Analysis of Perception of Gender Bias among Teaching Hospital Residents by Gender and Specialty: Insight from Medical Education in South Korea

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Abstract

Background:

Despite increasing numbers of female medical students, there is still a significant under-representation of women in most surgical specialties. Female doctors often face sexism in various aspects of their professional lives, including selection processes, communication, leadership opportunities and promotion. This study aims to examine the extent of the perceptions of gender bias among medical residents in different specialties, and to identify the components that influence the perception of gender bias.

Methods:

This study surveyed 112 residents in two teaching hospitals in South Korea to assess their perceptions of gender bias within their respective specialties. Responses were collected using a questionnaire designed specifically for this study. Results were analyzed based on several components, including career choices and pathways, professional dynamics, roles and interactions, and work-life disparities.

Results:

The study revealed a significant difference in perceptions of gender bias between male and female residents. In particular, male residents showed significantly higher scores in career choices and pathways, roles and interactions, disparities in work and life compared to their female counterpart. Medical and surgical residents showed a greater discrepancy in the perceptions of gender bias compared to clinical support residents.

Conclusions:

Several components contribute to the perceptions of gender bias between male and female residents and between different specialties. It is crucial to develop targeted strategies for each identified component and specialty. Efforts should be made to integrate gender education throughout the medical education continuum, from undergraduate to professional levels. By addressing these components and implementing comprehensive educational initiatives, we can work towards a more equitable and inclusive environment for future physicians.

Background

The number of women entering medical school has increased over the past few decades, and women now make up about half of the current medical school class. Despite this, only 23.7% of general surgery residents are women [1]. According to 2021 Korean statistics, about 34.1% of medical school admissions are female students, with the number reaching 3099, and the percentage of female students is over 50% in some universities [2]. The number of female specialists increased by 41% from 16,678 in 2014 to 23,514 in 2018. The only departments with a higher percentage of women were pathology and diagnostic

laboratory medicine and pediatric radiology. However, among surgical specialties, the percentage of women is as low as 0.7%, except for obstetrics and ophthalmology (orthopedics), and most of them are less than 10% [3].

In the 2019 Gender Equality in Healthcare Survey conducted by the Korean Women's Medical Association, 50% of female respondents reported experiencing gender discrimination in the selection process. In addition, many specialties do not select women unconditionally, ask about marriage or childbirth plans, and some are forced to withdraw their applications because they do not recruit women [4]. The proportion of female physicians is 38.1%, but the proportion of women in plastic surgery, which is a popular specialty, is only 15%, which clearly shows that the medical community is reluctant to hire women. An international study of internal medicine residents also found that male residents were treated more positively in the areas of communication and leadership than their female counterparts. In training hospitals, female obstetricians and gynecologists were less likely to be promoted to administrative leadership positions, and the rate of increase was minimal [5]. Female surgeons reported experiencing issues with being perceived differently than men and feeling marginalized [6].

In South Korea, approximately 10% of full-time faculty are currently women. Women are underrepresented in thoracic surgery and orthopedic surgery (8.0% and 8.5%, respectively) and overrepresented in colorectal surgery and plastic surgery (14.3% and 26.2%, respectively). Female medical students' specialty choices may be less stable than their male counterparts. At the medical school studied, only 24% of women who were interested in surgery when they entered medical school went into surgery, compared to 50% of men who were initially interested in surgery, a difference that was statistically significant in this study. In addition, fewer women than men became interested in surgery while in medical school (6.44% vs. 19%, p=0.001), and the difference does not appear to have changed between 1970 and 2000 [7].

However, this does not necessarily appear to be due to discrimination. Korean obstetricians have given up delivering babies due to anxiety about medical lawsuits and the physical and mental strain of being on call at night, and the younger they are and the more likely they are to be women. The Korean Association of Obstetricians and Gynecologists found that 7.9 percent of female specialists did not deliver at all in a 2012 survey on "working environment related to delivery," three times more than the 2.7 percent of male doctors. Sixty percent of female doctors cited "strong physical and mental stress," economic problems such as hospital operating deficits (13%), disturbances or violent interruptions due to medical accidents (3%), and medical lawsuits (2%) as reasons for their reluctance. It is also clear that female doctors consider work and time-related aspects and patient disposition to be more important in choosing a specialty, and career-related aspects to be less important than men [8,9]. In other words, it is difficult for women to overcome the limitations of their gender role.

