Research Square

Preprints are preliminary reports that have not undergone peer review.
They should not be considered conclusive, used to inform clinical practice,
or referenced by the media as validated information.

Knowledge, Attitudes, and Awareness Regarding Endometriosis Among Medical Students and Family Medicine Physicians: A Cross-Sectional Study from Turkey

İhsan Şafak

ihsansafak@ibu.edu.tr

Bolu Abant İzzet Baysal University

Pınar Fatma Yıldız

Bolu Abant İzzet Baysal University

Funda Dağıstanlı

Bolu Abant İzzet Baysal University

Mustafa Ayhan Ekici

Bolu Abant İzzet Baysal University

Research Article

Keywords: endometriosis, knowledge, attitudes, awareness, medical students, family medicine

Posted Date: November 19th, 2026

DOI: https://doi.org/10.21203/rs.3.rs-11260855/v1

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

Additional Declarations: No competing interests reported.

Abstract

Background

Endometriosis affects approximately 10% of women of reproductive age and is associated with a diagnostic delay of 7–10 years, partly attributable to insufficient awareness among healthcare professionals. We assessed knowledge, attitudes, and awareness regarding endometriosis among medical students and family medicine physicians in Bolu, Turkey.

Methods

This analytical cross-sectional study enrolled 400 participants (295 medical students in Years 4–6; 105 family medicine physicians stratified by experience). A structured 38-item questionnaire captured demographic data, an 18-item knowledge section and two Likert-scale sections measuring clinical attitudes (8 items) and education/awareness needs (5 items). Internal consistency was evaluated using Cronbach's alpha. Non-parametric tests (Kruskal–Wallis, Mann–Whitney U, Spearman correlation) and multiple linear regression were applied.

Results

The mean knowledge score was 13.35 ± 3.25 out of 18 (74.2% of maximum). Knowledge scores did not differ significantly across the seven groups ($H = 12.107$, $p = 0.060$, $\eta^2 = 0.016$). Clinical attitude scores differed significantly ($H = 23.086$, $p = 0.001$, $\eta^2 = 0.043$), with physicians having 6–10 years of experience scoring higher than Year-4 students after Bonferroni correction ($r = 0.286$). Education and awareness scores did not differ significantly across groups ($H = 10.387$, $p = 0.109$, $\eta^2 = 0.011$). Female sex was independently associated with higher scores in all domains ($p < 0.001$). Cronbach's alpha was 0.825 for the full Likert scale.

Conclusions

The mean knowledge score was 13.35/18 (74.2% of the maximum), with no statistically significant difference detected across the seven groups ($p = 0.060$). Clinical attitude scores differed significantly across groups; after Bonferroni correction, the sole significant pairwise difference was between physicians with 6–10 years of experience and Year-4 students ($p = 0.007$, $r = 0.286$). All groups reported a perceived need for further endometriosis education, and the proportion rating their own knowledge as poor or moderate (84.0%) underscores the case for curriculum review and continuing professional development.

Introduction

Endometriosis is a chronic inflammatory disease in which endometrial-like tissue grows outside the uterus, with an estimated prevalence of approximately 10% among women of reproductive age worldwide.[1, 2] Its clinical presentation is heterogeneous, ranging from dysmenorrhoea and chronic pelvic pain to dyspareunia and infertility, with well-documented consequences for quality of life, occupational functioning, and mental health.[3, 4, 5]

Diagnostic delay remains a central problem in the management of endometriosis. In many countries the interval between symptom onset and confirmed diagnosis averages 7–10 years,[6, 7] a gap driven in part by normalisation of pelvic pain, menstrual taboos, and limited awareness among frontline clinicians.[8, 9] Family medicine physicians and general practitioners are typically the first providers contacted by patients with dysmenorrhoea, chronic pelvic pain, or unexplained infertility; whether they consider endometriosis in the differential directly affects how quickly these patients reach specialist care.[10]

Medical students will form the next generation of primary-care practitioners, and the foundations laid during undergraduate training tend to persist into clinical practice.[11] Studies from various countries have documented deficiencies in both factual knowledge and professional attitudes regarding endometriosis among general practitioners, with surveys in France and New Zealand each identifying gaps in diagnostic criteria, guideline awareness, and perceived management competence.[12, 13] An awareness survey among women in Lebanon similarly revealed low endometriosis symptom recognition at the population level, underscoring a broader communication gap that education programmes could address.[14] Few studies have examined both practitioners and trainees within a single sample or tracked how knowledge and attitudes change across different stages of a medical career. Data from Turkey are particularly sparse.[15]

This study set out to compare endometriosis-related knowledge, clinical attitudes, and perceived educational needs among Year-4, Year-5, and Year-6 medical students and family medicine physicians in Bolu, Turkey. A secondary aim was to examine the effects of sex, age, and years of professional experience, and to determine which of these variables independently predicted scores on the knowledge and awareness sections.

Material and Methods

Study design and ethical approval

We conducted an analytical cross-sectional survey in Bolu, Turkey. The protocol received approval from the Non-Interventional Clinical Research Ethics Committee of Bolu Abant Izzet Baysal University (No. 2023/239) and was conducted in accordance with the Declaration of Helsinki. Before participants could access any survey items, they confirmed informed consent through a tick-box in the online Google Forms questionnaire. No personally identifiable information was recorded.

The study-specific questionnaire was developed based on the relevant literature and expert input and was pilot-tested before the main survey.

Internal consistency was assessed using Cronbach's alpha, yielding a coefficient of 0.82.

Participants

Recruitment targeted two populations: (i) clinical-year students (Years 4–6) at Bolu Abant Izzet Baysal University Faculty of Medicine, and (ii) family medicine specialists and residents working in Bolu province. Physicians were divided into four experience-based subgroups: 0–5, 6–10, 11–15, and ≥ 16 years.

Participants were eligible if they were enrolled in Year 4–6 of the medical programme or actively employed as a family medicine specialist or resident in Bolu, and if they provided voluntary informed consent. Those who submitted an incomplete questionnaire or withdrew during data collection were excluded.

