Gender disparities among medical students choosing to pursue careers in medical research: A cross-sectional cohort analysis

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Abstract

Background: Though the proportion of women in medical schools has increased, gender disparities among those who pursue research careers still exists. In this study, we seek to better understand the main factors contributing to the existing gender disparities among medical students choosing to pursue careers in medical research.

Methods: A cross-sectional cohort analysis was conducted using a 70-item survey that was sent to 16,418 medical students at 32 academic medical centers and was IRB approved at the University of Illinois at Chicago and the University of Pennsylvania. Data was collected from September 2012 to December 2014. Survey results were analyzed using chi-square tests to determine gender differences in demographic characteristics (training stage, race/ethnicity, marital status, parental status, financial support, and parental career background), career sector choice, career content choice, specialty choice, foreseeable career obstacles, and perceptions about medical research careers.

Results: There were 4433 respondents (27% response rate). Female respondents were more likely to be enrolled in MD-only programs, while male respondents were more likely to be enrolled in MD/PhD programs. More male trainees selected academia as their first-choice career sector, while more female respondents selected hospitalist as their first-choice career sector. More female respondents identified patient care and opportunities for community service as their top career selection factors, while more male respondents identified research and teaching as their top career selection factors.

Conclusions: There are many factors from a medical student's perspective that contribute to the existing gender disparities in pursuing a career in medical research, including student loan burden, future compensation, work/life balance, and family/caretaker obligations. While much progress has been made in attracting nearly equal numbers of men and women to the field of medicine, active efforts to bridge the gap between men and women in medical research careers are needed.

Introduction

Physician-scientists have long been considered an endangered species and the female physician-scientist an even more rare entity (1). Despite efforts to attract physicians to medical research, interest has continued to dwindle, especially among female trainees. Furthermore, women also continue to be underrepresented in leadership and administrative roles in academic medicine (2). While the causes of these phenomena have long been debated and are certainly multi-factorial, no solutions have been realized.

At beginning of the 20th century, Samuel Meltzer described his vision of the physician-scientist at the first meeting of what is now the American Society for Clinical Investigation. He stressed the importance of developing investigators capable of conducting research across disciplines and producing work that satisfies their respective criteria. According to Meltzer, "Clinical science will not thrive through chance investigations by friendly neighbors from the adjoining practical and scientific domains" (3). Today,

physician-scientists undergo in-depth training in both science and medicine which uniquely equips them to tackle challenges at the forefront of translational research. While MD-PhD students make-up just 2.5% of medical school graduates each year, they will go on to win nearly one-third of all NIH research grants awarded to physicians (4). They represent a highly motivated and talented pool of trainees that are vital to the future of medical research. Yet for the past three decades, many have expressed concern that physician-scientists are an “endangered species.” For reasons that are not well understood, the interest in medical research has been dwindling (5–7). To ensure a steady flow of diverse talent, we must assess the attitudes that guide the professional decisions of tomorrow’s physicians today.

Since the 1970s, the overall proportion of physician-scientists in biomedical research has contracted, yet the absolute number in the workforce has remained stable. This stability has masked alarming trends that could ultimately deplete the workforce. According to a 2014 report from the NIH, only 1.5% of MDs consider research their primary focus with even fewer physicians receiving funding as principal investigators on NIH grants (0.9%), split evenly between MDs and MD-PhDs (8). Whereas the number of nonphysician (PhD) NIH-funded investigators has increased by 50% over the last 20 years, the number of NIH-funded physician-scientists has essentially remained constant. Although public policies have encouraged an increase in the number of medical schools and medical students in the US, and medical school admission policies have placed value on undergraduate research, the percentage of physicians focused on research has fallen substantially.

The stagnating physician-scientist workforce has also failed to keep pace with the increase in racial and gender diversity of its MD counterpart. The ever-growing body of evidence continues to support the importance of achieving greater diversity in the biomedical workforce (9). Much progress has been made in attracting nearly equal numbers of both men and women to careers in medical science as both physicians and physician scientists, yet the pipeline remains leaky with striking losses of female talent at higher levels of academic medicine (10, 11). Historically, the female physician was a rarity. In the 1970s, the proportion of women graduating from US medical schools nearly tripled by the end of that decade (12). Today, women comprise 46% of residents, yet the proportion of women at the rank of full professor (12%) remains far below that of men (13).