Against this background, this study aims to investigate the perceptions of gender bias through a survey of residents at a Korean teaching hospital. In doing so, we aim to determine the extent of the perceptions of gender bias and identify components that influence their work performance and training. We hope that

the results of this study will stimulate discussion on how to improve gender differences in the medical profession.

Methods

Survey Participants

In September 2022, an online survey was conducted to collect data from current residents at two teaching hospital. To initiate the survey, a letter of cooperation and information about the study was sent to all working residents along with an online survey link via multimedia messaging system (MMS). The survey was conducted anonymously using Google Forms for a period of one month. Before starting the survey, participants were asked to provide informed consent indicating their willingness to volunteer.

Survey Questions (the Perceptions of Gender Bias Scale; the PGBS)

In designing our survey, we referred to previous studies [10,11] to cover a wide range of topics in a descriptive manner, rather than using a limited set of highly detailed gold-standard measures. Prior to implementation, we pilot-tested the survey with 8 residents and incorporated their feedback. We conducted a survey to examine perceptions of gender bias. Participants were asked to rate their perceptions on a 5-point Likert scale(-2=very negative. -1=negative, 0=average, 1=positive, 2=very positive). The survey consisted of a total of 25 items divided into seven sections: demographics (PGY, gender, specialty) and perceptions of gender bias. The complete list of survey questions can be found in Supplementary Table 1. Participants were asked to complete the survey, which took approximately 10 minutes of their time.

Analysis

We first grouped residents by gender and specialty. In terms of specialty, clinical medicine specialties can be broadly categorized into medical, surgical, and clinical support [12-15]. In a second step, we performed exploratory factor analysis to explore the underlying structure of the PGBS and to improve the interpretability of the factors. And then, we assessed the reliability of the PGBS using a Cronbach's alpha reliability coefficient. Lastly, to compare perceptions of gender bias across groups, we analyzed differences in the PGBS scores according to gender (male, female) and specialty (medical, surgical, and clinical support).

Statistical Methods

To examine test reliability and exploring factor structure of survey items, we used Cronbach's alpha and principal component analysis (PCA) with varimax rotation. Analysis of variance (ANOVA) was used to analyze differences in perceptions of gender bias among groups (gender and specialty). Data were analyzed using IBM SPSS Statistics 26 (SPSS for Window version; SPSS, Inc., Chicago, IL, USA).

Results

Characters of respondents Table 1, Supplementary table 2

Of the 501 total eligible participants, 112 completed the survey, for a response rate of 22.4%. 53 were male (46.4%) and 59 were female (52.7%) (Table 1). Of the respondents, 42 (37.5%) were medical, 49 (43.8%) were surgical, and 21 (18.7%) were clinical support residents. Respondents' specialties in detail are summarized in Table 1. Medical specialty includes internal medicine, pediatrics, family medicine, rehabilitation medicine, psychiatry, dermatology and neurology. Surgical specialty includes surgery, urology, plastic surgery, emergency medicine, otolaryngology, orthopaedics, gynaecology, and ophthalmology. Clinical support specialty includes anesthesiology, pathology, radiology, laboratory medicine, nuclear medicine, and radiation oncology.

Table 1. Demographics of the survey respondents

		Gender		Post Graduate Year			Sum
		Male	Female	1	2	3-4	
Medical	Respondents (%)	19 (45.2%)	23 (54.8%)	16 (38.1%)	14 (33.3%)	12 (28.6%)	42 (100%)
Surgical	Respondents (%)	22 (44.9%)	27 (55.1%)	13 (26.5%)	21 (42.9%)	15 (30.6%)	49 (100%)
Clinical support	Respondents (%)	12 (57.1%)	9 (42.9%)	9 (42.8%)	6 (28.6%)	6 (28.6%)	21 (100%)
Total	Total (%)	246 (49.1%)	255 (50.9%)	141 (28.2%)	138 (27.5%)	222 (44.3%)	501 (100%)
	Respondents (%)[a]	53 (46.4%)	59 (52.7%)	38 (33.9%)	41 (36.6%)	33 (29.5%)	112 (100%)
	Response rate	21.5%	23.1%	26.7%	29.7%	14.9%	22.4%
a: % in the respondents only							

Factor Structure of the PGBS

To determine whether the data collected in this study were suitable for factor analysis, we checked the KMO standard fit and examined the Bartlett's test of sphericity. The KMO standardized fit was .86, and the Bartlett test of sphericity was also significant, $\chi 2(231, n=112)=1611.552$, p<.001.