Sample size

We estimated sample size with a one-way analysis of variance (ANOVA) power calculation used as a conservative a priori proxy, employing a medium effect size (Cohen's f = 0.25), four broad professional comparison groups (Years 4–5–6 medical students and family medicine physicians), α = 0.05, and 95% power; ANOVA was chosen at the planning stage because no established Kruskal–Wallis power formula was available in the software used. This yielded a minimum of 84 participants per group (total n = 336). With an estimated 20% non-response rate, the recruitment target was set at 400. The final sample of 400 met this threshold. The primary statistical comparisons were conducted using the Kruskal–Wallis test across seven subgroups to reflect within-profession heterogeneity. Post hoc power estimation confirmed that the observed sample provided ≥ 80% power to detect a medium group effect ($\eta^2 \approx 0.06$) with the Kruskal–Wallis test at α = 0.05 (df = 6). The FM 11–15 year subgroup (n = 13) was underpowered for isolated pairwise comparisons involving that group specifically; findings for this stratum are treated as exploratory.

Questionnaire

The research team developed the questionnaire after reviewing existing endometriosis knowledge instruments and relevant clinical guidelines, with additional expert input. A pilot test involving 30 participants (not included in the final analysis) assessed clarity and completion time; participants finished in 5–7 minutes on average. Content validity was evaluated by five subject-matter experts (two gynaecologists, one family medicine specialist, and two medical education faculty) using a content validity index (CVI); all items achieved CVI ≥ 0.80 and no items required revision following the pilot. Internal consistency was later confirmed in the main sample (see Results). The instrument contained four sections:

Section 1 — Demographic data

age, sex, profession, academic year (students), and years of professional experience (physicians).

Section 2 — Knowledge (items 6–23): 18 multiple-choice questions covering the definition, epidemiology, symptoms, risk factors, diagnostic modalities, and treatment options for endometriosis. Each correct answer was scored 1 point (range: 0–18).

Section 3 — Clinical attitudes and awareness (items 24–31): an 8-item, five-point Likert scale (1 = strongly disagree to 5 = strongly agree) assessing clinical attitudes toward endometriosis. Items 30 and 31 were reverse-scored (range: 8–40).

Items 32–33 — Prior training and self-assessed knowledge

Item 32 asked whether participants had previously received education on endometriosis (yes/no); item 33 asked them to rate their own knowledge level on a five-point scale (very poor, poor, moderate, good, very good).

Section 4 — Education and awareness needs (items 34–38): a 5-item, five-point Likert scale measuring perceived educational needs regarding endometriosis (range: 5–25). The total Likert score was the sum of Sections 3 and 4 (range: 13–65).

Statistical analysis

The primary outcome of this study was the knowledge score (items 6–23, range 0–18). Secondary outcomes were the Section 3 clinical attitude score (range 8–40), the Section 4 education and awareness score (range 5–25), and the total Likert score (range 13–65). All analyses were performed in IBM SPSS Statistics v26.0. The Shapiro–Wilk test indicated non-normal distributions for every score variable ($p < 0.05$), so non-parametric tests were used for univariable group comparisons and correlations. Multiple linear regression was subsequently used to examine independent associations with score outcomes. Continuous data are expressed as mean ± standard deviation (SD) and median [interquartile range (IQR)]; categorical data as counts and percentages. Group differences across the seven categories were examined with the Kruskal–Wallis test and Bonferroni-corrected Mann–Whitney U post-hoc tests (Z refers to the standardised test statistic derived from the U statistic; its sign reflects the ordering of the two groups in SPSS output; a negative Z indicates that the first-named group had lower ranks than the second, and only |Z| is used to derive r). Two-group comparisons by sex or profession used the Mann–Whitney U test. Spearman's rho measured correlations between score variables. Effect sizes are reported as eta-squared (η^2) for Kruskal–Wallis tests and r (rank-biserial correlation coefficient, $r = |Z|/\sqrt{n}$, where n is the pairwise sample size) for Mann–Whitney U tests. Spearman's rho (ρ) is used for continuous correlations and is distinguished from r throughout. Multiple linear regression identified independent predictors of knowledge and Likert scores, with Year-4 students and male sex as reference

categories; multicollinearity was checked via variance inflation factors (VIF). The significance level was $p < 0.05$.

Results

Participant characteristics

The final sample comprised 400 participants: 295 medical students (Year 4, n = 126 [31.5%]; Year 5, n = 70 [17.5%]; Year 6, n = 99 [24.8%]) and 105 family medicine physicians (experience 0–5 years, n = 46 [11.5%]; 6–10 years, n = 30 [7.5%]; 11–15 years, n = 13 [3.3%]; ≥16 years, n = 16 [4.0%]). Of the total, 250 (62.5%) were female and 150 (37.5%) male. Mean age was 26.0 ± 6.3 years (median 24.0; range 20–57). Full demographic detail by group appears in Table 1.

Table 1
Demographic characteristics by participant group.

Group	n (%)	Female/Male	Age, years Mean ± SD	Knowledge Score Median [IQR]	Section 3 Score Median [IQR]	Section 4 Score Median [IQR]	Total Likert Score Median [IQR]
Year 4	126 (31.5)	80/46	22.2 ± 1.2	13.0 [11–15]	32.5 [31–35]	19.0 [16–20]	51.0 [48–55]
Year 5	70 (17.5)	48/22	23.4 ± 1.1	14.5 [12–16]	34.0 [31.2–36.8]	19.0 [17–20.8]	53.0 [49–56]
Year 6	99 (24.8)	60/39	24.3 ± 1.4	14.0 [12–15]	34.0 [31–36]	19.0 [17–21]	53.0 [48–56.5]
FM 0–5 yr	46 (11.5)	30/16	27.9 ± 2.1	14.0 [12–16]	34.0 [32–36]	19.0 [18–20]	53.0 [50–56.8]
FM 6–10 yr	30 (7.5)	18/12	33.2 ± 3.9	14.0 [13–15.8]	36.0 [32.2–39]	18.0 [17.2–20]	55.5 [50–59.5]
FM 11–15 yr	13 (3.3)	7/6	38.5 ± 4.0	14.0 [13–15]	33.0 [31–36]	20.0 [19–21]	53.0 [51–55]
FM ≥ 16 yr	16 (4.0)	7/9	48.1 ± 5.6	14.5 [13–16]	38.0 [33.8–39]	20.0 [19–22]	58.0 [55–60]
Total	**400 (100)**	**250/150**	**26.0 ± 6.3**	**14.0** [12–16]	**34.0 [31–37]**	19.0 [17–21]	52.5 [49–57]

FM, family medicine. IQR, interquartile range.

