

# Gender Roles in Medical Education from the Perspective of Medical Faculty Students and Their Effects on Specialty

## ABSTRACT

**Objective:** The purpose of this study is to ascertain the attitudes of students at a medical faculty regarding gender roles and how these attitudes affect the branch they wish to choose.

**Methods:** This is a descriptive study. A survey form consisting of 37 questions, including the Gender Role Attitudes Scale, was delivered to students online. In statistical analyses, normality analysis was performed with the Shapiro-Wilk test. Chi-square, Student-T and ANOVA tests were applied.

**Results:** Four Hundred Fifteen students participated in the research. A significant difference was detected between gender and the branch in which they planned to specialize ( $P<.001$ ). Comfortable working conditions were more common among female students' reasons for choosing their planned specialization than male students ( $P=.022$ ). Gender roles scale score of female students ( $60.8\pm9.1$ ) was found to be higher than male students ( $51.3\pm10.2$ ) ( $P<.001$ ). The gender roles scale score did not change depending on the grades the students attended ( $P=.771$ ).

**Conclusion:** It is noteworthy that medical education has no effect on students' attitudes towards gender. Their views on the subject are shaped by the demographic characteristics of the family. It is recommended that the hidden curriculum for medical education be evaluated and developed in future studies.

**Keywords:** Medical students, Gender equity, Gender

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## INTRODUCTION

Gender is a phrase with psychological and cultural connotations that emerges depending on particular social situations, whereas sex is a term used for biological differences. It is very difficult to combat the unconscious distinctions and inequities that exist between men and women as a result of traditional views about society, traditions, and cultural influences.<sup>1,2</sup>

According to the data obtained from YÖK statistics, while the male/female ratio among newly enrolled students in universities was 1.1 in 2013, the number of female students increased over the years, and this ratio decreased to 0.8 in 2022. The distribution of students across departments is particularly influenced by societal conventions, although the number of female students is increasing. The proportion of male students in engineering faculties is more than double that of female students, even though female enrollment is high in medical faculties.<sup>3</sup> Although there are more female doctors and medical students than ever before, their access to all areas of medicine is restricted by gender-related sociocultural variables.<sup>4</sup> The selection of a medical school specialty by students is also influenced by gender norms. Doctors' career decisions are influenced by sociocultural variables as well as training experience, which diminishes gender diversity in specialization. For example, in most countries, surgery remains a field of strong male dominance. The reasons for this are the difficult lifestyle conditions of the surgical career and the low number of female surgeons who can be taken as role models.<sup>5</sup> In Turkish society, women are traditionally expected to prioritize taking care of their homes and children over their careers and businesses. It is widely held in our nation that men belong to the surgical field of medicine, whereas women belong to fields such as pediatrics. Healthcare professionals should be advocates to raise the awareness of the people around them and should learn and teach innovations while following gender-sensitive policies and developments. Most importantly, as the service providers themselves, doctors should provide services with an egalitarian approach without discrimination.<sup>6,7</sup> The purpose of this study is to ascertain the attitudes of students at medical faculties regarding gender roles and how these attitudes affect the branch they wish to choose.

## METHODS

This is a descriptive study. Our research population included students (n=1371) studying at the Sivas Cumhuriyet University Faculty of Medicine. According to the sample calculation with a known universe and unknown prevalence, at least 301 students should be reached with a 95% confidence level and a 5% acceptable margin of error. In this research, information was given to the entire sample, and the study was conducted with 415 students who volunteered to participate.

The data collection form we used in the research included the Gender Role Attitudes Scale, which consists of 15 questions, demographic data consisting of 22 questions, and questions about the relationship between gender and medical education and the branch that wanted to be chosen. The Gender Role Attitudes Scale, a data collection tool, was developed by García-Cueto et al. in 2015.<sup>8</sup> The original scale has a single dimension in which 20 items are asked to determine individuals' egalitarian attitudes toward gender roles. As a result of the validity and reliability study conducted by Bakioglu et al., the scale was adapted to Turkish as a one-dimensional 15-item questionnaire.<sup>9</sup> The scale has a one-dimensional 5-point Likert-type rating (1 = I completely disagree - 5 = I completely agree). The Cronbach's alpha internal consistency coefficient of the original scale was calculated as 0.99. The internal consistency coefficient of the scale for the Turkish version of the scale is 0.88. Scores from the scale vary between 15 and 75. An increase in the score obtained from the scale indicates an increase in egalitarian attitudes toward gender roles.

