

Association of Embryology Education with Infertility Knowledge and Attitudes among Medical and Health Sciences Students

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Abstract

Aim: The aim of this study is to compare infertility-related knowledge and attitudes among students from the Faculty of Medicine (basic and clinical phases) and the Faculty of Health Sciences (midwifery and nursing programs), and to investigate the association between embryology education and students' knowledge and attitudes toward infertility.

Method: This cross-sectional study included 228 undergraduate students from the Faculties of Medicine and Health Sciences. The sample size was determined by power analysis and participants were recruited using the snowball sampling method. Data were collected through an online questionnaire consisting of a sociodemographic information form, infertility knowledge questions and the "Attitude Scale Toward Infertility". Statistical analyses were performed using R version 4.3.1. Chi-square, independent samples t-test, Mann Whitney U, and Kruskal Wallis tests were applied as appropriate.

Results: Students' responses to the infertility knowledge questions differed significantly according to gender, academic program, year of study, and receipt of embryology education ($p < 0.05$). Medical students had significantly higher attitude scores toward infertility than health sciences students (47.81 ± 7.58 vs. 36.72 ± 3.62 ; $t = -14.089$, $p < 0.001$). Likewise, students who had received embryology education demonstrated significantly higher attitude scores than those who had not (44.76 ± 8.31 vs. 37.64 ± 5.28 ; $t = 6.947$, $p < 0.001$).

Conclusion: Medical students and students who had received embryology education exhibited greater infertility-related knowledge and more positive attitudes toward infertility than their counterparts. These findings suggest that strengthening embryology education may improve clinical awareness of infertility, support future healthcare professionals in the accurate management of infertility, facilitate psychosocial care, and contribute to reducing infertility-related social stigma.

Keywords: Embryology education, infertility awareness, health professional candidates, attitude scale.

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Tıp ve Sağlık Bilimleri Öğrencileri Arasında Embriyoloji Eğitimi ile Kısırlık Konusundaki Bilgi ve Tutumlar Arasındaki İlişki

Amaç: Bu çalışmanın amacı, Tıp Fakültesi (temel ve klinik tıp dönemleri) ve Sağlık Bilimleri Fakültesi (ebelik ve hemşirelik bölümleri) öğrencileri için embriyoloji eğitimi almanın, sosyodemografik değişkenlerin infertilite konusundaki bilgi ve tutum düzeyleri üzerindeki etkisini belirlemektir.

Yöntem: Kesitsel çalışmanın örnekleme güç analizi ile belirlendi ve kartopu örnekleme yöntemiyle tıp ve sağlık bilimleri fakültelerinden toplam 228 lisans öğrencisi çalışmaya alındı. Veriler; sosyodemografik bilgi formu, infertilite bilgisi ile ilgili sorular ve "İnfertilite Tutum Ölçeği" içeren çevrimiçi bir anket aracılığıyla toplandı. İstatistiksel analizler R 4.3.1 programı kullanılarak yapıldı, ki-kare, t-testi, Mann Whitney U ve Kruskal Wallis analizleri kullanıldı.

Bulgular: Öğrencilerin infertilite bilgisi ile ilgili sorulara verdikleri yanıtlar cinsiyet, bölüm, sınıf ve embriyoloji eğitim durumu açısından istatistiksel olarak anlamlı farklılık göstermiştir ($p < 0,05$). Tıp öğrencilerinin kısırlık konusundaki tutum puanları ($47,81 \pm 7,58$), sağlık bilimleri öğrencilerinin ($36,72 \pm 3,62$) puanlarından anlamlı derecede yüksek bulundu ($t = -14,089$, $p < 0,001$). Müfredatta embriyoloji eğitimi alan öğrencilerin tutum puanlarının ($44,76 \pm 8,31$) almayanlara ($37,64 \pm 5,28$) göre daha yüksek olduğu ve bu farkın istatistiksel olarak anlamlı olduğu bulundu ($t = 6,947$, $p < 0,001$).

Sonuç: Araştırma bulguları, tıp öğrencilerinin ve müfredatında embriyoloji eğitimi olan grupların, infertilite konusunda daha iyi bir bilgi düzeyine ve daha olumlu/yüksek farkındalığa sahip tutum sergilediklerini göstermektedir. Gelecekteki sağlık profesyonellerinin infertilite klinik tablosunu doğru bir şekilde yönetmelerini, psikososyal destek süreçlerini planlamalarını ve sosyal damgalamayı önlemelerini sağlamak için klinik farkındalığı desteklemek amacıyla embriyoloji eğitiminin güçlendirilmesi önerilmektedir.

Anahtar Sözcükler: Embriyoloji eğitimi, infertilite farkındalığı, sağlık profesyoneli adayları, tutum ölçeği.

Introduction

Prenatal development from fertilization to birth, including the mechanisms of morphogenesis and organogenesis at the tissue, cellular, and molecular levels, is the focus of embryology, a fundamental medical science. In modern medical education, embryology is generally taught during the first three years of medical school, either as part of histology or as an independent course^{1,2}. In faculties of health sciences, subjects related to reproductive health, childbirth, and obstetrics provide the basic scientific foundation for nursing and midwifery education³. Because infertility is closely associated with abnormalities in gametogenesis, fertilization, and embryonic development, a sound understanding of embryology is essential for healthcare professionals involved in infertility diagnosis, treatment, and assisted reproductive technologies^{4,5}.

