

Article type : Research Letter

Positive and negative influences on female first authorship emergency medicine research

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1-21-2019

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In academic emergency medicine, female gender has been associated with fewer scholarly opportunities, fewer awards, and lower salaries.[1] First authorship of original research helps to determine rank and salary in academic medicine. Current data suggests a general under-representation of female first authors in medical literature from multiple specialties. Women are less likely to be listed as first author in the case of co-first authorship in high-impact

This is the author's manuscript of the article published in final edited form as:

Siddle, J. P., Ryckman, S. N., Hobgood, C. D., & Kline, J. A. (n.d.). Positive and negative influences on female first authorship emergency medicine research. *Academic Emergency Medicine*, 0(ja). <https://doi.org/10.1111/acem.13705>

Accepted Article
medical journals.[2] Men outnumber women at all tiers of peer review, ranging from reviewers to editors.[3] With this background in mind, we sought to compare responses of male and female first authors regarding their perceptions of the factors that helped or hindered their first author status in Emergency Medicine.

The distribution of authorship by gender in Emergency care-specific peer-reviewed publications has not been examined recently. In a 2005 assessment of major emergency medical journals the percent of female authorship (25%) mirrored the percent of academic female faculty (26%) [4, 5]. However, no study has examined the characteristics of female first authors, or their perceptions of important factors in achieving first author status.

Accordingly, we undertook a survey of all first authors in *Academic Emergency Medicine* over the past 5 years.

This was an exploratory survey designed primarily to be hypothesis-generating, and to identify potential gender based differences in responses to questions pertaining to mentoring, institutional or departmental policies, personal characteristics and domestic responsibilities.

This protocol was reviewed and deemed exempted by the Institutional Review Board of Indiana University School of Medicine on June 13, 2018 (protocol number 1803567471).

A 38 item web link survey was designed to identify factors believed to be important to the achievement of first author status. Survey items were constructed by a panel of 3 women and one man, representing trainee to full professor rank. We anticipated that all respondents spoke English and had college level reading comprehension. We used published guidelines to design questions for comprehension, content validity and directness [6]. Questions were designed to provide both multiple choice and Likert scale responses. We piloted all items in

full survey format to 12 academic emergency physicians equally divided by gender for feedback. The survey was administered using REDcap® (Research Electronic Data Capture, Nashville, TN) and was sent by email in two rounds to all subjects who met inclusion criteria.

The subject group was composed of all first authors who published an original investigation in *Academic Emergency Medicine* between June 2013- June 2018. One author (SR) recorded names and email addresses for all subjects listed on each article. We determined a priori that all undeliverable and missing emails would follow a search and recovery procedure to attempt contact prior to exclusion. Subjects received up to 3 emails requesting their voluntary participation. Aside from demographics and priority ranking, the majority of the data were captured as a 5-point Likert scale ranging from “not at all=1, to very much=5.”

Because we have no basis to determine the relative importance of an item based on an individual’s gender, we presented results as descriptive. Because this work was designed to be hypothesis generating we do not provide p values but included 95% confidence intervals of selected independent proportions, however, authors are willing to share statistical data and the study instrument.

We identified 551 papers of which 421 had unique, contactable first authors who received the survey. Analyzing names of potential authors, 154 (37%) of the potential sample were female. We obtained 276 responses, or 63% of the reachable sample. Of these unique respondents, 180 included gender data, of whom, 64 (36%) were female.

Supplemental Table 1 presents the ranked answers for all 276 responses. This table shows that > 90% of respondents (both males and females) indicated that personal drive as the highest importance to obtaining first authorship.

Female respondents were younger than male respondents with 35/64 (55%) females under age 40 compared with 33/116 (28%) of males. Females tended to be less likely to be married (80%) compared with males (91%). A lower proportion of females indicated faculty status (Assistant, Associate or Full Professor) than males (79% vs. 90%) and fewer indicated more than 5 years in faculty positions (56% vs. 81%), and 18% of females had achieved full professorship compared with 27% of males. Females more than males had no children/dependents living in their home (36% vs. 15%). The median number publications were higher for men than women (11 [1st-3rd quartiles 4.75 to 25] vs. 7 [2 to 14.25]).

Table 1 shows responses stratified by gender. The last column to the right presents the difference in percentage ranked “very much” by females minus the percentage ranked “very much” by males. This column suggests that the two largest differences observed by women that influenced their ability to become first authors were departmental policies (+23% difference, 95% CI [10- 38%, Miettinen formula]) and seeking a mentor on their own (+30% difference, 95% CI [14- 45%]). Additionally, 17%, 95% CI [4-31%] more females indicated high importance to the need for equality during negotiations. In summary, data in Table 1 suggest that females felt more strongly that their authorship success was affected by self-identifying a mentor, their own determination and drive, feeling they could negotiate on even terms, and having institutional/departmental policies that required scholarship for promotion. Females had higher female mentorship than males (38% vs. 15%). Similar to males, females did not rank gender-specific networking as important on their authorship success.