Unfortunately, the increase in the proportion of women in medical schools has not been met with a comparable increase in women pursuing research careers. Women are much less likely than their male counterparts to express interest in a career of medical research altogether, at either matriculation or graduation. Furthermore, women who initially express interest in pursuing research as part of their careers are more likely to lose their research career aspirations throughout medical school (14). The reasons for these disparities are certainly multifactorial and likely include factors such as lack of adequate role models, gender discrimination/bias, and work-life balance, but there remain many inconsistencies in the contribution of these factors to this alarming trend (15). In this study, we aim to further understand the drivers behind this disparity in interest in medical research careers through a nationwide survey conducted at 32 academic medical centers in the United States.

Methods

Data collection

The study was reviewed and exempted by the Institutional Review Board at the University of Illinois at Chicago and the University of Pennsylvania. A cross-sectional cohort analysis was conducted using a 70-item survey that was designed with feedback from a survey design team at the University of Illinois at Chicago (16, 17). Data were collected using an online survey tool (SurveyMonkey, www.surveymonkey.com). The survey was sent in September 2012 via e-mail to 16,418 MD and MD/PhD students at 32 academic medical centers through student listservs and the institutional representatives of the American Physician Scientists Association (APSA). Participants had the option of entering their institutional email address for a chance to receive a $50 Amazon gift certificate. Data collection ended in December 2014. E-mail addresses were kept separate from survey responses to maintain the anonymity of responses.

MD/PhD students were identified through how they paid for medical school as being sponsored by an MD/PhD program. MD candidates interested in research-intensive careers (MD-RI) were identified by their career intentions of wanting a research to clinical duty ratio of 50% or greater, which reflects the NIH guidelines for surgeon scientists.

Statistical analysis

Survey results were analyzed to determine significant gender differences in demographic characteristics (training stage, race/ethnicity, marital status, parental status, financial support, and parental career background), career sector choice, career content choice, specialty choice, foreseeable career obstacles, and perceptions about medical research careers. Chi-squared tests were used to measure the significance of associations between categorical variables. Where data did not meet minimum expected cell counts, Fisher's exact test was performed. All tests were performed using SPSS. All tests of significance were 2-sided and $p < 0.01$ was considered significant. Acute care specialties included pulmonary critical care, anesthesiology, and emergency medicine.

Results

Demographics

There were 4433 respondents (27% response rate). Demographic characteristics (gender, training stage, race/ethnicity, marital status, parental status, financial support, and parental career background) of respondents are summarized in Table 1.

Table 1
Demographics of Female and Male Respondents

Demographic	Female, n (%)	Male, n (%)	P-value
Gender Distribution	2328 (56.31%)	1795 (43.42%)	
Training program			**< 0.001**
MD-RI	366 (15.72%)	284 (15.82%)	
MD/PhD	394 (16.92%)	459 (25.57%)	
MD Only	1568 (67.35%)	1052 (58.61%)	
TOTAL	2328 (100 %)	1795 (100 %)	
Training stage[a]			**0.20**
Medical School Year 1	657 (28.42 %)	502 (28.22 %)	
Medical School Year 2	576 (24.91%)	462 (25.97 %)	
Medical School Year 3	392 (16.96%)	281 (15.80 %)	
Medical School Year 4	407 (17.60 %)	271 (15.23 %)	
Graduate School Year	5 (0.22 %)	5 (0.28 %)	
Year Out for Research	61 (2.63 %)	39 (2.19 %)	
Graduate School Year 1	64 (2.76 %)	69 (3.88 %)	
Graduate School Year 2	49 (2.12 %)	54 (3.04 %)	
Graduate School Year 3	44 (1.90 %)	40 (2.25 %)	
Graduate School Year 4	46 (1.99 %)	42 (2.36%)	
Graduate School Year 5 or more	11 (0.48 %)	14 (0.79 %)	
TOTAL	2312 (100 %)	1779 (100 %)	
Race			**0.002**
White	1587 (69.94 %)	1263 (72.75 %)	
Black or African American	114 (5.02 %)	52 (3.00 %)	
American Indian or Alaska Native	6 (0.26 %)	4 (0.23 %)	
Asian or Pacific Islander	259 (11.41 %)	159 (9.16 %)	
Multi-racial or Other	303 (13.35 %)	258 (14.86 %)	