Several studies have evaluated the knowledge and attitudes of future healthcare professionals toward infertility. Previous research indicates that health sciences students often have limited biological and clinical knowledge of infertility⁶. Although nursing and midwifery students generally demonstrate positive attitudes toward infertility, deficiencies remain regarding current assisted reproductive technologies and laboratory procedures^{7,8}. Similarly, medical students have been reported to possess adequate theoretical knowledge of reproductive health and fertility awareness but insufficient

embryological knowledge and practical understanding, partly because embryology is perceived as a complex three-dimensional subject¹.

To our knowledge, no previous study has compared infertility-related knowledge and attitudes among basic medicine (preclinic, Years 1–3) and clinical (Years 4–6) medical students and students from nursing and midwifery programs. Furthermore, it remains unclear how embryology education during the basic medicine years influences infertility awareness independently of clinical obstetrics and gynecology training. The progressive reduction in embryology teaching hours and the limited emphasis on its clinical relevance have raised concerns regarding students' preparedness². By comparing students at different educational stages and across health disciplines, this study aims to clarify the contribution of embryology education to infertility knowledge, clinical awareness, and attitudes toward infertility.

The aim of this study was to determine infertility-related knowledge, attitudes, and their association with sociodemographic characteristics among medical students (basic and clinical phases) and health sciences students enrolled in nursing and midwifery programs.

Material and Methods

Sample Size and Sampling Method

The required sample size was determined using G*Power 3.1. With an effect size of 0.44, a power of 0.95, and a confidence level, the sample size was determined to be 113 for each groups^{9,10}.

The snowball sampling method was used to recruit participants for the study. According to the General Data Protection Regulation (GDPR) and the principles of Open Science and research evaluation, the "European Code of Conduct for Research Integrity" (2023) highlights the impact of social media on the research data-collection process alongside technological developments¹¹. During data collection, the questionnaires were prepared in accordance with the principles of respect for individuals' privacy, scientific integrity, social responsibility, and scientific benefit in online research, as outlined by the British Psychological Society¹². According to Creswell, reaching individuals who can provide data and distributing questionnaires to them is advantageous for obtaining high-quality data¹³. In line with these views, participants were recruited using the snowball sampling method. Online communities involving different student groups were selected as starting points. The questionnaire was configured to allow only one response per participant and was then distributed. Before receiving the questionnaire, participants were presented with the "Informed Voluntary Consent Form"; data collection commenced after consent was obtained. Cookies and IP addresses were checked to verify the integrity of the collected data.

Inclusion and Exclusion Criteria

Students from the Faculties of Medicine and Health Sciences (nursing and midwifery) who provided informed voluntary consent and did not have any psychological disorders were included in the study.

Students who completed the questionnaires incompletely or incorrectly, as well as those who did not consent to participate, were excluded from the study.

Data Collection Forms

The questionnaire consisted of three sections. The first section included a sociodemographic data form covering age, gender, faculty and academic department, year of study, chronic illness, smoking and alcohol use, a history of infertility in the family or close circle, and receipt of embryology education. The second section included questions assessing infertility awareness. The third section included the "Attitude Toward Infertility Scale".

Attitude Toward Infertility Scale

The scale, developed by Siyez and colleagues in 2018, consists of 12 items and uses a five-point Likert-type response format: "(1) Strongly Disagree, (2) Disagree, (3) Neutral, (4) Agree, (5) Strongly Agree)." Items 1, 2, 5, 6, 8, 9, 11, and 12 are reverse-scored. The maximum possible score is 60, and the minimum possible score is 12. Higher scores indicate a more positive attitude toward infertility. The scale's Cronbach's alpha was 0.85⁶.

Ethical Statement

The protocol was approved by the Health Sciences Scientific Research Committee of Malatya Turgut Ozal University, Türkiye (No.: E-30785963-020-388205; date: 24 April 2026).

Data Analysis

Data were analyzed using the open-source program R (version 4.3.1). Statistical significance was set at $p < 0.05$. Descriptive statistics were presented as means, standard deviations, medians, counts, and percentages. For the comparison tests, the normality assumption was assessed using the Kolmogorov-Smirnov test. For groups with a normal distribution, pairwise comparisons were performed using the independent-samples t-test. For groups that were not normally distributed, pairwise comparisons were performed using the Mann-Whitney U test. For independent variables involving multiple groups that were not normally distributed, the Kruskal-Wallis test was applied; for pairwise comparisons, the Bonferroni-adjusted Mann-Whitney U test was used. For categorical data, contingency tables were created, and chi-square tests were performed.

