francis. The strategy followed the main PEO concepts: health professions students, participation in interprofessional education, and collaborative or interprofessional attitudes. We joined terms for the same concept with the Boolean operator OR and the main concepts with AND. The PubMed search read:

> (health professions students" OR "health professional students" OR "healthcare students" OR "medical students" OR "nursing students" OR "pharmacy students" OR "dental students" OR "allied health students") AND ("interprofessional education" OR "interprofessional learning") AND (attitude* OR readiness OR perception* OR collaboration OR teamwork)

For Taylor & Francis we used ("health professions students" OR "medical students" OR "nursing students") AND ("interprofessional education" OR "interprofessional learning") AND (attitude OR collaboration OR teamwork). The ScienceDirect search used the same string and applied it to the title, abstract, and keyword fields.

c. Study selection

Rayyan served to organize and screen the records. We removed duplicates first and then judged the titles and abstracts of the remaining records against the eligibility criteria. Articles that looked eligible went to full-text review, where we excluded those that failed the criteria and recorded the main reason for each exclusion. A PRISMA 2020 flow diagram documents the path from the records retrieved in PubMed, ScienceDirect, and Taylor & Francis through duplicate removal, title and abstract screening, and full-text assessment. Studies that met all criteria stayed in the review.

d. Data extraction

We extracted data from each eligible study with a standardized framework built from the review question and the eligibility criteria. The framework covered author and year, country, study design, participant characteristics, health professions represented, sample size, characteristics and duration of the IPE activity or exposure, factors examined, outcome measures, statistical methods, and main findings. If a study examined several eligible factors, we extracted all relevant associations between those factors and the collaborative or interprofessional outcome. We recorded information that was missing or unclear in the original publication as not reported, and we did not fill gaps with assumptions.

e. Risk of bias assessment

We appraised methodological quality and potential risk of bias with instruments suited to each design. Cross-sectional studies went through the Joanna Briggs Institute (JBI) Critical Appraisal Checklist for Analytical Cross-Sectional Studies, which covers eight areas: definition of inclusion criteria, description of participants and setting, validity and reliability of exposure measurement, use of objective and standard criteria to measure the condition, identification of confounders, strategies for handling confounding, validity and reliability of outcome measurement, and suitability of the statistical analysis. We assessed randomized controlled trials with the Cochrane Risk of Bias 2 (RoB 2) tool, whose five domains are the randomization process, deviations from intended interventions, missing outcome data, outcome measurement, and selection of the reported result. The randomized crossover study received the RoB 2 version for crossover trials. Risk of bias informed how we interpreted the evidence. It did not decide whether a study stayed in the review.

f. Data synthesis

Meta-analysis was not possible because the included studies varied in design, participants, IPE activities, factors examined, outcome measures, and statistical approaches. We therefore chose a narrative synthesis. The factors fell into broader categories: individual and demographic characteristics, psychological factors, educational factors, and IPE-related factors or intervention characteristics. We weighed the direction and statistical significance of each association or between-group difference together with study design and methodological quality. Results from different statistical methods kept their original form, with no conversion to a common effect measure. Structured tables summarize the findings, and a narrative describes the patterns, similarities, and differences among studies.

RESULTS AND DISCUSSION

1. Study selection

The searches returned 1,159 records: 750 from PubMed, 56 from ScienceDirect, and 353 from Taylor & Francis. After we removed 108 duplicates, 1,051 records remained for title and abstract screening, and we excluded 813 of them. We retrieved the other 238 articles in full text and assessed them against the eligibility criteria. That assessment excluded 228 articles: 15 for an ineligible population, 30 for an inappropriate exposure, 177 for an outcome that did not meet the review criteria, and 6 for an ineligible study design. Ten studies met all criteria and entered the final synthesis (Figure 1).