Scale reliability

Internal consistency was satisfactory for Section 3 (α = 0.819) and the combined Likert scale (α = 0.825). Section 4 yielded a modest alpha of 0.643, which, while acceptable for an exploratory five-item subscale, suggests that the education-needs items tap more than a single underlying dimension.[16] Removing item 38 ("I feel competent in diagnosing endometriosis") from Section 4 raised its alpha to 0.788, suggesting this self-efficacy item partly taps a dimension distinct from perceived training need. Item 38 was nevertheless retained in the primary scoring, as it was a pre-specified survey component and its post hoc removal would alter the scale. The alpha of 0.643 meets the commonly cited threshold of ≥ 0.60 for exploratory subscales.[16] Sensitivity analyses excluding item 38 yielded substantively identical conclusions: Section 4 H = 8.370 (p = 0.212) and total Likert H = 18.375 (p = 0.005), with the same direction and significance of all pairwise comparisons.

Knowledge scores

The mean knowledge score was 13.35 ± 3.25 out of 18 (median 14.0 [IQR 12.0–16.0]; 74.2% of the achievable maximum). A Kruskal–Wallis test across the seven groups returned H = 12.107 (df = 6, p = 0.060, η^2 = 0.016), falling short of statistical significance (p = 0.060). Women outscored men on the knowledge scale (median 14.0 vs 13.0; U = 22 537, Z = 3.619, p = 0.0003, r = 0.18). Median knowledge scores were equal for medical students and family medicine physicians (14.0 in both groups), yet when participants were collapsed into two professional categories, the distributions differed statistically (U = 13 363, Z = − 2.088, p = 0.036), though the effect size was small (r = 0.10) and the median score was identical in both groups.

In the primary multiple linear regression model (R^2 = 0.082, F(8,391) = 4.339, p < 0.001), female sex, Year-5 and Year-6 enrolment, and all four family-medicine experience categories were positively associated with knowledge score, whereas age showed a negative association (B = − 0.21, p = 0.006). Variance inflation factors ranged from 1.02 to 9.18; the higher VIF values for age (9.18) and FM ≥ 16 years (7.01) reflect the natural collinearity between age and the experience-group dummies. The negative coefficient for age (B = − 0.21) should therefore be interpreted with caution. A sensitivity analysis excluding age from the knowledge regression confirmed the collinearity concern: experience-group coefficients were substantially attenuated (FM ≥ 16 years: B = + 6.98 → B = + 1.61; FM 11–15 years: B = + 4.48 → B = + 1.11 (p = 0.229); Year-6: B = + 1.02 → B = + 0.56 (p = 0.187); FM ≥ 16 years p = 0.057). Model R^2 fell from 0.082 to 0.065. The large experience-group coefficients in the primary model therefore partly reflect the age difference across groups rather than professional experience per se, and the age coefficient (B = − 0.21) should be interpreted accordingly.

Clinical attitudes (Section 3)

The Section 3 (clinical attitudes) score averaged 33.44 ± 4.43 (median 34.0 [IQR 31.0–37.0]; 83.6% of the achievable maximum). The Kruskal–Wallis test showed a significant group effect (H = 23.086, df = 6, p = 0.001, η^2 = 0.043). Bonferroni-corrected Mann–Whitney U post-hoc comparisons indicated that Year-4 students scored lower than FM physicians with 6–10 years of experience (Z = − 3.573, p = 0.007, r = 0.286). Across the entire sample, family medicine physicians scored higher than medical students

(median 34.0 vs 33.0; U = 12 110, Z = − 3.320, p = 0.0009, r = 0.17). The sex difference persisted in this section, with women outscoring men (median 34.0 vs 33.0; U = 22 683, Z = 3.750, p = 0.0002, r = 0.19).

The regression model for Section 3 accounted for 9.9% of variance (R^2 = 0.099, F(8,391) = 5.364, p < 0.001). Significant predictors were female sex (B = + 1.94, p < 0.001), Year-5 (B = + 1.38, p = 0.033), and FM 6–10 years (B = + 3.59, p = 0.012). Year-6 approached significance (B = + 1.18, p = 0.053). FM 0–5 years (p = 0.066), FM 11–15 years (p = 0.551), FM ≥ 16 years (p = 0.160), and age (p = 0.894) did not reach significance. VIF values ranged from 1.02 to 9.18.

Education and awareness needs (Section 4)

The Section 4 (education and awareness needs) score was 18.88 ± 2.65 (median 19.0 [IQR 17.0–21.0]; 75.5% of the achievable maximum). No statistically significant difference emerged across the seven groups (H = 10.387, df = 6, p = 0.109, η^2 = 0.011). Female participants scored higher than male participants (median 19.0 vs 18.0; U = 22 963, Z = 4.003, p = 0.0001, r = 0.20), whereas the comparison between medical students and family medicine physicians as a whole did not reach significance (U = 13 639, Z = − 1.817, p = 0.067). (Fig. 1)

Regression analysis (R^2 = 0.085, F(8,391) = 4.548, p < 0.001) returned two independent predictors: female sex (B = + 1.23, p < 0.001) and FM ≥ 16 years of experience (B = + 3.99, p = 0.022). Age (p = 0.302), Year-5 (p = 0.854), Year-6 (p = 0.161), FM 0–5 years (p = 0.127), FM 6–10 years (p = 0.232), and FM 11–15 years (p = 0.062) did not reach significance. VIF values for this model ranged from 1.02 to 9.18, mirroring the collinearity pattern observed in the knowledge model; the FM ≥ 16-year coefficient (B = + 3.99) should therefore be interpreted with the same caution noted above.

Prior training and self-assessed knowledge (items 32–33)

Two supplementary items were included between Sections 3 and 4. Item 32 asked whether participants had previously received any formal education on endometriosis: 267 (66.8%) responded yes and 133 (33.2%) responded no. Item 33 asked participants to rate their own knowledge of endometriosis on a five-point scale: 200 (50.0%) rated it as moderate, 136 (34.0%) as poor, 43 (10.8%) as good, 16 (4.0%) as very poor, and 5 (1.2%) as very good. Collectively, 84.0% of participants rated their knowledge as poor or moderate.