Results

Table 1 presents a comparison of the sociodemographic characteristics of students in the Faculties of Medicine and Health Sciences. Statistically significant differences between the two faculties were found in gender ($\chi^2=9.432$, $p=0.002$), department ($\chi^2=228.000$, $p<0.001$), year of study ($\chi^2=62.392$, $p<0.001$), and smoking habits ($\chi^2=67.772$, $p<0.001$). However, no statistically significant differences were found between the Faculties of Medicine and Health Sciences in alcohol use ($\chi^2=1.060$, $p=0.589$) or chronic disease ($\chi^2=3.508$, $p=0.061$). A statistically significant difference was also found between the faculties regarding receipt of embryology education ($\chi^2=94.358$, $p<0.001$; Table 1).

Table 1. Comparison of demographic characteristics.

Variables	Groups	Health Science (n/%)	Medicine (n/%)	Total (n/%)	χ^2	p
Gender	Male	28 (24.56%)	50 (43.86%)	78 (34.21%)	9.432	0.002*
	Female	86 (75.44%)	64 (56.14%)	150 (65.79%)		
Department	Midwifery	69 (60.53%)	-	69 (30.26%)	228.000	<0.001*
	Nursing	45 (39.47%)	-	45 (19.74%)		
	Medicine	-	114 (100.00%)	114 (50.00%)		
Class	Class-1	24 (21.05%)	5 (4.39%)	29 (12.72%)	62.392	<0.001*
	Class-2	20 (17.54%)	55 (48.25%)	75 (32.89%)		
	Class-3	50 (43.86%)	16 (14.04%)	66 (28.95%)		
	Class-4	20 (17.54%)	22 (19.30%)	42 (18.42%)		
	Class-5	-	6 (5.26%)	6 (2.63%)		
	Class-6	-	10 (8.77%)	10 (4.39%)		
Smoking	Yes	84 (73.68%)	22 (19.30%)	106 (46.49%)	67.772	<0.001*
	No	30 (26.32%)	92 (80.70%)	122 (53.51%)		
Alcohol Use	Yes	14 (12.28%)	12 (10.53%)	25 (11.40%)	1.060	0.589
	No	100 (87.72%)	102 (89.47%)	202 (88.60%)		
Chronic Disease	Yes	14 (12.28%)	6 (5.26%)	20 (8.77%)	3.508	0.061

	No	100 (87.72%)	108 (94.74%)	208 (91.23%)		
Embryology Training	Yes	39 (34.21%)	109 (95.61%)	148 (64.91%)	94.358	<0.001*
	No	75 (65.79%)	5 (4.39%)	80 (35.09%)		

n; frequency, %; percent, χ^2 ; chi-square test, *p<0.05

Table 2 compares the responses to the infertility knowledge questions among students from the Faculties of Medicine and Health Sciences. Statistically significant differences in response distributions were found for questions 1, 2, and 4 to 12 (p<0.05). However, no statistically significant difference was found in the response distribution for question 3 (p>0.05).

Table 2. Comparison of infertility knowledge levels among students from the Faculties of Health Sciences and Medicine.

Variable	Group	Health Science (n/%)	Medicine (n/%)	Total (n/%)	χ^2	p
1. Infertility is a disease.	Yes	29 (25.44%)	79 (69.30%)	108 (47.37%)	43.981	<0.001*
	No	85 (74.56%)	35 (30.70%)	120 (52.63%)		
2. Infertility is more common in women than in men.	Yes	14 (12.28%)	48 (42.11%)	62 (27.19%)	25.609	<0.001*
	No	100 (87.72%)	66 (57.89%)	166 (72.81%)		
3. Infertility is more common in men than in women.	Yes	28 (24.56%)	27 (23.68%)	55 (24.12%)	0.024	0.877
	No	86 (75.44%)	87 (76.32%)	173 (75.88%)		
4. The incidence of infertility is equal in women and men.	Yes	71 (62.28%)	43 (37.72%)	114 (50.00%)	13.754	<0.001*
	No	43 (37.72%)	71 (62.28%)	114 (50.00%)		
5. Infertility is a condition that requires treatment.	Yes	43 (37.72%)	105 (92.11%)	148 (64.91%)	74.023	<0.001*
	No	71 (62.28%)	9 (7.89%)	80 (35.09%)		
	Yes	43 (37.72%)	6 (5.26%)	49 (21.49%)	35.587	<0.001*

6. In infertility treatment, in vitro fertilization (IVF) is the definitive solution.	No	71 (62.28%)	108 (94.74%)	179 (78.51%)		
7. In infertility treatment, artificial insemination is a definitive solution.	Yes	29 (25.44%)	7 (6.14%)	36 (15.79%)	15.965	<0.001*
	No	85 (74.56%)	107 (93.86%)	192 (84.21%)		
8. I understand that 12 months of unprotected intercourse is required for diagnosis in individuals with infertility.	Yes	44 (38.60%)	81 (71.05%)	125 (54.82%)	24.243	<0.001*
	No	70 (61.40%)	33 (28.95%)	103 (45.18%)		
9. In an approach to infertile couples, psychosocial support is necessary alongside medical treatment.	Yes	44 (38.60%)	113 (99.12%)	157 (68.86%)	97.381	<0.001*
	No	70 (61.40%)	1 (0.88%)	71 (31.14%)		
10. An embryo is formed by the fusion of male and female reproductive cells.	Yes	71 (62.28%)	110 (96.49%)	181 (79.39%)	40.765	<0.001*
	No	43 (37.72%)	4 (3.51%)	47 (20.61%)		
11. Staying up-to-date with current technological advancements in infertility treatment contributes to my professional development.	Yes	72 (63.16%)	108 (94.74%)	180 (78.95%)	34.200	<0.001*
	No	42 (36.84%)	6 (5.26%)	48 (21.05%)		
12. When approaching an individual diagnosed with infertility, I consider the risk of stigma (social discrimination).	Yes	71 (62.28%)	100 (87.72%)	171 (75.00%)	19.673	<0.001*
	No	43 (37.72%)	14 (12.28%)	57 (25.00%)		