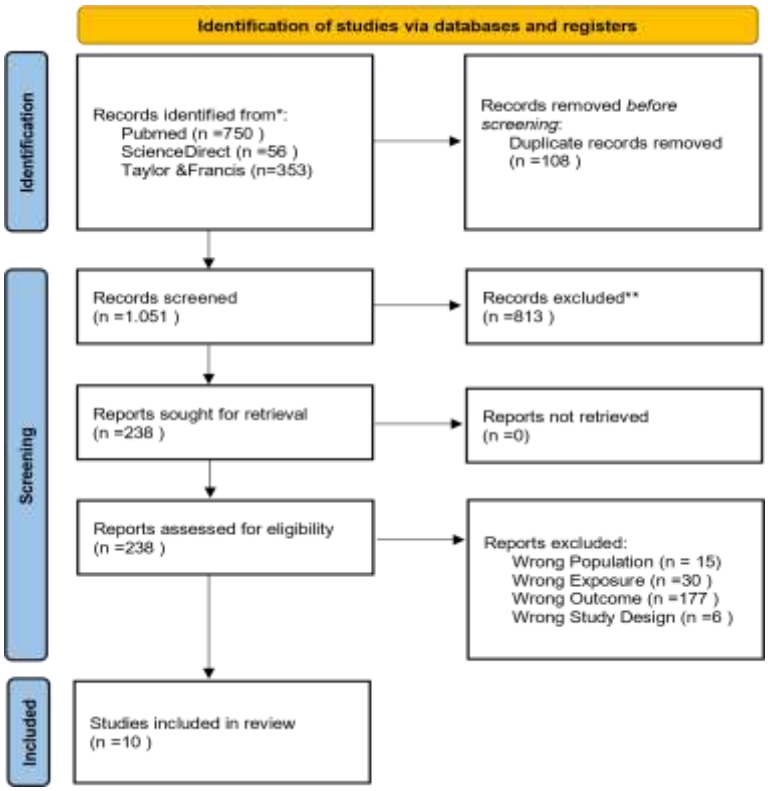


Figure 1. PRISMA 2020 flow diagram of the study selection process

2. Study characteristics

The 10 included studies appeared between 2020 and 2026. They came from Sweden, China, Japan, Hong Kong, and Singapore, plus one multinational study across Hong Kong, China, South Korea, and Thailand. Design, participants, sample size, duration of IPE exposure, and educational approach varied a great deal. Six studies used observational or cross-sectional designs (Dizon et al., 2026; Ganjitsuda et al., 2022; Jerntorp et al., 2026; Olsson et al., 2020; Shen et al., 2025; Zhang et al., 2024). Three were randomized controlled trials (Chu et al., 2023; Hamada et al., 2020; Liaw et al., 2020), and Chan et al. (2026) ran a randomized crossover trial.

Participants came from medicine, nursing, pharmacy, physiotherapy, occupational therapy, Chinese medicine, biomedical engineering, prosthetics and orthotics, radiology, speech therapy, and social work. Several studies also enrolled students from non-health disciplines in broader interprofessional activities. Samples ranged from 79 participants in Olsson et al. (2020) to 2,426 respondents in Ganjitsuda et al. (2022).

The IPE activities took many forms: interprofessional training wards and clinical placements, interprofessional problem-based learning (IPBL), clinical clerkships, team-based learning (TBL), virtual reality-based education, case-based learning, simulation, and interprofessional communication training. Exposure ran from a single training session to clinical experiences of several weeks. The studies measured collaborative and interprofessional outcomes with RIPLS,

IPECC-Set 9, JeffSATIC-J, SPICE-R, ICCAS, IEPS, ATHCT, and ISVS. The factors they investigated included demographic characteristics, personality traits, learning styles, academic stress, satisfaction of psychological needs, collective efficacy, group potency, and features of IPE interventions. Table 1 summarizes each study.

