



Research Paper

Exploring the gender gap: A nationwide comparative analysis of general surgery residency program leadership[☆]Xinfei Miao, BS^{*}, Reem Sarsour, BS, Madeleine Givant, BS, Helena Spartz, MD, PhD, FCAP

California University of Science and Medicine, 1501 Violet St, Colton, CA, United States of America

HIGHLIGHTS

- Women remain underrepresented in leadership in general surgery residency programs.
- A greater gender disparity exists in community-based programs.
- More resources are needed in community-based programs to promote gender diversity.

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ABSTRACT

Background: The gender disparity in surgery leadership roles is well-reported. However, the effect of program type and region on mean number of men or women occupying a particular leadership role has yet to be explored. This study aims to investigate the gender disparity of leadership positions in different types of General Surgery Residency Programs (GSRPs).

Methods: Leadership roles of the general surgery departments were collected from the Fellowship and Residency Electronic Interactive Database Access System (FREIDA) database. Each GSRP was categorized by region and program type using FRIEDA. Analysis of the mean number of men and women holding various leadership positions by program type and region was conducted using one-way ANOVA with post-hoc tests.

Results: A total of 345 GSRPs were analyzed. The mean number of women occupying various leadership roles was significantly higher at university-based programs when compared to community-based programs. No significant difference in mean number of women leaders was observed by region.

Conclusions: Women consistently occupy a lower number of GSRP leadership positions when compared to men, regardless of program type or region. University-based GSRP leadership positions have significantly greater gender inclusion compared to community-based GSRPs.

Key messages: University-based general surgery residency programs had a higher mean number of women in all leadership roles compared to other program types. In comparison, region did not appear to be a significant factor impacting the leadership gender disparity. Improvement is needed in community-based general surgery residency programs to bridge the gender gap in leadership roles.

Introduction

In recent years, progress has been made in promoting gender equality in medicine and surgery. Despite an increase in women matches into General Surgery Residency Programs (GSRPs), there is great gender disparity of current practicing surgeons [1,2]. According to the AAMC 2021 Physician Specialty Data Report, 22.6 % of active general surgeons, 17.6 % of plastic surgeons, 9.6 % of neurosurgeons, and 5.9 % of

orthopedic surgeons are women [3]. Addressing the gender gap within surgical residency programs appears challenging, as past studies have indicated that bridging the disparities observed in fields such as neurosurgery, orthopedic surgery, and urology may take three or more decades [4].

The representation of women at various leadership levels appears to be heavily impacted by this gender gap. With increasing numbers of women trainees, one would expect this to increase women

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^{*} Corresponding author at: California University of Science and Medicine, School of Medicine, 1501 Violet St, Colton, CA, 92324, United States of America.

E-mail address: xinfei.miao@md.cusm.edu (X. Miao).

Table 1
Gender representation in the role of PD, APD, and DC by program types.

	University-based	Community-based	Community-based; University-Affiliated	Other
PD				
Women	46 (38.0 %)	15 (18.3 %)	36 (11.5 %)	1 (25 %)
Men	75 (62.0 %)	67 (81.7 %)	103 (88.5 %)	3 (75 %)
APD				
Women	82 (50.3 %)	15 (21.4 %)	38 (36.2 %)	0 (0 %)
Men	81 (49.7 %)	55 (78.6 %)	67 (63.8 %)	2 (100 %)
DC				
Women	108 (15.2 %)	12 (11.1 %)	19 (7.9 %)	3 (37.5 %)
Men	604 (84.5 %)	96 (88.9 %)	223 (92.1 %)	5 (62.5 %)

Table 2
Gender representation in the role of PD, APD, and DC across four regions in U.S.