[a] Excluding Other/NA

Demographic	Female, n (%)	Male, n (%)	P-value
TOTAL	2269 (100 %)	1736 (100 %)	
Marital status			**0.07**
Married/Partnered	569 (25.10 %)	481 (27.61 %)	
Not Married/Partnered	1698 (74.90 %)	1261 (72.39 %)	
TOTAL	2267 (100 %)	1742 (100%)	
Parental status			**< 0.0001**
Has a child/children (of 4,041)	97 (4.28 %)	132 (7.57 %)	
Does NOT have a child/children	2168 (95.72 %)	1611 (92.43 %)	
TOTAL	2265 (100 %)	1743 (100 %)	
Primary source of medical school funding			**< 0.0001**
MD-PhD or DO-PhD sponsored only	345 (15.14 %)	403 (22.90 %)	
Scholarships	210 (9.21 %)	171 (9.72 %)	
Grants	37 (1.62 %)	36 (2.05 %)	
Loans	1238 (54.32 %)	874 (49.66 %)	
National Service	19 (0.83 %)	31 (1.76 %)	
Personal Savings	27 (1.18 %)	18 (1.02 %)	
Family/Partner Support	398 (17.46 %)	223 (12.67 %)	
Work	2 (0.09 %)	4 (0.23 %)	
Other	3 (0.13 %)	0 (0.00 %)	
TOTAL	2279 (100 %)	1760 (100 %)	
[a] Excluding Other/NA			

Gender

Among all respondents, there were more females (2328, 56.3%) than males (1795, 43.4%). Female respondents were more likely to be enrolled MD-only programs (1568, 67.4% versus 1052, 58.6%) while male respondents were more likely to be enrolled in MD/PhD programs (459, 25.6% versus 394, 16.9%). In contrast, an equal proportion of female (366, 15.7%) and male respondents (284, 15.8%) self-identified to be MD-RI as defined by intending a > 50% research/clinical ratio. P-value < 0.001 unless otherwise stated (Table 1).

Training stage

Survey responses came from trainees in all stages of MD and MD/PhD programs, including all medical school years, five different graduate school years, and students in a research year program. No significant difference in distribution between males and females within each specific stage of training was observed ($p = 0.20$). More responses came from those in their medical school phases (3548, 86.7%) than graduate or research years (543, 13.3%) (Table 1).

Race/ethnicity

The majority of respondents were white (2850, 71.3%) compared to American Indian or Alaskan Native (10, 0.25%), Asian or Pacific Islander (418, 10.3%), and multiracial or other (561, 14.1%). Among male students, significantly more white (1263, 72.8% versus 1587, 70.0%) and multiracial students (258, 14.9% versus 303, 13.4%) responded compared to females. In contrast, among female respondents, more identified as black (114, 5.0% versus 52, 3.0%) or Asian (259, 11.4% versus 159, 9.2%) compared to their male counterparts ($p = 0.002$) (Table 1).

Marital status

Most survey respondents were not married/partnered (2959, 73.8%) versus married/partnered students (1050, 26.2%). There were no gender differences between partnered and not partnered students ($p = 0.07$) (Table 1).

Parental status

A majority of respondents did not have children (3779, 94.3%) compared to those who had children (229, 5.7%). 132 (7.6%) of male respondents reported having children compared to 97 (4.3%) of female respondents ($p < 0.0001$) (Table 1).

Financial support

Significant differences were seen between sources of financial support. More males than females paid for their medical training exclusively through program (i.e. MD/PhD or DO/PhD) sponsorships (403, 22.9% versus 345, 15.1%), scholarships (171, 9.7% versus 210, 9.2%), grants (36, 2.1% versus 37, 1.6%), national services (31, 1.8% versus 19, 0.8%), and work (4, 0.2% versus 2, 0.1%). In contrast, more female than male respondents depended upon loans (1238, 54.3% versus 874, 49.7%), personal savings (27, 1.2% versus 18, 1.0%), and family/partner support (398, 17.5% versus 223, 12.7%) ($p < 0.0001$) (Table 1).

Career intentions

Career sector

Most trainees responded with academia as their first-choice sector (1841, 47.9%) compared to all other careers. More male trainees selected academia (833, 49.7% versus 1008, 46.7%) as their first-choice

career compared to females. In contrast, more female respondents chose hospitalist (432, 20.0% versus 254, 15.2%) careers as their top selection relative to males (p = 0.0004) (Fig. 1a).