Table 1. Study characteristics and findings

Study, country, and design	Participants and sample size	IPE activity and duration	Instrument	Findings and associated factors
Jerntorp et al. (2026); Sweden; cross-sectional survey, census sampling, two universities	Final-year nursing (n = 281), medical (n = 199), physiotherapy (n = 65), and occupational therapy (n = 46) students; 598 analyzed	Mandatory clinical placement at an interprofessional training ward; 2 weeks	IPECC-Set 9 (Interprofessional Education Collaborative Competency Self-Efficacy Tool); RIPLS and NEO-FFI as correlates	Extraversion (β = .121, p = .007) and conscientiousness (β = .203, p < .001) predicted higher self-efficacy. Women scored higher than men on all RIPLS dimensions, and medical students scored lower on roles and responsibilities.
Chu et al. (2023); China; intervention study with random assignment to IPBL or uniprofessional PBL, one questionnaire after the module	Clinical medicine, pharmacy, and nursing students, about one-third each; 360 (180 IPBL, 180 UPBL)	IPBL versus UPBL on an immunology module case; 2-week block with one 2-hour session per week	Attitude and Learning Ability Questionnaire (18 items); tutorial and final examination grades	IPBL students were more favorable on roles and responsibilities (4 of 5 items, p < .0001) and on all 7 teamwork items. Tutorial (p = .73) and final examination grades (p = .31) did not differ.
Ganjitsuda et al. (2022); Japan; multicenter cross-sectional survey, 7 medical schools	Medical students (years 1, 4, and 6), second-year residents, and doctors; 2,409 responses analyzed	Existing curricula compared across schools; clinical clerkships lasted 45–74 weeks	JeffSATIC-J (Japanese version of the Jefferson Scale of Attitudes Toward Interprofessional Collaboration)	First-year students scored highest (110.3 versus 105.9 in year 4 and 105.6 in year 6; p < .001), and women scored higher than men (109.5 versus 106.3; p < .001). Among year 6 students, longer clerkships correlated with higher scores (r = .78 to .96).
Zhang et al. (2024); China; cross-sectional online survey, convenience sampling	Clinical medicine (n = 250) and nursing (n = 250) students; 500 analyzed	No intervention; survey of readiness and learning styles, with 66.8% reporting prior interprofessional study	Chinese RIPLS (19 items)	Active experimentation (β = .421), willingness to join interprofessional discussions (β = .232), converger style, older age, female gender, lower study stress, and no previous interprofessional study predicted higher RIPLS. Medicine and nursing students did not differ (p = .493).

Study, country, and design	Participants and sample size	IPE activity and duration	Instrument	Findings and associated factors
Hamada et al. (2020); Japan; randomized controlled trial	Second-year medical students and second-year students of nursing, physical therapy, occupational therapy, and radiological technology; 112 analyzed (70 uniprofessional, 42 multiprofession al)	TBL program on a cerebral infarction rehabilitation case; half-day, after 7 days of self-learning	Japanese RIPLS (19 items), pre–post change	RIPLS rose in multiprofessional groups (75.60 to 78.93; p = .01) and stayed flat in uniprofessional groups (72.67 to 72.83; p = .85). The difference in change was 3.17 (95% CI 0.47–5.88; p = .02) and held after adjustment.
Chan et al. (2026); Hong Kong, mainland China, South Korea, and Thailand; randomized crossover trial	Nursing (n = 60), Chinese medicine (n = 21), biomedical engineering (n = 19), and prosthetics and orthotics (n = 2) students; 102 analyzed	Online IPE modules, VR360 versus asynchronous case-based learning; 2 modules over 2 months with a 3-week washout	SPICE-R; Learner Empowerment Scale; Online Student Engagement scale	SPICE-R improved in both groups at T1, with no between-group difference (p = .089). VR360 gave larger gains in engagement and empowerment at T1, and the VR-first group had higher SPICE-R at T2 (difference 4.79; p = .001).
Shen et al. (2025); Hong Kong; cross-sectional multilevel study, Self-Determination Theory	Nursing (n = 91), law (n = 11), Chinese medicine (n = 10), medicine (n = 8), pharmacy (n = 5), social work (n = 3), and engineering (n = 2) students; 130 in 28 teams	TBL-based IPE module on COVID-19 infection control and management; 4 weeks	ICCAS (Interprofessio nal Collaborative Competencies Attainment Survey)	Individual autonomy and relatedness predicted communication, roles and responsibilities, patient/family-centered approach, conflict management, and team functioning. Individual competence, individual relatedness, and team competence predicted collaboration.
Dizon et al. (2026); Hong Kong; cross-sectional online survey with path analysis	Medicine (n = 95), nursing (n = 86), law (n = 18), speech therapy (n = 16), social work (n = 10), pharmacy (n = 6), and Chinese medicine (n = 5) students; 236	COVID-19 infection control IPE simulation combining TBL and case-based learning; 3 weeks	Collective dedication scale (adapted Engagement Questionnaire, 4 items)	Group potency (β = .54) and collective efficacy (β = .24) had direct effects on collective dedication. Relatedness had a direct effect (.18) and indirect effects, and positive interdependence had an indirect effect only (total effect .78).