	West	South	Midwest	Northeast
PD				
Women	12 (24.0 %)	28 (24.8 %)	29 (35.4 %)	29 (28.7 %)
Men	38 (76.0 %)	85 (75.2 %)	53 (64.6 %)	72 (71.3 %)
APD				
Women	26 (46.4 %)	37 (37.8 %)	30 (37.5 %)	42 (39.6 %)
Men	30 (53.6 %)	61 (62.2 %)	50 (62.5 %)	64 (60.4 %)
DC				
Women	32 (17.1 %)	38 (11.9 %)	20 (10.9 %)	52 (13.6 %)
Men	155 (82.9 %)	280 (88.1 %)	164 (89.1 %)	329 (86.4 %)

representation along the general surgery pipeline. However, studies have demonstrated that despite a rise in women general surgery trainees to 46.1 % in 2021, women leaders have yet to achieve a comparable increase [3,5–8]. Prior research has found a low women representation in surgical societies and conferences along with a higher likelihood for women to rank in lower leadership positions within these societies [9,10]. A recent study conducted by Battaglia et al. has shown that in the surgical academia, men surgeons are twice as likely to be department chairs when compared to women [7].

Previous literature has shown that women leadership positively affects mentorship and patient outcomes [11,12]. Programs with a greater number of women leaders are more likely to have a higher number of women trainees, where women leaders serve as role models for future generations of residents and medical students [13]. In comparison to their men counterparts, women surgeons that are faculty in medical schools are more likely to spend over 50 % of time in clinical responsibility [14]. In a retrospective cohort study comparing patients treated by men and women surgeons, patients that were treated by women surgeons had lower rates of adverse postoperative outcome [15].

Numerous studies have investigated the role of women leadership and gender disparity within the academic GSRPs. However, research has yet to elucidate the association between gender representation in

Table 3
Descriptive one way ANOVA of gender representation of leaders by program regions.

	University-based				Community-based				C/U			
	N	Mean	Std deviation	95 % CI [LB, UB]	N	Mean	Std deviation	95 % CI [LB, UB]	N	Mean	Std deviation	95 % CI [LB, UB]
PD												
Women	121	0.3802	0.48745	[0.2924,0.4679]	82	0.1829	0.38899	[0.0978,0.2684]	138	0.2609	0.44071	[0.1867,0.3351]
Men	121	0.6198	0.48745	[0.5321,0.7076]	82	0.8171	0.38899	[0.7316,0.9025]	138	0.7464	0.45308	[0.6701,0.8226]
APD												
Women	121	0.6777	0.88708	[0.5180,0.8374]	82	0.1829	0.41952	[0.0907,0.2751]	138	0.2754	0.49476	[0.1921,0.3586]
Men	121	0.6694	1.01971	[0.4859,0.8530]	82	0.6707	0.94353	[0.4634,0.8780]	138	0.4855	0.73728	[0.3614,0.6096]
DC												
Women	121	0.8926	1.26360	[0.6651,1.1200]	82	0.1463	0.41935	[0.0542,0.2385]	138	0.1377	0.43884	[0.0638,0.2116]
Men	121	4.9917	4.11399	[4.2512,5.7322]	82	1.1707	1.92325	[0.7481,1.5933]	138	1.6159	2.48594	[1.1975,2.0344]

*P ≤ 0.05.

various leadership positions, program type, and region. Therefore, this study aims to assess if program type and region influence the number of men and women occupying the position of program director (PD), associate/assistant program director (APD), or departmental/divisional chief/chair (DC) with the goal of providing potential areas for improving women representation in general surgery.

Material and methods

A review of leadership roles in GSRPs was performed using the American Medical Association Fellowship and Residency Electronic Interactive Database Access [16] (AMA FREIDA), an online database that lists all GSRPs in the U.S. and its territories. Military-based programs were excluded due to lack of leadership role information listed on program websites. Additional information collected from AMA FREIDA included program type and location. Program type included university-based, community-based, community-based university-affiliated, and others. Through the Census Bureau Regions and Divisions with State FIPS Codes [17], program location was categorized into four regions: West, Midwest, South, and Northeast [17]. The number and gender of individuals occupying the role of PD, APD, and DC were collected from various GSRP websites. DCs from all divisions and departments within General Surgery were collected. DCs from divisions and departments offering an integrated sub-surgical specialty were excluded. The gender of individuals occupying a particular leadership position was identified through pronouns listed on GSRP websites. When pronouns were not available, associated images and names of individuals listed on GSRPs were evaluated by two independent reviewers.