Ethics committee approval for the study was obtained from Ethics Committee for non-interventional clinical research from Sivas Cumhuriyet University. (Date: 15.01.2020, Number: 2020-01/39) Furthermore, permission to use the scale in our survey was obtained from Bakioglu via email.

Traditionally, medical school courses are divided into "preclinical" and "clinical" courses. The preclinical years mostly include a didactic method of teaching-learning in which students are taught basic science topics. In the clinical years, medical students become student doctors in the hospital setting.<sup>10</sup> Therefore, while performing some analyses, we classified the students as preclinical or clinical.

The surveys to be used in the study were delivered to the students online by the researchers. This method was chosen because it was assumed that students would feel more comfortable answering questions in the online environment and would be able to answer the questions more accurately. The survey's first page contained an informed consent form. The study did not ask for any personal information from the students.

The statistical package for social sciences, SPSS version 23.0 (IBM SPSS Corp., Armonk, NY, USA), was used to examine the data. The Shapiro-Wilk test was used to examine the normality of the numerical data. First, the data were subjected to descriptive statistical analyses. Calculations were made to determine the central distribution measures (mean  $\pm$  standard deviation) for numerical data and frequencies for categorical data. To compare categorical data, the chi-square test was employed. Numerical data were compared between two categorical variables via

Student's t test. When comparing numerical data with more than two categorical variables, ANOVA was used. The Bonferroni correction was used for post hoc analysis. A significance level of  $P < .05$  and a 95% confidence range were used to analyze the results.

Approval for the study was obtained from the Ethics Committee for noninterventional clinical research of Sivas Cumhuriyet University (approval date/number: 15/01/2020-01/39). Furthermore, permission to use the scale in our survey was obtained from Bakioğlu via email.

## RESULTS

415 students volunteered to participate in the research. A total of 65.9% (n=280) of the students were female. A total of 60.0% (n=255) of the students were studying in basic sciences. The mean age was  $21.7 \pm 1.8$  years (min: 18-max: 27). The city where most of the students (52.2%, n=222) resided was in the Central Anatolia Region. A total of 76.2% (n=324) of them grew up in the city center. The demographic characteristics of the students are shown in Table 1.

**Table 1.** Demographic characteristics of students

<b>N=415</b>	<b>n</b>	<b>%</b>
<b>Sex</b>		
Female	280	65.9
Male	145	34.1
<b>Grade of Students</b>		
Basic science (Class 1,2,3)	255	60.0
Clinical science (Class 4,5,6)	170	40.0
<b>Geographical Region</b>		
Marmara	36	8.5
Aegean	22	5.2
Mediterranean	42	9.9
Central Anatolia	222	52.2
Black Sea	59	13.9
Eastern Anatolia	26	6.1
Southeastern Anatolia	18	4.2
<b>The Place Where They Live</b>		
City center	324	76.2
Town/village	101	23.8
<b>Father's Education Level</b>		
Primary school	59	13.9
High school	128	30.1
University and above	138	56
<b>Mother's Education Level</b>		
Primary school and below	125	29.4
High school	143	33.6
University and above	157	36.9
<b>The working status of mother</b>		
Working	155	36.5
Not working	270	63.5

A total of 94.6% (n=402) of the students were planning specialization training after graduation. The following are the branches in which students wish to specialize: 1.8% (n=6) are basic sciences, 52.3% (n=174) are surgical sciences, and 45.9% (n=153) are internal sciences. There was a significant difference in the branch in which they intended to specialize and gender ( $P < .001$ ), but there was no significant difference in the desire to receive specialization training or gender ( $P = .501$ ). For female

students, the desire to major in surgery was 40.1% (n=103), whereas for male students, the percentage was 61.8% (n=84). With respect to their choices for specialty education, female students were more likely than male students were to consider the comfort of their working environment ( $P = .022$ ). Table 2 displays the branches that students wish to select on the basis of their sex as well as the reasoning behind their selections.