Total Likert score

The combined Likert score (Sections 3 and 4) averaged 52.32 ± 6.13 (median 52.5 [IQR 49.0–57.0]; 80.5% of the achievable maximum). A significant group effect was detected (H = 21.186, df = 6, p = 0.002, η^2 = 0.039); after Bonferroni correction, the only pair retaining significance was Year-4 students versus FM ≥ 16 years (Z = − 3.184, p = 0.030, r = 0.267). Family medicine physicians scored higher overall than students (median 54.0 vs 52.0; U = 12 250, Z = − 3.183, p = 0.0014, r = 0.16), and women scored higher than men (median 53.0 vs 51.0; U = 23 579, Z = 4.559, p < 0.0001, r = 0.23). (Fig. 2)

The total Likert regression model explained 12.5% of variance ($R^2 = 0.125$, $F(8,391) = 6.994$, $p < 0.001$). Independent predictors were female sex (B = + 3.17, $p < 0.001$), Year-6 (B = + 1.70, $p = 0.043$), FM 0–5 years (B = + 2.58, $p = 0.045$), FM 6–10 years (B = + 4.62, $p = 0.018$), and FM ≥ 16 years (B = + 8.03, $p = 0.043$). Year-5 ($p = 0.103$), FM 11–15 years ($p = 0.210$), and age ($p = 0.582$) did not reach significance. As with the knowledge and Section 4 models, VIF values for age and the FM ≥ 16-year dummy remained elevated (up to 9.18), and the FM ≥ 16-year coefficient (B = + 8.03) should be interpreted with caution. (Fig. 3)

Correlations

Knowledge score showed moderate positive associations with total Likert score ($\rho = 0.41$, $p < 0.001$), Section 3 ($\rho = 0.40$, $p < 0.001$), and Section 4 ($\rho = 0.29$, $p < 0.001$). Sections 3 and 4 themselves were moderately correlated ($\rho = 0.44$, $p < 0.001$). Age did not correlate significantly with knowledge score ($\rho = 0.08$, $p = 0.13$), though a small positive association was observed with total Likert score ($\rho = 0.14$, $p = 0.006$). (Fig. 4)

Discussion

This analytical cross-sectional survey examined endometriosis-related knowledge, clinical attitudes, and perceived educational needs in a sample of 400 participants comprising medical students and family medicine physicians from Bolu, Turkey. The central finding was that knowledge scores showed no statistically significant variation across training year or professional experience, whereas clinical attitude scores differed by professional group, with the most pronounced difference observed between Year-4 students and physicians with 6–10 years of experience.

Knowledge

Although a mean knowledge score of 74.2% may seem adequate at first glance, the clinical significance of this level cannot be determined without a validated proficiency threshold. For context, endometriosis affects roughly 10% of reproductive-age women and carries a diagnostic delay of 7–10 years,[6, 7] underscoring the importance of adequate clinical knowledge. Knowledge scores did not show a clear gradient across training year or professional experience ($H = 12.107$, $p = 0.060$, $\eta^2 = 0.016$), suggesting that neither the undergraduate curriculum nor years of professional practice were associated with higher factual knowledge in this sample. Comparable gaps have been documented elsewhere: surveys of general practitioners in France and New Zealand identified deficits in diagnostic criteria awareness and management competence, while a population-level survey in Lebanon found similarly low symptom recognition among women.[12, 13, 14] When participants were collapsed into two broad categories (medical students vs. family medicine physicians), a statistically significant difference emerged (U = 13 363, $p = 0.036$), but the effect size was small ($r = 0.10$) and median scores were identical in both groups (14.0 out of 18), suggesting that this difference, while statistically detectable, is of limited practical

magnitude. A ceiling effect is plausible, since the knowledge section was intentionally pitched at foundational rather than advanced clinical concepts.

The most consistent independent predictor of knowledge score was female sex (B = + 1.07, p = 0.001). A sex difference in endometriosis awareness has also been demonstrated in the general public: Shah et al. found that women scored substantially higher than men on a structured endometriosis knowledge survey, an effect attributed to greater personal and social familiarity with the condition.[17]

Clinical attitudes

Clinical attitudes differed significantly across groups (p = 0.001). After Bonferroni correction, the sole pairwise difference retaining significance was between physicians with 6–10 years of experience and Year-4 students (p = 0.007, r = 0.286), indicating a medium effect in that specific comparison. This pattern suggests that attitudes may be shaped partly by cumulative clinical encounters, though the absence of a monotonic gradient across all experience groups cautions against overinterpreting the effect.[18, 19]

Clinical attitudes did not differ significantly among the three medical-student year groups after Bonferroni correction, a finding consistent with a ceiling effect or with broadly similar curriculum exposure across clinical years; it cannot be taken as direct evidence of curricular insufficiency from the present data alone. Evidence suggests that structured, dedicated educational interventions on endometriosis can improve both factual knowledge and clinical readiness, supporting calls for targeted curriculum development.[12, 20]

Education needs

The uniformly high Section 4 scores across all groups (no significant group difference; p = 0.109) indicate that perceived need for further endometriosis training is broadly shared, irrespective of training stage or professional experience. The higher Section 4 score observed in the most experienced physician group (FM ≥ 16 years; B = + 3.99) suggests that perceived educational need may persist even after many years of clinical practice. Given the small size of this subgroup (n = 16) and the high collinearity between age and experience in the regression model, this finding should be interpreted cautiously.

Items 32 and 33 add direct empirical support to this conclusion. Although 66.8% of participants reported having previously received some form of endometriosis education, 84.0% rated their own knowledge as poor or moderate, and only 12.0% rated it as good or very good. This finding suggests that prior educational exposure does not necessarily correspond to high self-perceived knowledge; however, the content, duration, and timing of previous education were not assessed in this study.

Sex differences

Female sex was a consistent independent predictor of higher scores in every domain (p ≤ 0.001 across all regression models), with effect sizes in the small-to-moderate range (r = 0.18–0.23), consistent with

the sex-based awareness differential documented in the general public.[17] Whether the advantage derives from personal familiarity with menstrual health, more active engagement with reproductive health literature, or some combination of the two remains an open question that a cross-sectional design cannot resolve.

Correlations

The moderate correlation between knowledge and total Likert scores ($\rho = 0.41$, $p < 0.001$) confirms that factual knowledge and attitudinal measures were related but not interchangeable constructs. The negligible correlation between age and knowledge score ($\rho = 0.08$, $p = 0.13$) indicates that age was not associated with higher factual knowledge in this sample. The discrepancy between this non-significant bivariate correlation and the significant negative regression coefficient for age ($B = -0.21$, $p = 0.006$) may reflect a suppression effect arising from correlated predictors (age and the experience-group dummies).