Descriptive statistics were used to describe percentages of men and women occupying various leadership roles by program type and region. Continuous variables were reported as means with standard deviation and 95 % confidence intervals. Analysis of the mean number of men and women holding various leadership positions by program type and region was conducted using one-way ANOVA with post-hoc tests. Statistical significance was set at α = 0.05. All statistical analysis was conducted using SPSS Statistics software, version 23 (IBM Corporation). This study is considered exempt from Institutional Review Board approval at California University of Science and Medicine, School of Medicine due to the public nature of the data collected.

Results

Program characteristics

A total of 345 Accreditation Council for Graduate Medical Education-approved U.S. GSRPs were identified using AMA FREIDA. Of the 345 programs, 50 (14.5 %) programs were located in the West, 82 (23.8 %) in the Midwest, 112 (32.5 %) in the South, and 101 (29.3 %) in the Northeast. Programs were further classified by program type, with 121 (35.1 %) being university-based, 82 (23.8 %) being community-based,

138 (40.0 %) being a community-based university-affiliated, and 4 (1.2 %) not falling into any previous category.

Gender representation by program type

Among examined leadership roles, 248 (71.7 %) men were PDs, 205 (60.3 %) men were APDs, and 928 (86.7 %) men were DCs. In comparison, 98 (28.3 %) women were PDs, 135 (39.7 %) were APDs, and 142 (13.3 %) were DCs (Table 1, Table 2).

One-way ANOVA was performed to compare the effect of program type on number of men or women occupying a particular leadership role. A statistically significant difference in mean number of women occupying the role of PD between program types was observed (F(3, 341) = [3.40], p = 0.02) (Table 3). Tukey’s HSD Test for multiple comparisons found that the mean number of women occupying the role of PD (p = [0.01], 95 % C.I. = [0.03, 0.36]) was significantly different between university-based and community-based programs. Our analysis also revealed a statistically significant difference in mean number of women occupying the role of APD (F(3, 341) = [12.75], p < 0.01) and DC (F(3, 341) = [21.56], p < 0.01) between program types. The mean number of women occupying the role of APD and DC was significantly different between university-based and community-based programs (p < [0.01], 95 % C.I. = [0.26, 0.73]), (p < [0.01], 95 % C.I. = [0.44, 1.05]), respectively, as well as university-based and university-affiliated community-based programs (p < [0.01], 95 % C.I. = [0.19, 0.61]), (p < [0.01], 95 % C.I. = [0.49, 1.02]), respectively (Table 4).

A statistically significant difference in mean number of men occupying the role of PD (F(3, 341) = [3.40], p = 0.02) and DC (F(3, 341) = [35.49], p < 0.01) was observed between program types (Table 3). The mean number of men occupying the role of PD (p = [0.01], 95 % C.I. = [-0.36, -0.03]) and DC (p < [0.01], 95 % C.I. = [2.69, 4.95]) was

Table 4

Multiple comparisons of post hoc test (Tukey HSD) of gender representation of leadership roles by program type.

	Program type (I)	Program type (J)	Mean difference	Std error	Sig.	
PD	Women	University-based	Community-based	0.19724	0.06393	0.012
		C/U	0.11930	0.05567	0.142	
		Community-based	C/U	-0.7794	0.06232	0.595
	Men	University-based	Community-based	-0.19724	0.06464	0.013
		C/U	-0.12654	0.05628	0.113	
		Community-based	C/U	0.07070	0.06301	0.676
APD	Women	University-based	Community-based	0.49476	0.09238	<0.001
		C/U	0.40232	0.08043	<0.001	
		Community-based	C/U	-0.09244	0.09005	0.734
	Men	University-based	Community-based	-0.00131*	0.12783	1.000
		C/U	0.18391	0.11130	0.351	
		Community-based	C/U	0.18522	0.12461	0.447
DC	Women	University-based	Community-based	0.74622	0.11874	<0.001
		C/U	0.75488	0.10338	<0.001	
		Community-based	C/U	0.00866*	0.11575	1.000
	Men	University-based	Community-based	3.82100	0.43790	<0.001
		C/U	3.37579	0.38128	<0.001	
		Community-based	C/U	-0.44521	0.42687	0.724

* The mean difference is significant at the 0.05 level.

significantly different between university-based and community-based programs. In addition, the mean number of men occupying the role of DC was statistically different between university-based and university-affiliated community-based programs (p < [0.01], 95 % C.I. = [2.39, 4.36]). No statistically significant difference was observed in mean number of men occupying the APD role between groups (F(3, 341) = [1.18], p = 0.32) (Table 4).