Study, country, and design	Participants and sample size	IPE activity and duration	Instrument	Findings and associated factors
Olsson et al. (2020); Sweden; cross-sectional observational study, convenience sample	Ninth-term medical students; 79 analyzed	Mandatory interprofessional clinical rotation in the 8th term with nursing and some physiotherapy and occupational therapy students; 2 weeks	IEPS (Swedish version, 12 items)	Mean IEPS was 59.1 (SD 4.2). No Big Five trait, age, or gender was associated with positive attitudes. The reflective–pragmatic learning style was the sole association (adjusted OR 8.05, 95% CI 1.21–53.71; p = .031).
Liaw et al. (2020); Singapore; randomized controlled trial, pretest–posttest	Third- and fourth-year medicine (n = 60) and nursing (n = 60) students; 120 completed	Doctor–nurse communication team training in multiuser virtual reality versus live simulation; 3 hours, follow-up at 2 months	ATHCT (Attitudes Toward Interprofessional Health Care Team, 14 items); ISVS (Interprofessional Socialization and Valuing Scale, 24 items)	Both groups improved from baseline to post-test on ISVS and ATHCT, with no between-group differences over time (p = .58 and .61). At 2 months, ISVS stayed above baseline in the VR group only (p = .047).

Factors associated with collaborative attitudes

The variables examined across the included studies fell into four groups: individual and demographic characteristics, personality and learning-related characteristics, psychological and team-related factors, and features of IPE delivery. The associations were not uniform. They differed with the study population and the educational context.

3. Individual and demographic factors

Several studies evaluated gender, and its relationship with interprofessional outcomes was inconsistent. Jerntorp et al. (2026) reported higher RIPLS scores among women than among men. Ganjitsuda et al. (2022) also found more favorable attitudes toward interprofessional collaboration among female participants. Zhang et al. (2024) identified female gender and older age as predictors of higher RIPLS scores. Olsson et al. (2020) saw a different pattern. Their mean IEPS score of 59.1 out of 72 pointed to positive attitudes toward IPE among these students, yet multivariable logistic regression found no significant relationship between positive attitudes and gender, age, personality characteristics, or learning styles.

Professional discipline and stage of education also showed associations. In Jerntorp et al. (2026), medical students scored lower than students from other health professions on the RIPLS

roles and responsibilities domain. Ganjitsuda et al. (2022) found more favorable collaborative attitudes in first-year students than in students at later stages. Among senior medical students, more time in clinical clerkships showed a positive association with the accountability component of collaborative attitudes. Demographic and educational characteristics therefore related to interprofessional outcomes within particular populations, and those relationships were not consistent across studies.

4. Personality and learning-related factors

Studies disagreed on personality. Jerntorp et al. (2026) found that extraversion and conscientiousness were positive predictors of self-efficacy for interprofessional collaborative practice on the IPECC-Set 9. Olsson et al. (2020) found no significant association between personality characteristics and positive attitudes toward IPE after multivariable analysis.

Zhang et al. (2024) added evidence on learning characteristics. The Abstract Conceptualization and Active Experimentation learning modes and the Converger learning style related to more favorable attitudes toward IPE, and lower study stress predicted higher RIPLS scores. Some personality and learning characteristics related to interprofessional outcomes within single studies, and other studies did not reproduce those relationships.

5. Psychological and team-related factors

Shen et al. (2025) and Dizon et al. (2026) studied psychological and team-related characteristics. Shen et al. measured satisfaction of basic psychological needs at the individual and team levels during a four-week TBL-based IPE module. At the individual level, autonomy and relatedness predicted communication, roles, patient-centeredness, conflict resolution, and team functioning. Individual competence, individual relatedness, and competence at the team level added to the prediction of collaboration.