n; frequency, %, percent, χ^2 ; chi-square test, * $p < 0.05$

Table 3 compares responses to the infertility knowledge questions among students with and without a history of infertility in their family or close social circle. Statistically significant differences in response distributions were found for questions 1, 3, 4, 8, 9, and 10 among students with and without a family or close-relative history of infertility ($p < 0.05$). No statistically significant differences were found for questions 2, 5, 6, 7, 11, and 12 between students with and without a history of infertility in their family or close social circle ($p > 0.05$).

Table 3. Comparison based on the presence of a family history of infertility.

Variable	Group	Family History of Infertility Yes (n/%)	Family History of Infertility No (n/%)	Total (n/%)	χ^2	p
1. Infertility is a disease.	Yes	39 (33.62%)	69 (61.61%)	108 (47.37%)	17.902	<0.001*
	No	77 (66.38%)	43 (38.39%)	120 (52.63%)		
2. Infertility is more common in women than in men.	Yes	29 (25.00%)	33 (29.46%)	62 (27.19%)	0.574	0.449
	No	87 (75.00%)	79 (70.54%)	166 (72.81%)		
3. Infertility is more common in men than in women.	Yes	19 (16.38%)	36 (32.14%)	55 (24.12%)	7.736	0.005*
	No	97 (83.62%)	76 (67.86%)	173 (75.88%)		
4. The incidence of infertility is equal in women and men.	Yes	67 (57.76%)	47 (41.96%)	114 (50.00%)	5.686	0.017*
	No	49 (42.24%)	65 (58.04%)	114 (50.00%)		
5. Infertility is a condition that requires treatment.	Yes	71 (61.21%)	77 (68.75%)	148 (64.91%)	1.424	0.233
	No	45 (38.79%)	35 (31.25%)	80 (35.09%)		
6. In infertility treatment, in vitro fertilization (IVF) is the definitive solution.	Yes	31 (26.72%)	18 (16.07%)	49 (21.49%)	3.832	0.050
	No	85 (73.28%)	94 (83.93%)	179 (78.51%)		
7. In infertility treatment, artificial insemination is a definitive solution.	Yes	16 (13.79%)	20 (17.86%)	36 (15.79%)	0.708	0.400
	No	100 (86.21%)	92 (82.14%)	192 (84.21%)		
8. I understand that 12 months of unprotected intercourse is required for diagnosis in individuals with infertility.	Yes	54 (46.55%)	71 (63.39%)	125 (54.82%)	6.525	0.011*
	No	62 (53.45%)	41 (36.61%)	103 (45.18%)		

9. In an approach to infertile couples, psychosocial support is necessary alongside medical treatment.	Yes	60 (51.72%)	97 (86.61%)	157 (68.86%)	32.336	<0.001*
	No	56 (48.28%)	15 (13.39%)	71 (31.14%)		
10. An embryo is formed by the fusion of male and female reproductive cells.	Yes	100 (86.21%)	81 (72.32%)	181 (79.39%)	6.714	0.010*
	No	16 (13.79%)	31 (27.68%)	47 (20.61%)		
11. Staying up-to-date with current technological advancements in infertility treatment contributes to my professional development.	Yes	86 (74.14%)	94 (83.93%)	180 (78.95%)	3.286	0.070
	No	30 (25.86%)	18 (16.07%)	48 (21.05%)		
12. When approaching an individual diagnosed with infertility, I consider the risk of stigma (social discrimination).	Yes	84 (72.41%)	87 (77.68%)	171 (75.00%)	0.842	0.359
	No	32 (27.59%)	25 (22.32%)	57 (25.00%)		

n; frequency, %; percent, χ^2 ; chi-square test, * $p < 0.05$

Table 4 presents the infertility knowledge of students who had and had not previously received embryology training. Statistically significant differences in response distributions were found for questions 1 to 11 between the two groups ($p < 0.05$). No statistically significant difference was found for question 12 ($p > 0.05$).

Table 4. Comparison based on receipt of embryology training.