Next, to determine the appropriate number of factors, factors with eigenvalues greater than 1 were extracted, and four factors were extracted. The four factors were found to explain 65.8% of the total variance, eigen values=4.84, 1.06.

And then, principal component analysis (PCA) was used to determine the underlying structure of the PGBS variables. For factor extraction, we utilized the criteria that each item should have a factor loading of .30 or higher and a factor loading difference of .10 with other factors (Floyd & Widmann, 1995). All items loaded between .46~.86 on at least one component. Items 8, 14, and 20 were found to load on two components. In this case, given their relatively high loadings and the qualitative content of the items, they were selected as belonging to one component.

Table 2 presents the results of the PCA and varimax rotation for the PGBS variables. Component 1 had primary loadings for items 9, 10, 12, 13, 16, 17, and 18, and we labeled component 1 as "occupational dynamics". Component 2 had primary loadings for items 1, 2, 3, 4, and 5, and we labeled components 2 as "career choices and pathways. Component 3 had primary loadings for item 11, 14, 15, 19, and 20, and we labeled component 3 as "roles and interactions”. Component 4 had primary loadings for items 6, 7, 8, 21, and 22, and we labeled component 4 as "disparities in work and life. The results of the exploratory factor analysis of the 22 items are presented in Table 2, Supplementary table 1.

Table 2. Principal component of the PGBS with varimax rotation

Gender perception items	Rotated factor loading				
	component 1 (occupational dynamics)	component 2 (career choices and pathways)	component3 (roles and interactions)	component 4 (disparities in work and life)	η2
Item 1	.15	**.73**	.25	-.23	.67
Item 2	.07	**.72**	.30	.17	.64
Item 3	.09	**.86**	.03	.11	.77
Item 4	.08	**.82**	-.16	.24	.76
Item 5	.28	**.72**	.33	.14	.73
Item 6	.31	.33	.36	**.55**	.57
Item 7	.24	.41	.41	**.51**	.65
Item 8	.34	.45	.37	**.46**	.66
Item 9	**.68**	.15	.09	.30	.57
Item 10	**.74**	.16	.00	.17	.60
Item 11	.03	.06	**.63**	.27	.47
Item 12	**.77**	-.01	-.01	.04	.60
Item 13	**.72**	.09	.45	.11	.75
Item 14	.59	.10	**.60**	.23	.76
Item 15	.46	.16	**.70**	.07	.73
Item 16	**.57**	.32	.47	-.07	.67
Item 17	**.69**	.13	.17	.22	.57
Item 18	**.66**	.16	.33	.06	.57
Item 19	.19	.20	**.70**	.42	.74
Item 20	.11	.25	**.59**	.53	.71
Item 21	.21	.17	.43	**.73**	.79
Item 22	.13	-.06	.09	**.70**	.51
Initial Eigenvalues	9.20	2.39	1.83	1.06	
Initial % of variance	41.83	10.88	8.31	4.84	
Postrotation	4.41	3.85	3.49	2.74	

Eigenvalues				
Postrotation % of variance	20.05	17.49	15.88	12.45

Reliability of the PGBS

To check the reliability of the PGBS variable, we used to calculate internal consistency coefficient (Cronbach's α). The overall Cronbach's α for the 22 items was .93. The internal consistency coefficients (Cronbach's α) for each sub-component were .87 for component 1 (occupational dynamics), .86 for component 2 (career choices and pathways), .83 for component 3 (roles and interactions), and .84 for component 4 (disparities in work and life), indicating good reliability.

Differences in overall perceptions of gender bias across groups

ANOVA was conducted to examine the differences in overall gender perceptions according to gender and specialty. Descriptive statistics for each group are presented in Table. 3.