Dizon et al. (2026) examined positive interdependence, relatedness, group potency, and collective efficacy in an IPE simulation that combined TBL and case-based learning. Path analysis showed indirect relationships from positive interdependence and relatedness to collective dedication, running through group potency and collective efficacy. Group potency and collective efficacy also had direct effects on collective dedication. Together, these findings place satisfaction of psychological needs, group potency, and efficacy-related constructs among the factors associated with interprofessional outcomes.

6. IPE design and educational exposure

Several included studies compared IPE formats and tracked change in collaborative or interprofessional outcomes. Chu et al. (2023) set interprofessional problem-based learning against uniprofessional problem-based learning. Students in the interprofessional condition reported more favorable outcomes for collaboration and greater awareness of professional roles. They also

improved in self-directed learning and learning motivation, while final examination performance matched that of the uniprofessional group.

Hamada et al. (2020) compared multiprofessional and uniprofessional TBL. Total RIPLS scores rose more in the multiprofessional condition, with mean changes of 3.33 in the multiprofessional group and 0.16 in the uniprofessional group ($p = .022$).

Chan et al. (2026) and Liaw et al. (2020) examined technology-supported IPE. Chan et al. compared online 360-degree virtual reality IPE with online case-based IPE. At T1, both approaches improved SPICE-R scores with no significant difference between groups, and VR360 produced larger gains in learner empowerment and online engagement at that point. Liaw et al. compared multiuser virtual reality with live simulation for doctor–nurse communication training among medical and nursing students. Both approaches produced immediate improvements in teamwork attitudes, and neither ATHCT nor ISVS differed between groups over time. At the two-month follow-up, ISVS stayed above baseline in the virtual reality group but not in the simulation group, and ATHCT returned to a level that did not differ from baseline in either group. The findings show no overall advantage of virtual reality over live simulation.

7. Risk of bias and methodological quality

Methodological appraisal followed the design of each study. Four of the six cross-sectional studies assessed with the JBI checklist, Jerntorp et al. (2026), Zhang et al. (2024), Shen et al. (2025), and Dizon et al. (2026), met all eight criteria (Table 2). Ganjitsuda et al. (2022) met seven, because its approach to confounding was unclear. Olsson et al. (2020) reported no strategy for handling the confounders it identified, so we interpreted that study with caution.

Table 2. JBI critical appraisal of the cross-sectional studies

Study	Q1	Q2	Q3	Q4	Q5	Q6	Q7	Q8	Overall
Jerntorp et al. (2026)	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Include
Ganjitsuda et al. (2022)	Yes	Yes	Yes	Yes	Yes	Unclear	Yes	Yes	Include
Zhang et al. (2024)	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Include
Shen et al. (2025)	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Include
Dizon et al. (2026)	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Include
Olsson et al. (2020)	Yes	Yes	Yes	Yes	Yes	No	Yes	Yes	Include with caution

Note. Q1 = inclusion criteria defined; Q2 = subjects and setting described; Q3 = valid and reliable exposure measurement; Q4 = objective, standard criteria for the condition; Q5 = confounders identified; Q6 = strategies for confounding stated; Q7 = valid and reliable outcome measurement; Q8 = appropriate statistical analysis.

We evaluated the randomized controlled studies by Chu et al. (2023), Hamada et al. (2020), and Liaw et al. (2020) with RoB 2, and each received an overall judgment of some concerns (Figure 3). Domain judgments differed. Chu et al. showed low risk for missing outcome data and some concerns in the other domains. Hamada et al. had low risk for deviations from intended

interventions and some concerns in the rest. Liaw et al. had low risk for deviations from intended interventions and for missing outcome data, with some concerns in the remaining domains.

We assessed Chan et al. (2026) with the RoB 2 tool for crossover trials (Figure 2). Missing outcome data carried a low risk of bias, the other domains received unclear judgments, and the overall judgment was unclear risk. No included study fell into the high-risk category, and the appraisal excluded none. We still weighed the confounding limitations of the observational studies and the concerns or unclear judgments among the randomized studies when we interpreted the evidence.