**Table 2.** Specializations that students want to choose and their reasons for choosing

	Students' sex		P
	Female % (n)	Male % (n)	
<b>A desire for specialization</b>			
Yes	93.9 (263)	95.9 (139)	.501
Undecided	6.1 (17)	4.1 (6)	
No	-	-	
<b>Desired area of specialization</b>			
Basic sciences	4.7 (12)	-	< .001
Surgical sciences	40.1 (103)	61.8 (84)	
Internal sciences	55.3 (142)	38.2 (52)	
<b>Reasons for choosing</b>			
High financial returns	16.1 (45)	18.6 (27)	.499
Comfortable working conditions	34.3 (96)	23.4 (34)	.022
Compatible with the values and judgments I believe in	47.9 (134)	53.8 (78)	.261
The gender of the patient population	1.1 (3)	0 (0)	.554
The ages of the patient population	8.2 (23)	6.9 (10)	.705
Job satisfaction	15.0 (42)	12.4 (18)	.557

Students' gender attitudes about their fields of expertise were questioned. In the answers given to these questions, the gender egalitarian attitudes of female students attract attention. The female students reported that there was no gender difference in the capacity to handle the requirements of the profession, which included coolness; skill, strength and endurance; patience; and effective communication skills (all  $P < .001$ ). Table 3 provides an analysis of the results by gender.

**Table 3.** Students' gender attitudes about their fields of expertise

	Could be more successful, % (n)			P
	Woman	Men	Gender does not matter	
<b>If the job requires coolness</b>				
Female students' answers	1.4 (4)	15 (42)	83.6 (234)	< .001
Male students' answers	0 (0)	45.4 (66)	54.5 (79)	
<b>If the job requires skill</b>				
Female students' answers	19.6 (55)	3.6 (10)	76.8 (215)	< .001
Male students' answers	15.9 (23)	22.8 (33)	61.4 (89)	
<b>If the job requires strength and endurance</b>				
Female students' answers	0.4 (1)	55.4 (155)	44.2 (124)	< .001
Male students' answers	1.4 (2)	80.7 (117)	17.9 (26)	
<b>If the job requires patience</b>				
Female students' answers	37.5 (105)	1.4 (4)	61.1 (171)	< .001
Male students' answers	36.6 (53)	9.7 (14)	53.8 (78)	
<b>If the job requires good communication skills</b>				
Female students' answers	11.1 (31)	14.6 (41)	74.3 (208)	< .001
Male students' answers	26.9 (39)	20 (29)	53.1 (77)	
<b>Could be more exposed to mobbing</b>				
Female students' answers	63.2 (177)	5 (14)	31.8 (89)	.004
Male students' answers	42.8 (62)	18.6 (27)	38.6 (56)	
<b>Could be more exposed to abuse</b>				
Female students' answers	86.8 (243)	.7 (2)	12.5 (35)	.412
Male students' answers	82.1 (119)	.7 (1)	17.2 (25)	
<b>Could be more exposed to violence</b>				
Female students' answers	48.6 (136)	5 (14)	46.4 (130)	< .001
Male students' answers	26.9 (39)	31 (45)	42.1 (61)	

The majority of female students (62.9%; n=176) believed that academics did not discriminate, in contrast to the majority of male students (47.6%; n=69), who said that academics in branches of internal science were more tolerant and privileged toward students of the opposite sex ( $P=.001$ ). Most male students (44.1%; n=64) said that the other sex was treated more tolerantly than the majority of female students (55%; n=154), who believed that academics in the field of surgery did not discriminate ( $P=.003$ ). Students of both sexes (F: 77.9%; M: 71%) said they did not discriminate on the basis of gender when asked

about their preferences for the gender of the patients when doing private area examinations ( $P=.384$ ). Concerns about starting a family restricted 44.6% (n=125) of female students from selecting a specialization; among male students, this rate was 30.3 (n=44,  $P<.001$ ).