ANOVA results showed that the main effect of gender and the interaction of gender and specialty category were statistically significant, $F(1, 106)=27.301$, $p<.001$, $F(2, 106)=3.124$, $p<.05$, respectively, while the main effect of specialty category was not significant, $F(2, 106)=.970$, $p=.38$, ns. In the main effect of gender, males scored significantly higher than females. To examine the interaction effect, we conducted simple effect tests and found that there was a significant between-group difference in medical and surgical specialties, $F(1, 40)=16.775$, $p<.001$, and $F(1, 47)=35.311$, $p<.001$, respectively, with males scoring significantly higher than females. On the other hand, there was no significant difference between the groups based on gender in the clinical support category, $F(1, 19)=.336$, $p=.57$, ns. Furthermore, there was a significant group difference by specialty in the male sample, $F(2, 50)=5.677$, $p<.01$. Post hoc analyses (Scheffe') revealed significantly lower scores for males in clinical support compared to males in internal medicine and surgical specialties. However, there was no significant group difference in the female sample by specialty, $F(2, 56)=.232$, $p=.79$, ns. The differences in total scores of the PGBS according to gender and specialty category are presented in Figure. 1.

Table 3. Descriptive statistics of the PGBS scores across groups

Components of perceptions of gender bias	Gender	Specialty			*Total*
		Medical	Surgical	Clinical support	
		M(*SD*)	*M*(*SD*)	*M*(*SD*)	*M*(*SD*)
Occupational dynamics	Male	.79(2.42)	.36(2.53)	-1.17(4.39)	.17(3.04)
	Female	-1.09(3.49)	-.89(2.81)	-1.33(3.20)	-1.03(3.10)
	All	-.24(3.16)	-.33(2.73)	-1.24(3.83)	-.46(3.11)
Career choice and pathway	Male	1.21(1.58)	3.14(2.90)	.67(2.60)	1.89(2.60)
	Female	-.74(3.29)	-.44(4.38)	.33(2.95)	-.44(3.75)
	All	.14(2.81)	1.16(4.16)	.52(2.64)	.66(3.44)
roles and interactions	Male	2.32(1.73)	1.59(1.76)	-.42(2.19)	1.40(2.10)
	Female	-1.78(3.54)	-1.93(2.02)	-1.00(1.94)	-1.73(2.68)
	All	.07(3.51)	-.35(2.59)	-.67(2.06)	-.25(2.88)
disparities in work and life	Male	.63(1.57)	.91(1.87)	-2.00(3.25)	.15(2.43)
	Female	-4.09(3.54)	-4.41(3.28)	-3.22(2.44)	-4.10(3.25)
	All	-1.95(3.67)	-2.02(3.81)	-2.52(2.93)	-2.09(3.58)
Total	Male	4.95(5.87)	6.00(7.04)	-2.92(10.84)	3.60(8.35)
	Female	-7.70(12.33)	-7.67(8.71)	-5.22(5.61)	-7.31(9.84)
	All	-1.98(11.72)	-1.53(10.48)	-3.90(8.87)	-2.14(10.64)

Differences in four subtypes of perceptions of gender bias across groups

ANOVA was conducted to examine differences in perceptions of gender bias according to gender and specialty by each subtype (subcomponent). Descriptive statistics by group and four subtypes (subcomponent) are presented in Table. 4.

First, ANOVA was conducted on the occupational dynamics scores. As a result, the main effect of gender, the main effect of specialty classification, and the interaction of specialty and gender were not statistically significant, $F(1, 106)=3.073$, $p=.08$, ns., $F(2, 106)=.971$, $p=.38$, ns., $F(2, 106)=.532$, $p=.58$, ns., respectively.

Next, AVONA was conducted on the career choices and pathways scores. The results showed a significant main effect of gender, $F(1, 106)=8.902$, $p<.01$, with males scoring significantly higher than females. On the other hand, the main effect of specialty category and the interaction of gender and

specialty category were not statistically significant, F(2, 106)=.1.423, p=.25, ns. and F(2, 106)=.1.977, p=.14, ns., respectively.

Third, we conducted AVONA on the roles and interactions scores. The results showed that the main effect of gender and the interaction of gender and specialty category were statistically significant, F(1, 106)=32.699, p<.001, F(2, 106)=4.067, p<.05, respectively, while the main effect of specialty category was not significant, F(2, 106)=1.218, p=.30, ns. In the main effect of gender, males scored significantly higher than females. To examine the interaction effect, we conducted simple effect tests and found that there was a significant between-group difference in medical and surgical specialties, F(1, 40)=21.183, p<.001, and F(1, 47)=41.168, p<.001, respectively, with males scoring significantly higher than females. On the other hand, there was no significant difference between the groups based on gender in the clinical support specialties, F(1, 19)=.401, p=.53, ns. Furthermore, there was a significant group difference by specialty in the male sample, F(2, 50)=8.173, p<.001. Post hoc analyses (Scheffe') revealed significantly lower scores for males in the clinical support specialties compared to internal medicine and surgery. However, there was no significant group difference in the female sample by specialty, F(2, 56)=.401, p=.67, ns.