Variable	Group	Embryology Training Yes (n/%)	Embryology Training No (n/%)	Total (n/%)	χ^2	p
1. Infertility is a disease.	Yes	88 (59.46%)	20 (25.00%)	108 (47.37%)	24.734	<0.001*
	No	60 (40.54%)	60 (75.00%)	120 (52.63%)		
2. Infertility is more common in women than in men.	Yes	58 (39.19%)	4 (5.00%)	62 (27.19%)	30.659	<0.001*
	No	90 (60.81%)	76 (95.00%)	166 (72.81%)		
3. Infertility is more common in men than in women.	Yes	45 (30.41%)	10 (12.50%)	55 (24.12%)	9.096	0.003*
	No	103 (69.59%)	70 (87.50%)	173 (75.88%)		

4. The incidence of infertility is equal in women and men.	Yes	59 (39.86%)	55 (68.75%)	114 (50.00%)	17.331	<0.001*
	No	89 (60.14%)	25 (31.25%)	114 (50.00%)		
5. Infertility is a condition that requires treatment.	Yes	118 (79.73%)	30 (37.50%)	148 (64.91%)	40.660	<0.001*
	No	30 (20.27%)	50 (62.50%)	80 (35.09%)		
6. In infertility treatment, in vitro fertilization (IVF) is the definitive solution.	Yes	13 (8.78%)	36 (45.00%)	49 (21.49%)	40.369	<0.001*
	No	135 (91.22%)	44 (55.00%)	179 (78.51%)		
7. In infertility treatment, artificial insemination is a definitive solution.	Yes	17 (11.49%)	19 (23.75%)	36 (15.79%)	5.874	0.015*
	No	131 (88.51%)	61 (76.25%)	192 (84.21%)		
8. I understand that 12 months of unprotected intercourse is required for diagnosis in individuals with infertility.	Yes	94 (63.51%)	31 (38.75%)	125 (54.82%)	12.858	<0.001*
	No	54 (36.49%)	49 (61.25%)	103 (45.18%)		
9. In an approach to infertile couples, psychosocial support is necessary alongside medical treatment.	Yes	115 (77.70%)	42 (52.50%)	157 (68.86%)	15.382	<0.001*
	No	33 (22.30%)	38 (47.50%)	71 (31.14%)		
10. An embryo is formed by the fusion of male and female reproductive cells.	Yes	133 (89.86%)	48 (60.00%)	181 (79.39%)	28.303	<0.001*
	No	15 (10.14%)	32 (40.00%)	47 (20.61%)		
11. Staying up-to-date with current technological advancements in infertility treatment contributes to my professional development.	Yes	128 (86.49%)	52 (65.00%)	180 (78.95%)	14.425	<0.001*
	No	20 (13.51%)	28 (35.00%)	48 (21.05%)		
12. When approaching an individual diagnosed with infertility, I consider the risk of stigma (social discrimination).	Yes	113 (76.35%)	58 (72.50%)	171 (75.00%)	0.411	0.522
	No	35 (23.65%)	22 (27.50%)	57 (25.00%)		

n; frequency, %; percent, χ^2 ; chi-square test, *p<0.05

Table 5 presents the Attitude Toward Infertility Scale scores and between-group comparisons. Students in the Faculty of Medicine had significantly higher attitude scores toward infertility than students in the Faculty of Health Sciences ($t=-14.089$, $p<0.001$). Similarly, students who had received embryology education had significantly higher attitude scores toward infertility than those who had not ($t=6.947$, $p<0.001$). The difference in Attitude Toward Infertility Scale scores between the faculties was not only statistically significant but also demonstrated a very large effect size (Cohen's $d=1.870$). Similarly, the difference associated with embryology training showed a large effect size (Cohen's $d=0.960$).

Table 5. Comparison of Attitude Toward Infertility Scale scores.

Variable	Group	Mean $\pm$ sd	t	p	Effect size
Faculty	Health Science	36.72 $\pm$ 3.62	-14.089	<0.001*	1.870
	Medicine	47.81 $\pm$ 7.58			
Embryology Training	Yes	44.76 $\pm$ 8.31	6.947	<0.001*	0.960
	No	37.64 $\pm$ 5.28			

sd; standard deviation, t; independent t test, * $p<0.05$

Table 6 compares responses to infertility-related questions among students in basic medical sciences, clinical medicine, midwifery, and nursing. A statistically significant difference was found in the distribution of responses between students who had and had not received embryology education ($\chi^2=132.581$, $p<0.001$).

Table 6. Comparison of embryology training status among students in basic medical sciences, clinical medicine, midwifery, and nursing.

Variable	Group	Midwifery (n/%)	Nursing (n/%)	Basic Medical Sciences (n/%)	Clinical Medicine Sciences (n/%)	Total (n/%)	χ^2	p
Embryology Training	Yes	39 (56.52%)	-	73 (96.05%)	36 (94.74%)	148 (64.91%)	132.581	<0.001*
	No	30 (43.48%)	45 (100.00%)	3 (3.95%)	2 (5.26%)	80 (35.09%)		

n; frequency, %; percent, χ^2 ; chi-square test, * $p<0.05$

Table 7 compares responses to infertility-related questions among students in basic medical sciences, clinical medicine, midwifery, and nursing. Statistically significant differences in response distributions were found for questions 1 to 12 among the four groups ($p<0.05$).

Table 7. Comparison of responses from students in basic medical sciences, clinical medicine, midwifery, and nursing.