Strengths and limitations

This study has several methodological strengths: recruitment spanned two distinct professional populations, scale reliability was verified through internal consistency analysis, and the study design enabled direct comparison across multiple stages of medical training and clinical experience. Against these strengths, the FM 11–15 year subgroup (n = 13) was small, which constrained statistical power for that stratum specifically. Causal inference is precluded by the cross-sectional design. Voluntary participation may have skewed the sample toward individuals with a pre-existing interest in endometriosis, and self-reported items may not faithfully capture actual clinical behaviour. The regression model included both age and experience-group dummies simultaneously; variance inflation factors for age (VIF = 9.18) and the FM ≥ 16-year dummy (VIF = 7.01) indicate substantial collinearity, which may inflate the standard error of the age coefficient and limits the interpretability of that estimate. A sensitivity analysis excluding age from the knowledge regression confirmed that the experience-group coefficients were substantially attenuated when age was removed (FM ≥ 16 years: B reduced from + 6.98 to + 1.61; FM 11–15 years and FM ≥ 16 years lost statistical significance), indicating that the large experience-group effects in the primary model are partly attributable to the age difference between groups rather than to professional experience alone. Finally, because data were collected within a single province (Bolu), which has a single academic medical centre and a specific family medicine workforce profile, generalisation to other Turkish regions, different healthcare system configurations, or non-Turkish settings should be approached with caution.

Conclusions

Endometriosis knowledge scores showed no significant variation with training year or years of clinical practice. Clinical attitudes, by contrast, were significantly higher among physicians with 6–10 years of experience compared with Year-4 students (the only Bonferroni-corrected significant pairwise difference), and perceived educational need was uniformly elevated across all groups. Female sex was independently associated with higher scores across all measured domains. These results point to the

need for a more systematic approach to endometriosis education, both within undergraduate medical curricula and through continuing professional development for practising family medicine physicians. Longitudinal and intervention studies are warranted to determine whether targeted training translates into earlier clinical recognition, shorter diagnostic delay, and improved referral practices for patients with endometriosis.

Abbreviations

ANOVA
Analysis of variance
df
Degrees of freedom
FM
Family medicine
H
Kruskal–Wallis test statistic
IQR
Interquartile range
r
Rank-biserial correlation coefficient (effect size for Mann–Whitney U tests; r = |Z|/√n)
ρ
Spearman’s rank correlation coefficient
R^2
Coefficient of determination
SD
Standard deviation
SPSS
Statistical Package for the Social Sciences
U
Mann-Whitney U test statistic
Z
Standardised test statistic from Mann–Whitney U post-hoc comparison
p
p-value (probability of obtaining the observed result under the null hypothesis)
VIF
Variance inflation factor
α
Significance level (probability threshold); also Cronbach's alpha (internal consistency reliability coefficient) in the context of scale validation
B

Unstandardised regression coefficient (unit change in outcome per unit change in predictor, with other predictors held constant)
η^2
Eta-squared effect-size estimate

Declarations

Competing interests

The authors declare no competing interests.

Ethics approval and consent to participate

The study was approved by the Non-Interventional Clinical Research Ethics Committee of Bolu Abant Izzet Baysal University (approval No. 2023/239) and complied with the Declaration of Helsinki. All participants provided electronic informed consent before data collection.

Consent to publish

Not applicable.

Funding

No funding was received for this study.

Author Contribution

I.S., P.F.Y., and F.D. conceived and designed the study. I.S. obtained ethics approval. I.S., P.F.Y., and F.D. collected the data. I.S. and P.F.Y. administered the survey, performed the statistical analysis, and wrote the main manuscript text. I.S., F.D., and M.A.E. revised the manuscript critically for important intellectual content. All authors reviewed and approved the final version of the manuscript.

Acknowledgements

The authors thank all medical students and family medicine physicians who participated in this study.

The authors used AI-assisted tools for language editing, grammar checking, and figure generation. All content was reviewed and verified by the authors, who take full responsibility for the accuracy and integrity of the manuscript.

Data Availability

The data supporting the findings of this study are available from the corresponding author upon reasonable request. The data were collected through an online questionnaire, and access to the dataset may be provided for research purposes upon reasonable request, subject to applicable ethical and confidentiality requirements.

References

1. Bulun SE, Yilmaz BD, Sison C, Miyazaki K, Bernardi L, Liu S, et al. Endometr Endocr Rev. 2019;40(4):1048–79. https://doi.org/10.1210/er.2018-00242.
2. Vercellini P, Viganò P, Somigliana E, Fedele L. Endometriosis: pathogenesis and treatment. Nat Rev Endocrinol. 2014;10(5):261–75. https://doi.org/10.1038/nrendo.2013.255.
3. Nnoaham KE, Hummelshoj L, Webster P, d'Hooghe T, de Cicco Nardone F, de Cicco Nardone C, et al. Impact of endometriosis on quality of life and work productivity: a multicenter study across ten countries. Fertil Steril. 2011;96(2):366–e3738. https://doi.org/10.1016/j.fertnstert.2011.05.090.
4. Simoens S, Dunselman G, Dirksen C, Hummelshoj L, Bokor A, Brandes I, et al. The burden of endometriosis: costs and quality of life of women with endometriosis and treated in referral centres. Hum Reprod. 2012;27(5):1292–9. https://doi.org/10.1093/humrep/des073.
5. De Graaff AA, D'Hooghe TM, Dunselman GA, Dirksen CD, Hummelshoj L, Simoens S. The significant effect of endometriosis on physical, mental and social wellbeing: results from an international cross-sectional survey. Hum Reprod. 2013;28(10):2677–85. https://doi.org/10.1093/humrep/det284.
6. Hadfield R, Mardon H, Barlow D, Kennedy S. Delay in the diagnosis of endometriosis: a survey of women from the USA and the UK. Hum Reprod. 1996;11(4):878–80. https://doi.org/10.1093/oxfordjournals.humrep.a019270.
7. De Corte P, Klinghardt M, von Stockum S, Heinemann K. Time to Diagnose Endometriosis: Current Status, Challenges and Regional Characteristics—A. Syst Literature Rev BJOG. 2025;132(2):118–30. https://doi.org/10.1111/1471-0528.17973.
8. Fryer J, Mason-Jones AJ, Woodward A. Understanding diagnostic delay for endometriosis: A scoping review using the social-ecological framework. Health Care Women Int. 2025;46(3):335–51. https://doi.org/10.1080/07399332.2024.2413056.
9. Culley L, Law C, Hudson N, Denny E, Mitchell H, Baumgarten M, et al. The social and psychological impact of endometriosis on women's lives: a critical narrative review. Hum Reprod Update. 2013;19(6):625–39. https://doi.org/10.1093/humupd/dmt027.
10. Agarwal SK, Chapron C, Giudice LC, Laufer MR, Leyland N, Missmer SA, et al. Clinical diagnosis of endometriosis: a call to action. Am J Obstet Gynecol. 2019;220(4):e3541–35412. https://doi.org/10.1016/j.ajog.2018.12.039.