Finally, we conducted AVONA on the disparities in work and life scores. The results showed that the main effect of gender and the interaction of gender and specialty category were statistically significant, F(1, 106)=42.963, p<.001, F(2, 106)=3.986, p<.05, respectively, while the main effect of specialty category was not significant, F(2, 106)=.806, p=.45, ns. In the main effect of gender, males scored significantly higher than females. To examine the interaction effect, we conducted simple effect tests and found that there was a significant between-group difference in medical and surgical specialties, F(1, 40)=28.935, p<.001, and F(1, 47)=45.449, p<.001, respectively, with males scoring significantly higher than females. On the other hand, there was no significant difference between the groups based on gender in the clinical support category, F(1, 19)=.892, p=.36, ns. Furthermore, there was a significant group difference in the male sample by specialty, F(2, 50)=7.743, p<.01. Post hoc analysis (Scheffe') revealed significantly lower scores for males in the clinical support specialties compared to internal medicine and surgery. However, there was no significant group difference in the female sample by specialty, F(2, 56)=.440, p=.65, ns. The differences in subtypes (subcomponents) scores of the PGBS according to gender and specialty category are presented in Figure. 2.

Discussion

The results of this study showed that male residents perceived their gender more positively than female residents. In particular, among medical and surgical residents, gender was closely related to specialty, and male residents perceived their gender more positively than female residents. In addition, the level of gender perceptions among female residents was lower than the level of gender perception among medical and surgical residents, but male medical and surgical residents were more likely to perceive their gender positively than male medical and surgical residents. The perceptions of gender that differed according to gender or specialty were analyzed according to four components.

The first component, occupational dynamics, is a concept that encompasses the subtle interactions between faculty, peers and senior residents in the medical field, as they are both doctors and trainees. Although no statistically significant differences were found in this study, there were still differences between men and women in medical and surgical specialties compared to clinical support specialties. This is further supported by a study reported by the specialty of Anesthesiology, which is a support specialty, which found no differences in the extent of task delegation or evaluation between male and female residents [16]. However, there is still a noticeable difference in how evaluative feedback is provided to male and female residents. Consultants who are in a position to evaluate a resident's performance tend to be more cautious and careful when providing critical feedback to female residents. Conversely, they are more confident and assertive when providing feedback to male residents [17]. Participants reported experiencing a clinical practice culture in which they were taught and supported differently based on gender [18]. These behaviors and attitudes appear to be learned during medical school and graduate medical education, suggesting that the curriculum itself may inadvertently influence these gender biases.

Second, when it comes to choosing a specialty, regardless of specialty, women perceive their gender to be a negative influence and men perceive it to be a positive influence. In order to interpret the results of this study, it is necessary to have a look at studies with medical students. In Canada and Norway, female students were less likely than males to choose surgery as their first choice and significantly more likely than males to choose family medicine as their first choice [19, 20]. In Japan, female students significantly preferred pediatrics, obstetrics and gynecology, and psychiatry over males, and males significantly preferred surgery and orthopedics over females [21]. Similarly, in China, gender differences were significant for 10 out of 16 specialties, with males most likely to choose surgery, internal medicine and orthopedics, and females most likely to choose internal medicine [22]. Specialty preferences change as the grade increases, with female students having a greater preference for surgery at the beginning of their training, but this preference decreases towards the end of their training. Male students, on the other hand, have remained consistent in their specialty preferences compared to female students [23–25]. The reason why the preferences are divided, and change is because of the differences in the values that are based on gender. Male students place a higher value on autonomy, management, prestige, and academic pursuits, while female students place a higher value on lifestyle and service, with those choosing a supportive specialty placing a significantly higher value on lifestyle and those choosing a surgical specialty placing the lowest value on lifestyle [26, 27]. The lack of significant differences in this study among already-decided doctors may be due to the fact that they have already chosen their specialty based on these values.