Gender representation by program region

When comparing the effect of program region on number of men or women occupying a particular leadership role, no statistically significant difference in mean number of women occupying the role of PD (F(3, 341) = [1.02], p = 0.38) or APD (F(3, 341) = [0.98], p = 0.40) by region was observed (Table 5). We observed no statistically significant difference in mean number of men occupying the role of PD (F(3, 341) = [1.12], p = 0.34), APD (F(3, 341) = [0.19], p = 0.91), or DC (F(3, 341) = [2.32], p = 0.08) by region. A weakly statistically significant difference in mean number of women occupying the role of DC between regions (F(3, 341) = [2.74], p < 0.04) was observed but this result was not strong enough to yield significant values for Tukey’s HSD Test for multiple comparisons (Table 6).

Discussion

In all GSRPs, leadership positions were predominantly filled by men with women occupying less than one-fourth of all leadership roles. Our analysis of program type and mean number of men or women occupying a particular leadership role revealed university-based programs had a higher mean number of women PDs than community-based programs, while the inverse was observed for men. University-based programs were also found to have a higher mean number of women APDs and DCs than both community-based and community-based university-affiliated programs. University-based programs had a higher mean number of men in the DC role than community-based and community-based university-

Table 5

Descriptive one-way ANOVA of gender representation of leaders by program regions.

		N	Mean	Std deviation	95 % CI [Lower bound, upper bound]	
PD	Women	West	50	0.2400	0.43142	[0.1174, 0.3626]
		Midwest	82	0.3537	0.48105	[0.2480, 0.4594]
		South	112	0.3500	0.43496	[0.1686, 0.3314]
	Men	Northeast	101	0.2871	0.45468	[0.1974, 0.3769]
		West	50	0.7600	0.43142	[0.6374, 0.8826]
APD	Women	Midwest	82	0.6463	0.48105	[0.5406, 0.7520]
		South	112	0.7589	0.45014	[0.6746, 0.8432]
		Northeast	101	0.7129	0.45468	[0.6231, 0.8026]
	Men	West	50	0.5200	0.81416	[0.2886, 0.7514]
		Midwest	82	0.3659	0.59860	[0.2343, 0.4974]
South		112	0.3302	0.59105	[0.2197, 0.4410]	
DC	Women	Northeast	101	0.4158	0.75190	[0.2674, 0.5643]
		West	50	0.6000	0.98974	[0.3187, 0.8813]
		Midwest	82	0.6098	0.92638	[0.4062, 0.8133]
	Men	South	112	0.5446	0.86876	[0.3820, 0.7073]
		Northeast	101	0.6337	0.85700	[0.4645, 0.8028]
DC	Women	West	50	0.6400	1.35164	[0.2559, 1.0241]
		Midwest	82	0.2439	0.80983	[0.0660, 0.4218]
		South	112	0.3393	0.70460	[0.2074, 0.4712]
		Northeast	101	0.5149	0.86734	[0.3436, 0.6861]
		Men	West	50	3.1000	4.33425
	Men	Midwest	82	2.0000	3.03884	[1.3323, 2.6677]
		South	112	2.5000	3.13078	[1.9138, 3.0862]
		Northeast	101	3.2574	3.49161	[2.5312, 3.9837]

*P ≤ 0.05.

affiliated programs. No significant difference between program type and number of men APDs was found.

These findings are in concordance with past studies demonstrating the apparent gender gap in general surgery [5,7,8,18]. The cause of this gender disparity across all GSRPs may be multifactorial as it has been shown that traditional gender roles, lack of mentors, and sexism in medical settings feasibly hinder women’s leadership and career advancement [19].

Our results indicate that university-based programs tend to have a higher number, on average, of women in leadership roles when compared to other program types. This observation contradicts a previous study conducted by Weiss et al., where no statistical significance was found across leadership positions and program type [20]. This suggests an increase in women representation in various leadership positions among university-based programs. This improvement in gender diversity may be due to the implementation of educational programs and pipelines that empower women’s leadership [21,22]. The establishment of the Association of Program Directors in Surgery Diversity and Inclusion Taskforce has demonstrated a significant increase in women in leadership positions in various organizations [23]. However, further research is necessary to investigate the factors influencing the women advancement seen at university-based programs.