11. Dixon S, McNiven A, Talbot A, Hinton L. Navigating possible endometriosis in primary care: a qualitative study of GP perspectives. Br J Gen Pract. 2021;71(710):e668–76. https://doi.org/10.3399/BJGP.2021.0030.
12. Ellis K, Meador A, Ponnampalam A, Wood R. Survey of General Practitioner Perspectives on Endometriosis Diagnosis, Referrals, Management and Guidelines in New Zealand. Health Expect. 2024;27(5):e70015. https://doi.org/10.1111/hex.70015.
13. Roullier C, Sanguin S, Parent C, Lombart M, Sergent F, Foulon A. General practitioners and endometriosis: Level of knowledge and the impact of training. J Gynecol Obstet Hum Reprod. 2021;50(10):102227. https://doi.org/10.1016/j.jogoh.2021.102227.
14. Kazan Z, Mroueh F, Hazime Z, Joumaa S, Hamze K, Husseini A, et al. Knowledge and concern towards endometriosis among Lebanese women: a cross-sectional study. BMC Womens Health. 2024;24(1):609. https://doi.org/10.1186/s12905-024-03443-y.
15. Yuksel Ozgor B, Azamat S, Berkay EG, Tureli D, Oguz SH, Dural O, et al. Epidemiology of Endometriosis Awareness in Turkey. Cureus. 2023;15(4):e37536. https://doi.org/10.7759/cureus.37536.
16. Nunnally JC. Psychometric Theory. 2nd ed. New York: McGraw-Hill; 1978.
17. Shah DK, Moravek MB, Vahratian A, Dalton VK, Lebovic DI. Public perceptions of endometriosis: perspectives from both genders. Acta Obstet Gynecol Scand. 2010;89(5):646–50. https://doi.org/10.3109/00016341003657900.
18. Ellis K, Munro D, Clarke J. Endometriosis Is Undervalued: A Call to Action. Front Glob Womens Health. 2022;3:902371. https://doi.org/10.3389/fgwh.2022.902371.
19. Brosens I, Gordts S, Benagiano G. Endometriosis in adolescents is a hidden, progressive and severe disease that deserves attention, not just compassion. Hum Reprod. 2013;28(8):2026–31. https://doi.org/10.1093/humrep/det243.
20. Khan KN, Ogawa K, Iwasa K, Kuroboshi H, Okimura H, Koshiba A, et al. A targeted educational programme improves fundamental knowledge of menstrual pain and endometriosis in young women: The Endometriosis Awareness Promotion Project. Reprod Biomed Online. 2022;45(6):1216–29. https://doi.org/10.1016/j.rbmo.2022.07.009.

Figures

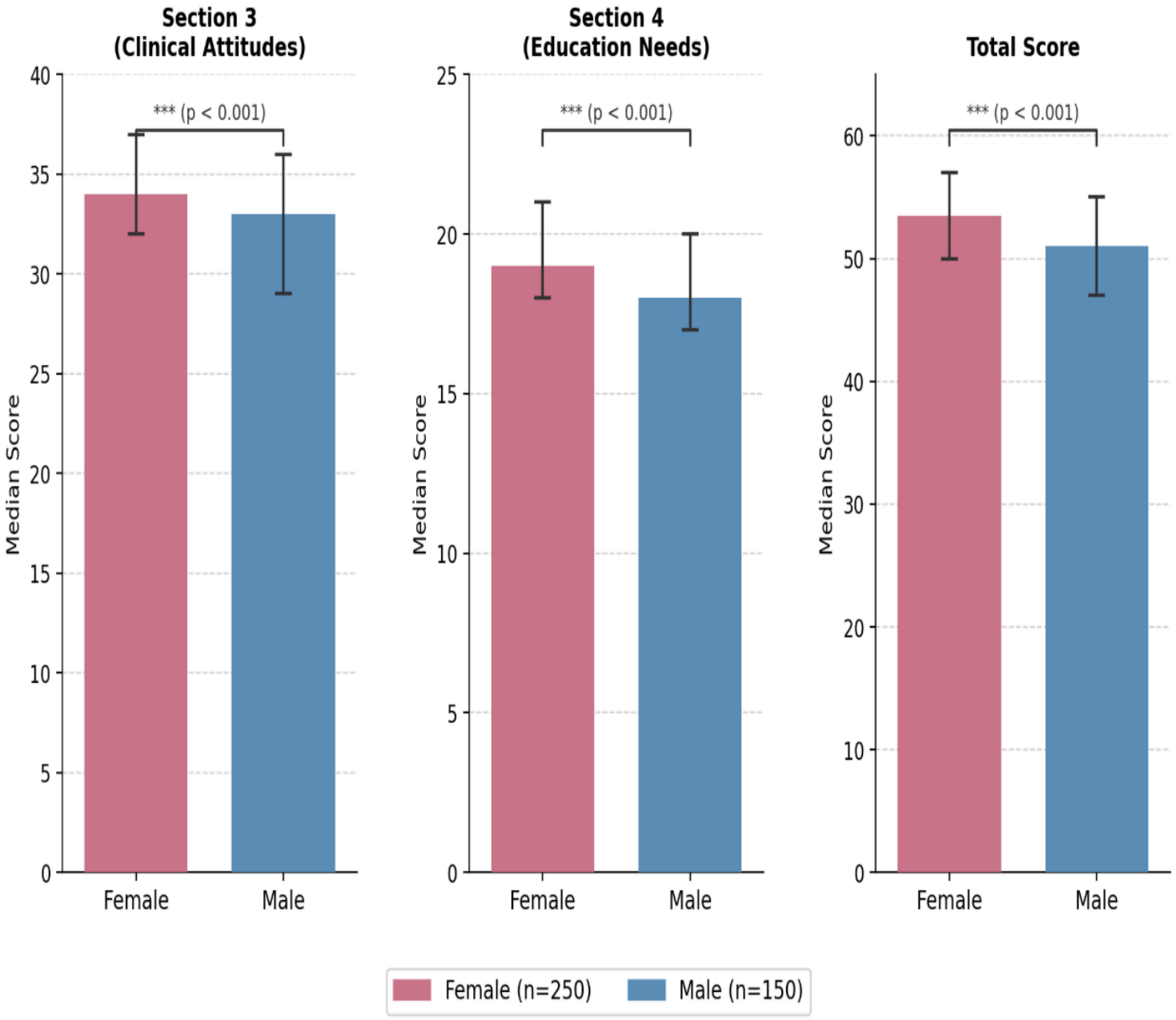


Figure 1

Median Section 3 (clinical attitudes), Section 4 (education and awareness needs), and total Likert scores by sex. Error bars represent the interquartile range. Mann–Whitney U tests were used for between-sex comparisons.