The mean score of the students on the gender role attitudes scale was  $57.6 \pm 10.5$ . A comparison of various factors with students' gender role attitudes is shown in Table 4.

**Table 4.** A comparison of various factors with students' gender roles attitudes

	The Gender Role Attitudes Scale Score (M±SD)	P
<b>Sex</b>		
Female	60.8 ± 9.1	< .001
Male	51.3 ± 10.2	
<b>Grade of Students</b>		
Basic science (Class 1,2,3)	57.7 ± 10.8	.771
Clinical science (Class 4,5,6)	57.4 ± 10	
<b>Geographical Region</b>		
Marmara	57.2 ± 9.3	.748
Aegean	60 ± 9.5	
Mediterranean	57.1 ± 12.7	
Central Anatolia	57.3 ± 10.4	
Black Sea	58.7 ± 10.7	
Eastern Anatolia	55.4 ± 10.3	
Southeastern Anatolia	58.9 ± 10	
<b>The Place Where They Live</b>		
City center	57.7 ± 10.4	.693
Town/village	57.2 ± 10.8	
<b>Father's Education Level</b>		
Primary school	49.7 ± 10.2	< .001 <sup>a</sup>
High school	61.3 ± 9.1	
University and above	57.5 ± 10.3	
<b>Mother's Education Level</b>		
Primary school and below	54.9 ± 10.1	.004 <sup>a,b</sup>
High school	58.8 ± 10.6	
University and above	58.5 ± 10.4	
<b>The working status of mother</b>		
Working	57.0 ± 11	.149
Not working	58.5 ± 9.6	
<b>Feeling constrained in selecting a specialization because of concerns about beginning a family</b>		
Yes	55.6 ± 10.4	.008 <sup>c,d</sup>
No	58.4 ± 11.5	
Undecided	59.3 ± 8.8	
<b>Desired area of specialization</b>		
Basic sciences	61.3 ± 6.8	.017 <sup>e</sup>
Surgical sciences	56 ± 11.5	
Internal sciences	58.9 ± 9.7	

Bonferroni Post hoc correction a: primary-high school, b: primary school-university, c: yes-no, d: yes-undecided, e: internal-surgical sciences

## DISCUSSION

Physicians who provide healthcare are supposed to act with equality and without prejudice, and they should also contribute to the improvement of sexist attitudes in society. The findings of this study showed that the sex of students and the educational attainment of mothers and fathers had substantial impacts on the gender role attitudes of medical students. Students who expressed fear about starting a family during their career planning had significantly lower gender role scores. It was discovered that students' opinions toward gender roles were independent of their years of education. Studies carried out at several Turkish medical universities revealed no discernible variation in medical students' grade levels or gender attitudes.<sup>11-13</sup> The gender roles and gender perceptions measured before and after the midwifery students' semester-long "Gender and Violence" course did not significantly change, according to a study performed in Konya by Karakoç et al.<sup>14</sup> These findings suggest that students' egalitarian gender norms are unaffected by medical education. The transfer of institutional-organizational, interpersonal-social, contextual-cultural, and motivational-psychological issues between faculty and students through an unwritten, largely ad hoc, and highly interpersonal form of teaching and learning is known as the "hidden curriculum" in medical education. One of the subjects included in medical education's concealed curriculum is egalitarian views on gender roles.<sup>15</sup> In this study, students' gender beliefs and roles were found to be unaffected by their education in medical school, which is consistent with other studies in the literature. It is advised that medical schools look into their hidden curriculum and address this problem.