The third component is named roles and interaction because it consists of questions about gender differences in roles as leaders as well as in roles as physicians interacting with non-physician staff in the hospital. In this study, female physicians perceive their gender in clinical roles and interactions as having an adverse impact on their opportunities to be leaders and as a disadvantage when interacting with physicians from other professions. This was more pronounced when they encountered more patients and professions, such as medical and surgical specialties. Women are forced to learn in a medical school

environment that reinforces this bias. Small group activities with first-year medical students also showed that women were more reluctant to be leaders [28]. Furthermore, female surgeons and surgical trainees found it more difficult to exercise authority than their male colleagues, and patients and hospital staff tended to ignore them and trust their male colleagues more [29–31]. As many studies have shown, many patients confuse female surgeons with nurses, and female surgeons are treated differently from their male colleagues and receive less respect from hospital staff. Some patients have made inappropriate comments to female surgeons and residents, with many assuming that female surgeons are nurses [29, 30]. Some female surgical trainees, unlike their male colleagues, were not addressed by their titles and were routinely referred to by their first names [29, 32, 33]. This treatment led to a loss of enthusiasm among female surgeons [30, 34]. On the other hand, when it comes to doctor-patient communication, the students' research showed that women are actually rated as superior to men, and that men often overestimate their communication skills [35, 36], but when they go to the clinic, they feel underestimated and ignored, reflecting the difficulty of breaking the male-dominated culture of medicine.

Fourthly, in terms of disparities in work and life, female specialists also feel discriminated against, particularly in medical and surgical specialties. Since their undergraduate years, both male and female medical students have experienced sexism and sexual harassment first-hand and have witnessed or heard about incidents during their medical training, recognizing that sexism is a real phenomenon that manifests itself differently depending on academic activity, specialty and training setting. [37]. In addition, students perceive a culture of sexism in clinical practice that affects their learning [38]. Doctors gave more gender-specific advice to female students than to males, and that this advice had a significant impact on the students' decision-making process. In addition, women disproportionately felt that their careers would be disadvantaged and limited compared to men. [39] In addition, there is a real disparity in income and career advancement for women doctors in many countries [40, 41]. Over a long period of time, from undergraduate medical education to the end of residency, women have naturally become aware of gender differences and doubt their abilities due to various social situations [42]. And it is likely that the hidden curriculum that female residents learned from the past and present of senior female residents in their courses and female doctors in their work influenced their perceptions of inequality [43, 44].

A Swiss report that implemented gender education in medical education and evaluated its effectiveness found that gender education had a positive impact on medical students' gender perceptions and attitudes, with female medical students showing more change [45]. A report from Taiwan found that gender education targeting not only students but also professors, who have a strong influence on medical education, had a positive impact on students' attitudes towards adulthood [46]. Therefore, multifaceted interventions are needed. More time and effort are needed to educate doctors about gender equality, as they are at a critical juncture leading to further training, but not enough is being done [47]. In addition to such education, it is necessary to strengthen awareness and education about gender discrimination with other professions working in teaching hospitals, to develop policies and programs to help reconcile family and career, to continue research and monitoring on gender discrimination, and to create an unfavorable working environment by establishing support systems so that men and women do not feel

discriminated against. Slowly, perceptions and conditions can be improved by educating and supporting doctors early in their careers, before they become stereotyped and lose confidence.

This study has several limitations. First, the study was conducted in only two teaching hospitals, which limits the generalizability to the entire population of more than 10,000 residents in Korea. Therefore, the results of this study cannot be applied to individual hospitals and can only be used as a guide to trends. However, we believe that the homogeneity of the participating hospitals allowed for a reliable comparison across specialties and genders. Second, the response rate (22.4%) was relatively low compared with other previous studies [10, 48, 49], which may introduce selection and active participant bias. In addition, our data precluded analysis of whether respondents were representative of the overall population by specialty distribution. Another limitation is that we used a questionnaire that lacks evidence of validity, unlike previous studies that used validated survey instruments [49–51]. Therefore, the results of this study cannot be directly compared with existing studies and have limited use as a longitudinal study. However, the primary aim of this study was to compare results between subgroups within the respondents, and we prioritized understanding the perceived status of residents' gender difference. Therefore, a customized questionnaire based on similar studies was developed and used [13, 14, 51].