Variable	Group	Midwifery (n/%)	Nursing (n/%)	Basic Medical Sciences (n/%)	Clinical Medicine Sciences (n/%)	Total (n/%)	χ^2	p
1. Infertility is a disease.	Yes	14 (20.29%)	15 (33.33%)	57 (75.00%)	22 (57.89%)	108 (47.37%)	48.813	<0.001*
	No	55 (79.71%)	30 (66.67%)	19 (25.00%)	16 (42.11%)	120 (52.63%)		
2. Infertility is more common in women than in men.	Yes	14 (20.29%)	-	28 (36.84%)	20 (52.63%)	62 (27.19%)	34.463	<0.001*
	No	55 (79.71%)	45 (100.00%)	48 (63.16%)	18 (47.37%)	166 (72.81%)		
3. Infertility is more common in men than in women.	Yes	28 (40.58%)	-	23 (30.26%)	4 (10.53%)	55 (24.12%)	29.919	<0.001*
	No	41 (59.42%)	45 (100.00%)	53 (69.74%)	34 (89.47%)	173 (75.88%)		
4. The incidence of infertility is equal in women and men.	Yes	41 (59.42%)	30 (66.67%)	29 (38.16%)	14 (36.84%)	114 (50.00%)	14.344	0.002*
	No	28 (40.58%)	15 (33.33%)	47 (61.84%)	24 (63.16%)	114 (50.00%)		
5. Infertility is a condition that requires treatment.	Yes	28 (40.58%)	15 (33.33%)	71 (93.42%)	34 (89.47%)	148 (64.91%)	74.824	<0.001*
	No	41 (59.42%)	30 (66.67%)	5 (6.58%)	4 (10.53%)	80 (35.09%)		
6. In infertility treatment, in vitro fertilization (IVF) is the definitive solution.	Yes	14 (20.29%)	29 (64.44%)	3 (3.95%)	3 (7.89%)	49 (21.49%)	67.293	<0.001*
	No	55 (79.71%)	16 (35.56%)	73 (96.05%)	35 (92.11%)	179 (78.51%)		
7. In infertility treatment, artificial insemination is a definitive solution.	Yes	14 (20.29%)	15 (33.33%)	4 (5.26%)	3 (7.89%)	36 (15.79%)	19.582	<0.001*
	No	55 (79.71%)	30 (66.67%)	72 (94.74%)	35 (92.11%)	192 (84.21%)		
8. I understand that 12 months of unprotected intercourse is required for diagnosis in	Yes	28 (40.58%)	16 (35.56%)	47 (61.84%)	34 (89.47%)	125 (54.82%)	32.330	<0.001*
	No	41 (59.42%)	29 (64.44%)	29 (38.16%)	4 (10.53%)	103 (45.18%)		

individuals with infertility.								
9. In an approach to infertile couples, psychosocial support is necessary alongside medical treatment.	Yes	14 (20.29%)	30 (66.67%)	75 (98.68%)	38 (100.00%)	157 (68.86%)	124.721	<0.001*
	No	55 (79.71%)	15 (33.33%)	1 (1.32%)	-	71 (31.14%)		
10. An embryo is formed by the fusion of male and female reproductive cells.	Yes	55 (79.71%)	16 (35.56%)	73 (96.05%)	37 (97.37%)	181 (79.39%)	73.241	<0.001*
	No	14 (20.29%)	29 (64.44%)	3 (3.95%)	1 (2.63%)	47 (20.61%)		
11. Staying up-to-date with current technological advancements in infertility treatment contributes to my professional development.	Yes	42 (60.87%)	30 (66.67%)	72 (94.74%)	36 (94.74%)	180 (78.95%)	34.751	<0.001*
	No	27 (39.13%)	15 (33.33%)	4 (5.26%)	2 (5.26%)	48 (21.05%)		
12. When approaching an individual diagnosed with infertility, I consider the risk of stigma (social discrimination).	Yes	41 (59.42%)	30 (66.67%)	65 (85.53%)	35 (92.11%)	171 (75.00%)	21.020	<0.001*
	No	28 (40.58%)	15 (33.33%)	11 (14.47%)	3 (7.89%)	57 (25.00%)		

n; frequency, %; percent, χ^2 ; chi-square test, * $p < 0.05$

Table 8 presents the Attitude Toward Infertility Scale scores of students in basic medical sciences, clinical medicine, midwifery, and nursing, together with between-group comparisons. The highest attitude score was observed among students in basic medical sciences, whereas the lowest was recorded among midwifery students. Attitude scores differed significantly among the four groups ($H=115.337$, $p < 0.001^*$). Pairwise comparisons revealed statistically significant differences between midwifery and nursing ($p=0.008^*$), midwifery and clinical medicine ($p < 0.001^*$), midwifery and basic medicine ($p < 0.001^*$), nursing and clinical medicine ($p < 0.001^*$), and nursing and basic medicine ($p < 0.001$). A Kruskal-Wallis test revealed a statistically significant difference in infertility attitudes among the four departments ($H=115.337$, $p < 0.001$), indicating a large effect size ($\eta^2=0.508$). This large effect further highlights the clinical and practical significance of educational background for attitudes toward infertility.