Both females (38%) and males (40%) ranked competing administrative responsibilities as the most significant impediment. Regardless of gender, respondents rated their top obstacles to authorship as follows: competing administrative tasks, lack of departmental support, lack of

departmental commitment, and competing domestic responsibilities, in descending order of importance. Conflict over determination of first author order was not ranked as a significant barrier to first authorship in either group. The survey also asked for free text to elaborate on obstacles; 15/64 (23%) females provided a response compared with 15/116 (13%) males. In general, females commented more about time and mentoring, whereas men commented on money and departmental support.

This survey helps elucidate factors that female versus male first authors associated with helping and hindering their ability to attain first author status in a peer-reviewed academic emergency medicine journal. We found several differences. In terms of helpful influences, females tended to rate mentoring (+30%, 95% CI [14- 45%]), departmental policies (+23%, 95% CI [10- 38%]), and empowerment in discussions (+17%, 95% CI [4-31%]) as very important compared with males. Females generally had lower academic rank. However, women were younger than men. We also found many areas of alignment between females and males. For example >90% of both genders strongly identified with the statement “My own determination and drive” (Supplemental Table 1) as highly important. Out of 14 potential hindrances in Table 1, females and males were within 5% of each other in the proportion of respondents who ranked the question of highest importance (“very much”) for 7/14 (50%) of the potential hindrances.

We thus present a current snapshot of the factors that influenced a sample of emergency care authors over the last 5 years. The younger age of female researchers may suggest an arrival of more young women into their careers as medical school admissions have recently reached gender parity. Conversely, it may show the exit or failure to thrive of senior females’ career trajectories. To our knowledge, this is the first survey to examine author perceptions of

forces that influenced authorship. We add to prior literature and show an increasing trend towards female authorship in Emergency Medicine and greater proportion of authorship and academic faculty [4, 5].

Consistent with prior literature, female respondents ranked highly their ability to identify mentors as a key to success. [7-9]. Our survey is not open ended enough to reveal the how the respondents identified their mentors. Females identified a higher proportion of female mentors for research despite fewer promoted female faculty above them. Gender-specific mentor groups expected to help promote and retain female faculty were not ranked as helpful to specifically publishing research. Our study corroborates that clinical duties had no strong gender-specific influence.

Responding females in this sample had fewer dependents and children than males, and 11% fewer females indicated that a partner who contributed to domestic responsibilities was very important. Prior research in gender impact on all physician careers bears out a higher proportion of males with dependents than females with less deleterious effects to their careers, publications, and promotions [10]. Of relevance, published recommendations for best practices for the advancement of women in EM have centered on development of overall support now for “family” rather than child-care specific practices or gender-specific wellness practices geared towards women [1].

This work is largely hypothesis generating. For example, while females tended to rank departmental policies as more important than men, we have no insight into the content or topic of the policies, including if they are deemed “family friendly.” Other limitations include the single journal sample and no comparison of non-first authors.

In conclusion, compared with males, female first authors were younger, more junior in rank and experience, had fewer publications, and fewer dependents. Female first authors are less inclined to agree that traditionally gendered domestic responsibilities impair their research and were more likely to attribute their success to equal negotiation, self-identifying mentors, and institutional policies for scholarly promotion. Clear policies, relevant research mentorship, and support that encourage research and promotion may matter as much as, or even more than, deconstructing traditionally gendered obstacles, and should serve as a standard for academic institutions interested in retaining and elevating their female workforce.

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Table 1. Ranking of factors associated with first authorship by gender

	Female					Male					*Difference
	very much	somewhat	not at all	n/a	Missing	very much	somewhat	not at all	n/a	Missing	
Formal research training (e.g., research fellowship, research training grant)	32	6	12	4	10	44	15	28	6	23	12%
Formal fellowship training other than research (e.g., ultrasound)	14	6	23	16	5	19	15	43	23	16	5%
Published research is a requirement for fellowship completion	7	5	25	18	9	13	17	52	21	13	0%
Mentoring from a person or persons sought out by you	39	5	3	0	17	40	20	11	5	40	30%
Mentoring from a scholarly mentoring panel, assembled by someone other than yourself	9	8	25	6	16	9	12	43	16	36	8%
Gender specific networking (e.g., women's peer support)	0	12	27	11	14	0	1	78	31	6	0%
Protection from clinical duties provided by grant funding	16	7	19	15	7	27	15	40	12	22	-1%
Protection from clinical duties provided by department/division, independent of grant funding	18	6	15	12	13	29	17	30	7	33	0%
Departmental or institutional resources such as technical, intellectual and staff support that facilitate scholarship. Examples are help with statistics or regulatory processes	25	9	11	2	17	26	16	18	2	54	11%
Direct departmental or institutional fiscal reward for scholarship (e.g., payment per manuscript)	3	6	37	15	3	1	9	80	12	14	4%
Departmental or institutional policies that require scholarship for rank advancement,	17	12	18	6	11	7	27	39	6	37	23%

salary increase or promotion and tenure											
My own determination and drive	58	0	0	0	6	91	4	0	1	20	5%
Having a stay at home significant other, spouse or partner to help with domestic responsibilities	7	3	32	17	5	19	12	40	11	34	-11%
Feeling I could negotiate or be seen as an equal in discussions with other decision makers of my department/division	11	19	12	4	18	6	29	41	5	35	17%
*Female-male, percentage with "very much" response											