This study is significant in that it is the first to examine the extent to which male and female physicians perceive gender differences in medical specialties, divided into medical, surgical, and clinical support. Future research directions are to develop educational programs for medical doctors to improve their perceptions of gender bias that vary according to the factors analyzed in this study and their specialty. Furthermore, a cohort study will be conducted to verify the effectiveness of the various programs by applying them to different specialties and factors. It is hoped that the long-term cohort will serve as a springboard for expanding the field of female specialists.

Conclusion

Several components contribute to the perceptions of gender bias between male and female residents and between different specialties. To improve perceptions of gender bias, it is important to develop targeted strategies for each of the identified components and specialties. In addition, efforts should continue to integrate gender education throughout medical education, from undergraduate through to residency. By addressing these components and implementing comprehensive educational initiatives, we can create a more equitable and inclusive environment for residents and future physicians. In addition, research should continue to be conducted to demonstrate this effectiveness.

Declarations

Data Availability

The datasets used during the current study are available from the corresponding author on reasonable request.

Ethical Statement

This study protocol was approved by both *Asan Medical Center Institutional Review Board* and GangNeung Asan Hospital *Institutional Review Board* where the study was conducted (AMC 2022-1278 and GNAH 2022-10-001-001). This study adhered to the ethical guidelines of the World Medical Association's Declaration of Helsinki. Informed consent was obtained from all subjects at the time of enrollment.

Consent for publication

Not applicable

Availability of data and materials

Not applicable

Competing interests

The authors declare that they have no competing interests.

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none

Authors' contributions

EK, JL and JY were involved in the conceptualization and design of this study. EK collected the data. JL analyzed the data and interpreted the results. JY drafted the initial manuscript with critical feedback from EK and JL. All authors read and approved the final manuscript.