A study carried out in Taiwan examined the ten-year history of messages exchanged among medical students on a popular sharing platform. The study revealed that the discriminatory treatment of female students, a hostile work environment, stereotypical gender-based labor division, and sexual harassment all harmed the students' self-confidence and learning opportunities.<sup>16</sup> Male students felt that academics in the internal and surgery departments were more accepting of students of other genders, although most female students in our study said that academics did not discriminate between students on the basis of gender. The gender role attitudes scale scores of the male students were considerably lower than those of the female pupils. According to this finding, male students do not possess a perceptually egalitarian mindset. Even if academics act equally, they may have interpreted female students as being treated tolerantly. Similar to the findings of this study, female medical students in China had more egalitarian views on gender than did their male counterparts.<sup>11-13,17</sup> Gender role attitudes between

male and female students also reveal themselves in the question of which gender can improve their field of expertise. When asked which gender does better if a job requires endurance and strength, 81% of the male students said men, whereas this percentage was approximately 55% for the female students. For example, regarding which gender would be more successful in jobs that require patience, both male and female students answered "women" at a rate of 37%. Compared with men, students of both genders stated that women may have a greater possibility of being exposed to mobbing, harassment, and violence in the workplace. According to the findings of a study conducted in England, students' perceptions of the gender-based culture in clinical practice had an impact on their learning.<sup>4</sup> According to a study performed in Ireland by Cronin et al., female students were affected by positive role models and considered factors such as parental leave, working hours, and the option to work part-time while deciding on a surgical profession. Similarly, female students were more inclined than male students in our study to consider working conditions when deciding on a specialization. According to reports, there are more women than men working as surgeons in Malaysia, and this trend is attributed to the influence of female role models.<sup>5</sup> In the United States, women make up 62% of pediatricians, and the proportion of female pediatricians in academia is quite low in comparison to that of men.<sup>18</sup> There is still a global glass ceiling on women's professional aspirations and advancements, even in the medical field, where practitioners are expected to serve as role models for society and treat patients fairly.

Demographic factors such as the students' own gender and the educational attainment of their parents were found to have a significant effect on their gender roles. Similar findings were reported by Zeybek et al., who reported that people who were born and reared in urban areas and whose parents had greater levels of education had more egalitarian views.<sup>17</sup> The gender role scores of those with working mothers, mothers with higher levels of education, and those without siblings were shown to be more egalitarian than others in Ergin et al.'s study.<sup>12</sup>

The most significant finding of our research is that medical education has no effect on students' attitudes toward gender; instead, the family's demographics shape their opinions on the subject. The hidden curriculum for medical education should be assessed and improved in further research.

Notably, medical education has no effect on students' attitudes toward gender. Their views on the subject are shaped by the demographic characteristics of the family. It is recommended that the hidden curriculum for medical education be evaluated and developed in future studies.

## Limitations of the study

Since our study was conducted in a single center, generalizations cannot be made to large populations. In our study, we used a scale with Turkish psychometric measurements. This is a strength of the study, but the use of a mixed method, including a qualitative method, could have enabled more detailed data to be obtained. It is presented as a recommendation for future studies.

**Ethics Committee Approval:** Ethics committee approval for the study was obtained from Ethics Committee for non-interventional clinical research from Sivas Cumhuriyet University. (Date: 15.01.2020, Number: 2020-01/39)