Table 8. Comparison of Attitude Toward Infertility Scale scores among students in basic medical sciences, clinical medicine, midwifery, and nursing.

Variable	Group	Mean $\pm$ sd	M (Min - Max)	H	p	Effect size (η^2)
Attitudes Towards Infertility	Midwifery	35.72 $\pm$ 3.17	36(28-41)	115.337	<0.001*	0.508
	Nursing	38.24 $\pm$ 3.77	38(32-46)			
	Basic Medical Sciences	47.84 $\pm$ 7.57	48(20-60)			
	Clinical Medicine Sciences	47.74 $\pm$ 7.7	48(32-60)			

Sd; standard deviation, M; Median, H; Kruskal Wallis test, *p<0.05

Discussion

The present study compares the infertility-related knowledge and attitudes of medical students with those of midwifery and nursing students in the Faculty of Health Sciences. The findings indicate that infertility awareness extends beyond reproductive health or obstetrics education to include basic medical sciences, particularly embryology. Medical students had significantly higher attitude scores toward infertility than students in the Faculty of Health Sciences. These findings suggest that addressing infertility not only as a social or psychological condition but also as a biological process related to gametogenesis, fertilization, implantation, embryonic development, and assisted reproductive procedures may strengthen attitudes.

Students who had received embryology education had substantially higher attitude scores than those who had not received embryology instruction. This finding reinforces the view that embryology provides a clinical foundation for understanding infertility rather than being separate from clinical practice. However, despite its continued clinical relevance in areas such as obstetrics, gynecology, pediatrics, genetic counseling, and assisted reproductive technologies^{2,3}, studies have indicated that fewer hours of embryology are allocated in current medical curricula. Recent research among medical students has shown that they consider embryology clinically valuable but believe it should be supplemented with clinical context because the subject is perceived as difficult and abstract^{1,4}. Therefore, the present results suggest that, in addition to maintaining the importance of embryology in medical education, it should also be addressed more systematically in health sciences curricula.

Many believe that embryology knowledge unrelated to clinical practice has a limited impact on fostering lasting awareness among students. Therefore, a teaching model based on spiral and vertical integration between the basic and clinical sciences is recommended^{3,14}. The attitude scores of basic medical and clinical medical students in

our study were very similar. The mean attitude score was 47.84 ± 7.57 among basic medical students and 47.74 ± 7.70 among clinical medical students. This finding suggests that education in basic medical sciences and embryology during the first three years of medical school provides a positive foundation for developing favorable attitudes toward infertility. However, the transition to obstetrics and gynecology internships or clinical practice did not provide sufficient vertical integration to further promote this attitude. Therefore, theoretical knowledge provided during the preclinical period may not be fully adequate. Integrating clinical cases related to embryological knowledge, the evaluation of infertile couples, the application of assisted reproductive techniques, and ethical and psychosocial aspects into the preclinical period could positively affect these outcomes.

The lower attitude scores among midwifery and nursing students than among medical students suggest that embryological and laboratory-based mechanisms receive insufficient coverage because infertility is addressed more often under the headings of childbirth, reproductive health, or family planning in health sciences education. Dönmez and Emül (2021)⁸ found that nursing students' knowledge and attitudes toward infertility were generally favorable, but these levels were affected by characteristics such as year of study, gender, location, and family history of infertility. Additionally, Çakır et al. (2020)⁷ reported that although final-year students' attitudes toward infertility were generally positive, there was still room for improvement, particularly among midwifery and nursing students. They reported that final-year nursing students had higher attitude scores toward infertility than final-year midwifery students. The main curriculum-based explanation for this difference is that midwifery students have more frequent encounters with infertile individuals in gynecology and obstetrics departments and in vitro fertilization (IVF) centers during their education and clinical training. Although infertility is often covered within a narrower theoretical timeframe in the nursing curriculum, the opportunity for midwifery students to communicate directly with and provide healthcare to this patient population has a direct positive effect on their views⁷. The lowest attitude score in the midwifery group in this study indicates that, although midwifery students are likely to encounter infertile couples in clinical settings in their future professions, they may need more robust curricular support addressing infertility from embryological, clinical, and psychosocial perspectives.

One study reported that the attitudes of nursing, midwifery, and nutrition/dietetics students toward infertility differed according to their department and that the attitude scores of health sciences students were higher than those previously reported in the literature¹⁵. In our study, medical students had higher attitude scores than health sciences students. This disparity shows that health sciences students are not a homogeneous group and that their attitude levels should be examined according to factors such as department, year of study, personal contact with infertility, and embryology instruction.