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Figures

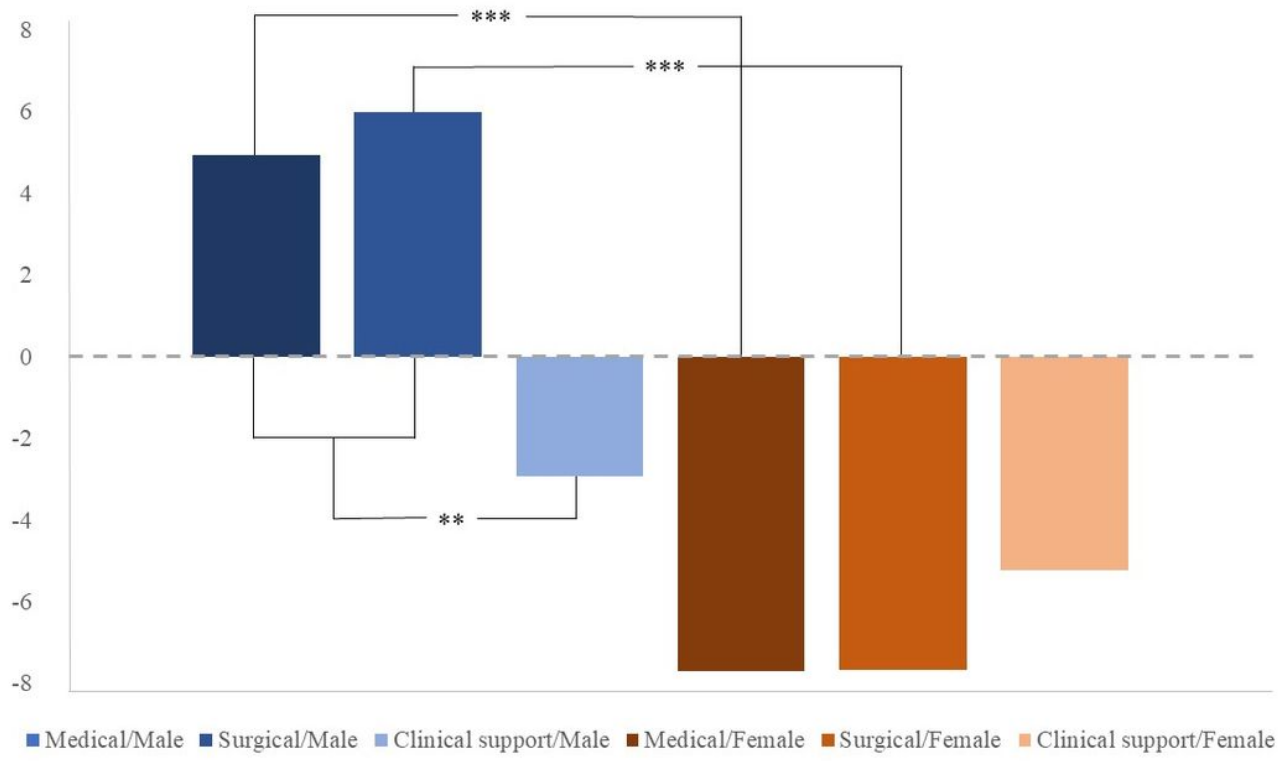

Figure 1

Differences in the PGBS total scores across groups

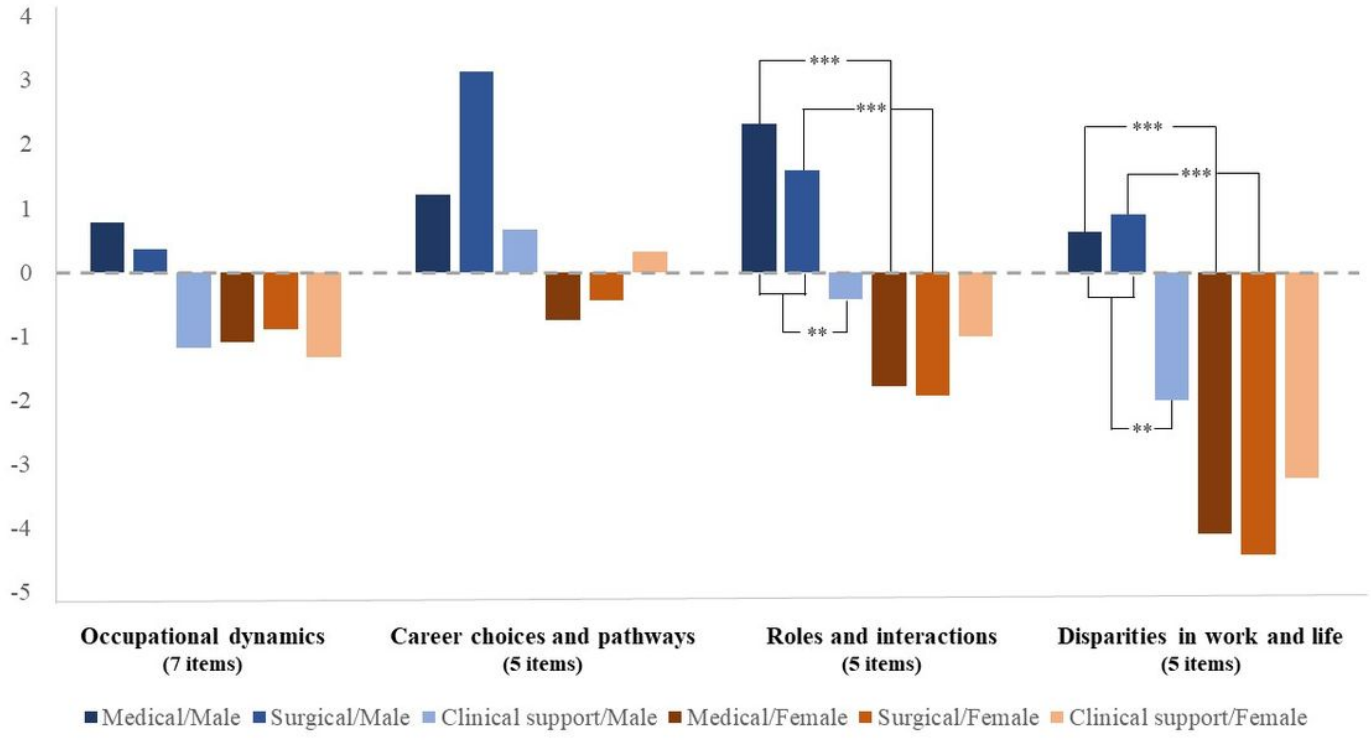

Figure 2

Differences in the PGBS subcomponents scores across groups

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- Supplementarytable.docx