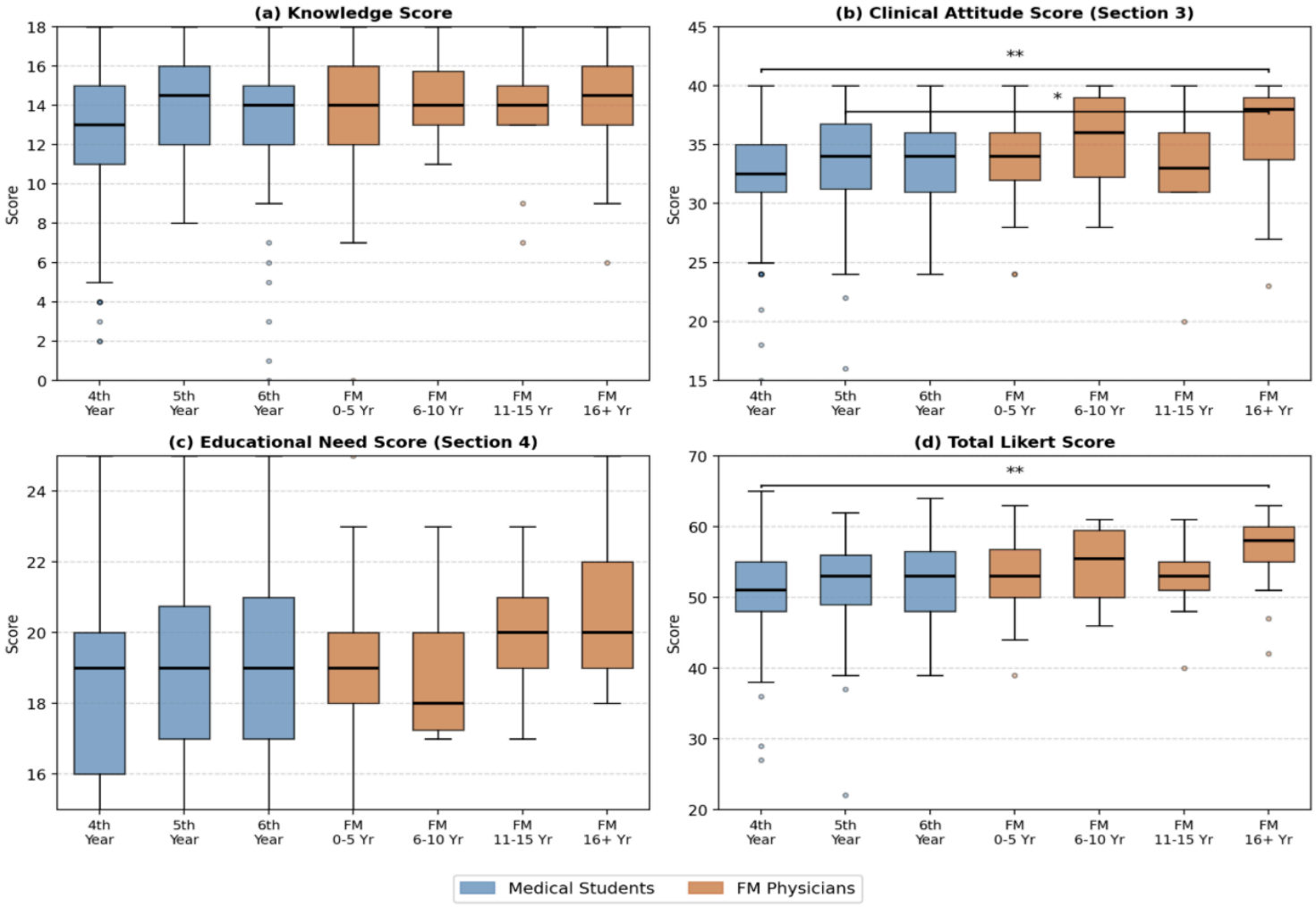


Figure 2

Distribution of knowledge (Section 2), clinical attitude (Section 3), educational need (Section 4), and total Likert scores across participant groups. Year 4–6 = medical students; FM = family medicine physicians stratified by years of experience. Boxes span the interquartile range, horizontal lines indicate medians, and whiskers extend to 1.5×IQR. Significance brackets indicate post-hoc Bonferroni-corrected Mann–Whitney U comparisons ($p < 0.05$). Outliers are shown as individual points.