Analysis of program region and mean number of men and women occupying a particular leadership role showed no significant difference in the mean number of men or women occupying the position of PD or APD across regions. A weakly significant difference in the mean number

Table 6
Multiple Comparisons of Post Hoc Test (Tukey HSD) of Gender Representation of Leadership Roles by Program Region.

	Program region (I)	Program region (J)	Mean difference	Std error	Sig.	
PD						
Women	West	Midwest	-0.11366	0.08103	0.498	
		South	-0.01000*	0.07681	0.999	
		Northeast	-0.04713*	0.7809	0.931	
	Midwest	South	0.10366	0.06563	0.392	
		Northeast	0.06653	0.06713	0.755	
		Northeast	-0.03713	0.06197	0.932	
	Men	West	Midwest	0.11366	0.08189	0.508
			South	0.00107	0.07763	1.000
			Northeast	0.04713	0.07892	0.933
Midwest		South	-0.11259	0.06633	0.327	
		Northeast	-0.06653	0.06784	0.761	
		Northeast	0.04606	0.06263	0.883	
APD						
Women	West	Midwest	0.15415	0.12168	0.585	
		South	0.18964	0.11534	0.355	
		Northeast	0.10416	0.11726	0.811	
	Midwest	South	0.3550	0.09856	0.984	
		Northeast	-0.04999	0.10080	0.960	
		Northeast	-0.08548	0.09305	0.795	
	Men	West	Midwest	-0.00976	0.16106	1.000
			South	0.05536	0.15267	0.984
			Northeast	-0.03366	0.15521	0.996
Midwest		South	0.06511	0.13046	0.959	
		Northeast	-0.2391	0.13343	0.998	
		Northeast	-0.08902	0.12317	0.888	
DC						
Women	West	Midwest	0.39610	0.16054	0.067	
		South	0.30071	0.15218	0.199	
		Northeast	0.12515	0.15471	0.850	
	Midwest	South	-0.09538	0.13004	0.884	
		Northeast	-0.27095	0.13300	0.176	
		Northeast	-0.17557	0.12277	0.481	
	Men	West	Midwest	1.10000	0.62291	0.292
			South	0.6000	0.59047	0.740
			Northeast	-0.15743	0.60031	0.994
Midwest		South	-0.5000	0.50457	0.755	
		Northeast	-1.25743	0.51605	0.072	
		Northeast	-0.75743	0.47638	0.386	

* The mean difference is significant at the 0.05 level.

of women DCs was observed across regions with the West having the highest mean number of women DCs and the Midwest having the lowest. This suggests region does not seem to have a prominent effect on the number of women holding leadership roles as program type.

There are several limitations of this study. Leadership data was collected from GSRP websites which may contain out-of-date information resulting in possible inaccuracies and underreporting of women leadership. We acknowledge the limitation in assessing gender as binary and the lack of pronouns listed on GSRP websites in restricting gender identification accuracy. Due to the cross-sectional methodology of this study, we were unable to determine the period that men and women have served in a particular leadership role as well as the length of time between their role as general faculty and appointment to a leadership position.

Conclusion

Despite the growing number of women trainees entering GSRPs, a significant gender disparity in leadership positions remains. This gender gap is heightened in community-based programs and may be alleviated by increasing women recruitment and implementing measures to retain and promote women that attend community-based GSRPs.

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Ethical approval

This study is considered exempt from Institutional Review Board approval at California University of Science and Medicine, School of Medicine due to the public nature of the data collected.

CRedit authorship contribution statement

Xinfei Miao: Conceptualization, Investigation, Methodology, Project administration, Resources, Visualization, Writing – original draft, Writing – review & editing. **Reem Sarsour:** Conceptualization, Investigation, Resources, Writing – original draft, Writing – review & editing. **Madeleine Givant:** Data curation, Formal analysis, Investigation, Resources, Validation, Visualization, Writing – review & editing. **Helena Spartz:** Methodology, Project administration, Supervision, Writing – review & editing.

Declaration of competing interest

Spartz, Miao, Sarsour, and Givant have no conflict of interests to declare.

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