**Informed Consent:** Informed consent was obtained from the participants.

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## REFERENCES

1. Aydemir S, Öz E, Erdamar G. Gender in Education: A Systematic Review of the Literature in Turkey. *Int Cont Educ Research*. 2022;9(2):232-247. doi:10.33200/ijcer.923247
2. Lindsey LL. Gender Roles: A Sociological Perspective. 6th ed. Routledge; 2015. doi:10.4324/9781315664095
3. Yükseköğretim Kurulu. Öğrenci Sayıları. Yükseköğretim Bilgi Yönetim Sistemi. Published 2024. Accessed February 22, 2024. <https://istatistik.yok.gov.tr/>
4. Samuriwo R, Patel Y, Webb K, Bullock A. 'Man up': Medical students' perceptions of gender and learning in clinical practice: A qualitative study. *Med Edu*. 2020;54(2):150-161. doi:10.1111/medu.13959
5. Cronin C, Lucas M, McCarthy A, et al. Are we reaping what we sow? Gender diversity in surgery: a survey of medical students. *Postgrad Med J*. 2019;95(1121):119-124. doi:10.1136/postgradmedj-2018-136136
6. Özden S, Gölbaşı Z. Determination of health workers attitudes towards gender roles. *KOU Sag Bil Derg*. 2018;4(3):95-100. (in Turkish)
7. Çelik Bekleviç A, Kıran S. Bir Üniversite Hastanesi Araştırma Görevlilerinin Toplumsal Cinsiyet Rollerine Tutum Ölçeği ve Çalışma Yaşamında Toplumsal Cinsiyet Rollerine Algısının Değerlendirilmesi. *BEÜ Sağlık Uygulama ve Araştırma Merkezi Hemşirelik Hizmetleri Müdürlüğü Bilimsel Çalışmalar Dergisi*. Published online 2017:29-37. (in Turkish)
8. García-Cueto E, Rodríguez-Díaz FJ, Bringas-Molleda C, López-Cepero J, Paíno-Quesada S, Rodríguez-Franco L. Development of the Gender Role Attitudes Scale (GRAS) amongst young Spanish people. *Int J Clin Health Psychol*. 2015;15(1):61-68. doi:10.1016/j.ijchp.2014.10.004
9. Bakioğlu F, Türküm AS. Adaptation of Gender Role Attitudes Scale to Turkish: A Study of Validity and Reliability. *KEF Dergi*. 2019;27(2):717-725. doi:10.24106/kefdergi.2697. (in Turkish)
10. Kogan JR, Shea JA. Course evaluation in medical education. *Teach Educ*. 2007;23(3):251-264. doi:10.1016/j.tate.2006.12.020
11. Aydın S, Ergönül E. Medical Students' Perception of Gender: A Comparison Between the preclinical and Clinical Phases. *Dokuz Eylül Üniversitesi Sosyal Bilimler Enstitüsü Dergisi*. 2022;24(4):1708-1732. doi:10.16953/deusosbil.1198887 (in Turkish).
12. Sönmez Y, Bulut Kısaoğlu N, Okan Dönmez K. Attitudes Towards Gender Roles of First and Sixth Graders of a Medical Faculty and Related Factors. *Smyrna Tıp Dergisi*. 2018;3:14-21.(in Turkish)
13. Ergin A, Bekar T, Aydemir Acar G. Tıp Fakültesi Öğrencilerinin Toplumsal Cinsiyet Rollerine Yönelik Tutumları ve Etkileyen Faktörler. *Fırat Tıp Dergisi*. 2019;24(3):122-128. (in Turkish).
14. Karakoç H, Duran B, Döner Şİ. The Effect of Gender and Violence Awareness Training Given to University Students on Gender Perception and Attitude. *Güncel Hemşirelik Araştırmaları Dergisi*. 2022;3(2):114-121.
15. Lawrence C, Mhlaba T, Stewart KA, Moletsane R, Gaede B, Moshabela M. The Hidden Curricula of Medical Education: A Scoping Review. *Acad Med*. 2018;93(4):648-656. doi:10.1097/ACM.0000000000002004
16. Cheng LF, Yang HC. Learning about gender on campus: an analysis of the hidden curriculum for medical students. *Med Educ*. 2015;49(3):321-331. doi:10.1111/medu.12628
17. Zeybek V, Kurşun M. Attitudes of medical students towards gender roles. *Pamukkale Med J*. Published online 2019. doi:10.31362/patd.468353
18. Silver JK, Poorman JA, Reilly JM, Spector ND, Goldstein R, Zafonte RD. Assessment of Women Physicians Among Authors of Perspective-Type Articles Published in High-Impact Pediatric Journals. *JAMA Netw Open*. 2018;1(3):e180802. doi:10.1001/jamanetworkopen.2018.0802