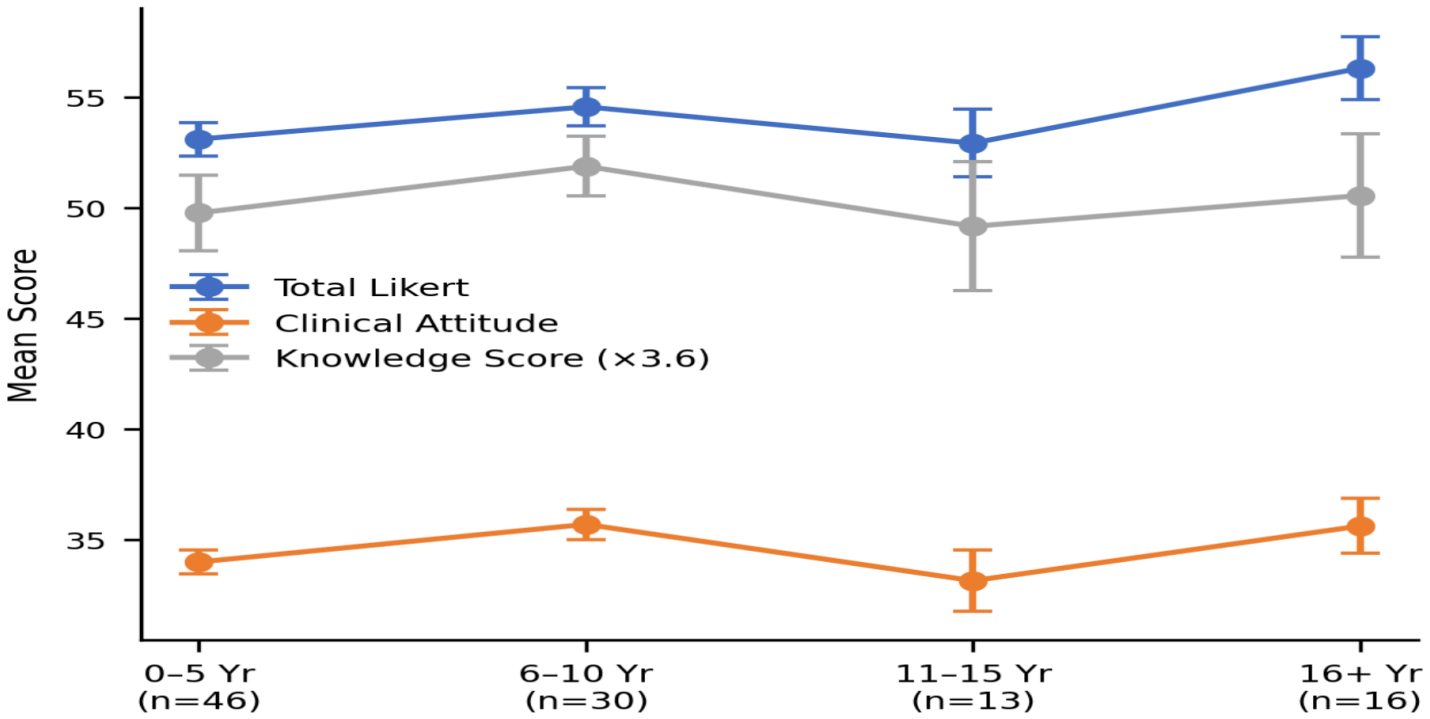


Figure 3

Mean scores for knowledge (scaled ×3.6 for visual comparison), clinical attitudes (Section 3, range 8–40), and total Likert score by years of professional experience group. Error bars indicate 95% confidence intervals. FM, family medicine.

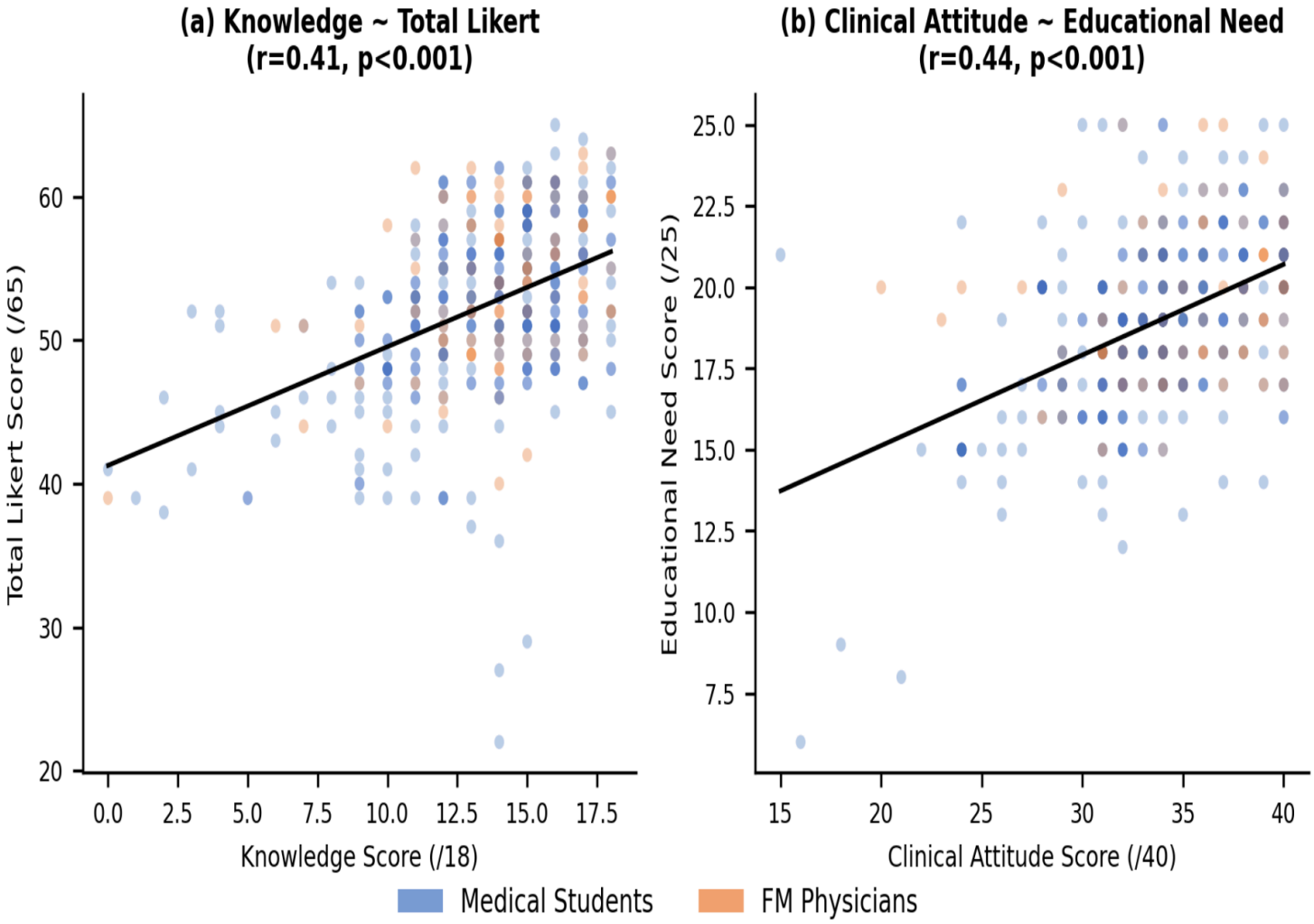


Figure 4

Spearman correlations between knowledge score, Section 3 (clinical attitudes), Section 4 (education/awareness), and total Likert score. Lines are visual trend lines for display purposes only and do not represent the Spearman analysis. r, Spearman's rho. ***p < 0.001.

Supplementary Files

This is a list of supplementary files associated with this preprint. Click to download.

- EndometriosisAwarenessQuestionnaireEnglish.pdf