Regarding the knowledge questions, the responses suggest that differences in attitude scores reflect more than a generally positive approach; they also reflect actual differences in specific knowledge areas. Significant differences were found for 11 of the 12 knowledge

questions between medical and health sciences students, suggesting education-related differences in fundamental areas such as understanding infertility as a disease, recognizing that treatment does not guarantee a definitive result, knowing the 12-month unprotected-intercourse criterion for diagnosis, recognizing the need for psychosocial support, and understanding the biological formation of embryos. The substantial differences across all knowledge questions in the comparison of the four groups show that basic medical sciences, clinical medicine, midwifery, and nursing programs are not uniform in terms of infertility knowledge. These findings indicate that a single course or clinical internship cannot adequately cover infertility education. Horizontal and vertical curriculum components, including basic biology, clinical decision-making, ethics, psychosocial support, and stigma awareness, are needed.

One of the study's main contributions is the analysis based on whether students had received embryology instruction. Statistically significant differences were found for 11 of the 12 knowledge questions between students who had and had not received embryology education. Students who had received embryology education provided more informed responses, particularly regarding infertility as a condition requiring treatment, the fact that IVF and insemination are not definitive solutions, diagnostic criteria, the need for psychosocial support, embryo formation, and the contribution of staying up to date with current technological developments to professional development. The findings suggest that embryology education may contribute to improved infertility awareness and more positive attitudes toward patient-centered infertility care. A bibliometric analysis of the intersection of midwifery, histology, and embryology by Çadırcı et al. (2026)⁵ noted that basic sciences reinforce pregnancy, fetal development, and evidence-based decision-making processes in midwifery education. The present study provides empirical support for this inference through students' attitudes and knowledge levels.

Mukhtar et al. (2023)² state that embryology education in medical school curricula should be integrated with histology during the preclinical period or taught independently. It includes cellular, molecular, and morphological details from gametogenesis to implantation and from morphogenesis to anomalies in early embryonic development. Our findings indicate that knowledge gained through embryology education is positively associated with attitudes toward reproductive health and infertility.

The findings of this study indicate a structural divergence in attitudes toward infertility between students in the Faculty of Medicine and those in the Faculty of Health Sciences (midwifery and nursing), all of whom are future health professionals. The high proportion of female students in the midwifery and nursing programs may also influence attitudes toward infertility. Studies have shown that female gender and professional orientation toward reproductive health disciplines are closely associated with the development of empathy toward couples facing infertility and a reduction in societal stigma¹⁶. The more balanced gender distribution in medical schools and the holistic approach to patients in clinical settings highlight the need for greater emphasis on empathy and stigma-related course content from the preclinical period onward.

Embryology education may improve biological and clinical awareness but may not be sufficient to change the societal stigma, social pressure, and psychological burden associated with infertility. Infertility is described as a life crisis with medical, psychological, and social consequences for couples; during treatment, feelings of guilt, stigma, deterioration of partner relationships, social isolation, and treatment discontinuation may occur¹⁷. Therefore, educational programs should incorporate psychological care, communication skills, ethical counseling, and anti-stigma training alongside embryology instruction. The results show that psychosocial support is as important as medical treatment when caring for individuals experiencing infertility, indicating that future health professionals should be equipped not only with biomedical knowledge but also with patient-centered communication skills and cultural sensitivity.

According to the literature, understanding of infertility is influenced by personal or familial experiences and lived realities^{8,18}.

Conclusion and Recommendations

A three-level curriculum framework for infertility education may positively influence the training of healthcare workers. The first phase should comprise the embryological foundations of gametogenesis, fertilization, implantation, embryonic development, congenital anomalies, and assisted reproductive techniques and should be organized and taught during the early years of medical and health sciences education. During the second, clinical phase, case-based learning should be integrated with training in assisted reproductive technology centers, obstetrics and gynecology, reproductive endocrinology, andrology, urology, genetic counseling, and embryology laboratories. In the third stage, communication with infertile couples, stigma, ethical decision-making, psychosocial support, and cultural sensitivity should be included among the core competencies common to all programs. This model could facilitate the transfer of preclinical knowledge to clinical awareness, strengthen the role of health sciences students in infertility care, and reinforce a patient-centered approach among all future health professionals.

In conclusion, the findings suggest that embryology education is associated with greater infertility knowledge and more positive attitudes among future healthcare professionals. The similarly high attitude scores of preclinical and clinical medical students are consistent with an association between early embryology education and positive attitudes; however, these findings also demonstrate the need to translate this knowledge further into patient-centered and practical skills in assisted reproductive technology centers during the clinical period. The lower attitude scores among midwifery and nursing students indicate that content related to embryology, infertility, and assisted reproductive technologies should be strengthened in a more systematic and clinically integrated manner in health sciences curricula, including psychosocial aspects. The results indicate that an obstetrics course alone may not be sufficient for infertility education; an integrated, stigma-sensitive teaching strategy that includes embryology as well as clinical and laboratory procedures is needed for future physicians, midwives, and nurses.

Study Limitations

This study has several limitations. First, its cross-sectional design precludes causal inference. Second, because participants were recruited using snowball sampling, selection bias cannot be excluded and the findings may not be fully generalizable to all medical and health sciences students. Third, all data were collected from a single institution, limiting the generalizability of the findings. Finally, knowledge and attitudes were assessed through self-reported questionnaires, which may be influenced by response bias. Future studies employing multivariable regression analyses are warranted to determine the independent contribution of embryology education after adjustment for potential confounding variables.

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