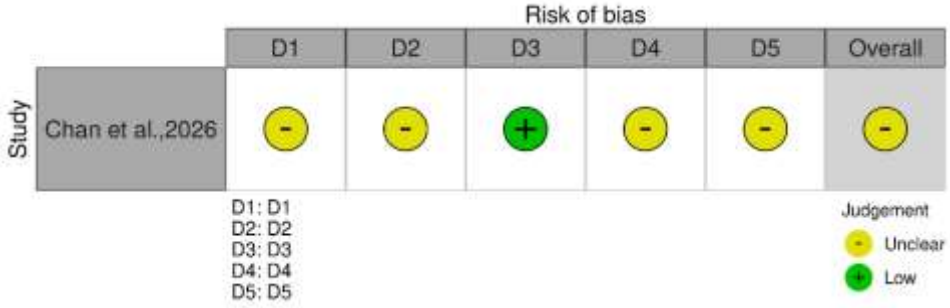


Figure 2. RoB 2 summary plot across randomized studies

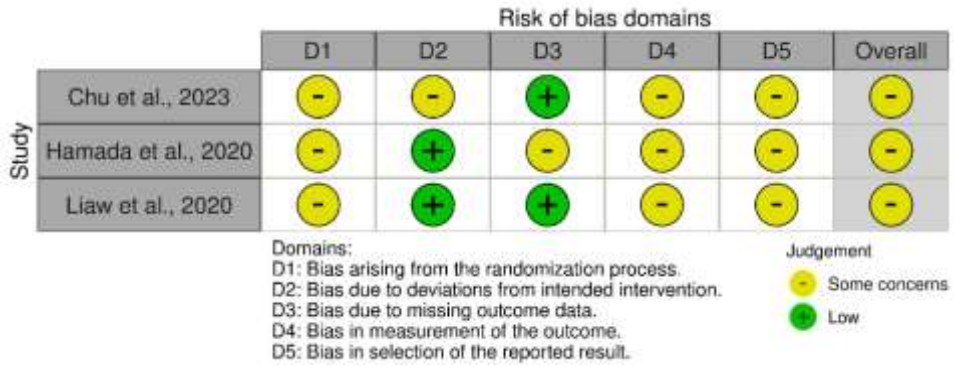


Figure 3. RoB 2 traffic-light plot of randomized studies

CONCLUSION AND RECOMMENDATIONS

Factors at several levels related to collaborative attitudes and related interprofessional outcomes among health professions students. Individual and learning-related factors included demographic characteristics, personality traits, and learning characteristics, and the associations varied from study to study. Psychological and team-related factors included autonomy, competence, relatedness, positive interdependence, group potency, and collective efficacy. Favorable interprofessional outcomes followed structured IPE activities in most studies. The evidence did not show that one educational approach outperforms another.

The review has limitations. The included studies varied a great deal in design, participants, IPE approach, and outcome measure. They also examined related but distinct constructs: readiness for interprofessional learning, collaborative self-efficacy, interprofessional competency, perceived interprofessional skills, teamwork attitudes, and collective dedication. The outcomes therefore do not represent one identical construct. Several studies used cross-sectional designs, which limits conclusions about causality. We did not register the review protocol in PROSPERO, so readers cannot verify whether the methods and analyses were set before the review began.

Future studies should prioritize longitudinal and well-designed experimental designs that track change in collaborative attitudes over time and test the effects of different IPE approaches. Wider use of validated measures aimed at collaborative attitudes would make studies easier to compare. Researchers also need to examine how individual, psychological, team-related, and educational factors interact in shaping collaborative attitudes among health professions students.

REFERENCES

Bogossian, F., New, K., George, K., Barr, N., Dodd, N., Hamilton, A. L., et al. (2023). The implementation of interprofessional education: A scoping review. *Advances in Health Sciences Education, 28*(1), 243–277. https://doi.org/10.1007/s10459-022-10128-4

Chan, S. L., Fung, J. T. C., Wong, M. S., Lee, J. J., Chan, E. Y. Y., Cheng, C. C. W., et al. (2026). Empowering healthcare students in online interprofessional learning through virtual reality educational technology: A randomised controlled cross-over trial. *Nurse Education Today, 164*, 107134. https://doi.org/10.1016/j.nedt.2026.107134

Chu, M., Xu, L., Liu, Y., Ye, H., Zhang, Y., Xue, Y., et al. (2023). Interprofessional education in problem-based learning: A frontier form of PBL in medical education. *Journal of Education and Health Promotion, 12*(1).

Dizon, J. I. W. T., He, Q., Shen, X., Nalipay, M. J., Wang, R., Chan, K. M. K., et al. (2026). What predicts collective dedication in health professions education? A path analysis among health and social care students. *Advances in Health Sciences Education, 31*(4), 1067–1087.

Ganjitsuda, K., Tagawa, M., Tomihara, K., Saiki, T., Kikukawa, M., Takamura, A., et al. (2022). Long-term clinical clerkship improves medical students' attitudes toward team collaboration. *International Journal of Medical Education, 13*, 274–286.

Hamada, S., Haruta, J., Maeno, T., Maeno, T., Suzuki, H., Takayashiki, A., et al. (2020). Effectiveness of an interprofessional education program using team-based learning for medical students: A randomized controlled trial. *Journal of General and Family Medicine, 21*(1), 2–9.

Jerntorp, S. H., Lundgren, J., Jakobsson, J., Aho, A. C., Carlson, E., & Axelsson, M. (2026). Healthcare students' personality traits, readiness for interprofessional learning and self-efficacy for competence in interprofessional collaborative practice: A cross-sectional study. *Nurse Education Today, 166*, 107193. https://doi.org/10.1016/j.nedt.2026.107193

Liaw, S. Y., Ooi, S. W., Rusli, K. D. B., Lau, T. C., Tam, W. W. S., & Chua, W. L. (2020). Nurse-physician communication team training in virtual reality versus live simulations: Randomized controlled trial on team communication and teamwork attitudes. *Journal of Medical Internet Research, 22*(4), 1–9.

Mattiazzi, S., Cottrell, N., Ng, N., & Beckman, E. (2023). The impact of interprofessional education interventions in health professional student clinical training: A systematic review. *Journal of Interprofessional Education & Practice, 30*, 100596.

Morgan, K. H., Barroso, C. S., Bateman, S., Dixson, M., & Brown, K. C. (2020). Patients' experiences of interprofessional collaborative practice in primary care: A scoping review of the literature. *Journal of Patient Experience, 7*(6), 1466–1475. https://doi.org/10.1177/2374373520925725

Olsson, C., Lachmann, H., Kalén, S., Ponzer, S., & Mellstrand Navarro, C. (2020). Personality and learning styles in relation to attitudes towards interprofessional education: A cross-sectional study on undergraduate medical students during their clinical courses. *BMC Medical Education, 20*(1), 1–8.

Pomare, C., Long, J. C., Churruca, K., Ellis, L. A., & Braithwaite, J. (2020). Interprofessional collaboration in hospitals: A critical, broad-based review of the literature. *Journal of Interprofessional Care, 34*(4), 509–519. https://doi.org/10.1080/13561820.2019.1702515

Shen, X., Dizon, J. I. W. T., Tipoe, G. L., & Ganotice, F. A. (2025). Effects of students' psychological needs satisfaction on interprofessional competencies: A multilevel analysis. *BMC Medical Education, 25*(1).

Wilhelmsson, M., Ponzer, S., Dahlgren, L. O., Timpka, T., & Faresjö, T. (2011). Are female students in general and nursing students more ready for teamwork and interprofessional collaboration in healthcare? *BMC Medical Education, 11*(1), 15. https://bmcmededuc.biomedcentral.com/articles/10.1186/1472-6920-11-15

Zhang, C., Wang, X., Xing, Y., Luan, W., & Jin, T. (2024). Correlation between learning styles and attitudes toward interprofessional education among medical students: A cross-sectional study. *BMC Medical Education, 24*(1), 1–9.