Career content

Clinical duty was the top career intention for most students, (2539, 66.2%) relative to all others. More females desired clinical duties (1526, 70.1% versus 1013, 61.1%) and advocacy work (73, 3.4% versus 16, 1.0%) as their first career intention compared to male trainees. Male students, in contrast, chose translational research (242, 14.6% versus 200, 9.2%), basic research (130, 7.8% versus 75, 3.4%), and therapeutics/diagnostics work (44, 2.7% versus 27, 1.2%) as their top career intention compared to females (p < 0.0001) (Fig. 1b).

Residency specialties: 1st specialty of interest: Both male and female students selected medical specialties most frequently as the top intended specialty (782, 47.0% and 1245, 58.0% respectively). Significantly more male trainees preferred surgical specialties (471, 28.3% versus 499, 23.3%), emergency medicine (168, 10.1% versus 153, 7.1%), and radiology (90, 5.4% versus 75, 3.5%) relative to females, while more female respondents chose medical specialties (1245, 58.0% versus 782, 47.0%) as their top intended specialty (p < 0.0001) (Fig. 1c).

Career selection factors

1394 (36.3%) respondents and 1319 (34.4%) respondents identified work life balance and patient care as the most critical career selection factors, respectively. In gender comparisons, there were significant differences between top career selection factors. More male respondents identified research (255, 15.4% versus 169, 7.7%), teaching (60, 3.6% versus 41, 1.9%), financial security (110, 6.6% versus 52, 2.4%) and autonomy (61, 3.7% versus 33, 1.5%) as the top career selection factors. In comparison, more female respondents identified patient care (809, 37.1% versus 510, 30.8%), community service (93, 4.3% versus 29, 1.8%) and work life balance (855, 39.2% versus 539, 32.6%) as the top career selection factors (p < 0.0001) (Table 2).

Table 2
Top Career Selection Factors by Female and Male Respondents

Factor[a]	Female, n (%)	Male, n (%)	P < 0.0001
Opportunities to do research	169 (7.74 %)	255 (15.42 %)	
Opportunities for patient care	809 (37.06 %)	510 (30.83 %)	
Opportunities to teach	41 (1.88 %)	60 (3.63 %)	
Opportunities for community service	93 (4.26 %)	29 (1.75 %)	
Opportunities for interaction with students	20 (0.92 %)	16 (0.97 %)	
Opportunities for travel	14 (0.64 %)	10 (0.60 %)	
Opportunities for international work	70 (3.21 %)	42 (2.54 %)	
Opportunities for national work	8 (0.37 %)	8 (0.48 %)	
Opportunities for local work	12 (0.55 %)	7 (0.42 %)	
Ability to balance work and personal life	855 (39.17 %)	539 (32.59 %)	
Financial security	52 (2.38 %)	110 (6.65 %)	
Autonomy	33 (1.51 %)	61 (3.69 %)	
Prestige	7 (0.32 %)	7 (0.42 %)	
TOTAL	2183 (100 %)	1654 (100 %)	

[a] Excluding Other/NA

Obstacles: *Foreseeable work-related obstacles*: There is a significant difference between the top foreseeable obstacles identified by male and female respondents ($p < 0.0001$). Though balancing family and work responsibilities was most commonly selected by both males and females as the first foreseeable obstacle, a greater percentage of female respondents (1219, 55.9% versus 709, 42.6%) selected this obstacle. In contrast, a greater percentage of male respondents (202, 12.2% versus 128, 5.9%) identified lack of opportunity/research funding as the top foreseeable obstacle (Table 3).

Table 3
Obstacles by Female and Male Respondents

Obstacle[a]	**Female, n (%)**	**Male, n (%)**	**P < 0.0001**
Lack of opportunity/funding	128 (5.87 %)	202 (12.15 %)	
Not finding position in desired location	179 (8.21 %)	181 (10.88 %)	
Loan repayment	319 (14.63 %)	210 (12.63 %)	
Malpractice/lawsuit	19 (0.87 %)	42 (2.53 %)	
Under-compensation	65 (2.98 %)	74 (4.45 %)	
Discrimination/biases against your gender, ethnicity, sexual orientation	34 (1.56 %)	12 (0.72 %)	
Sexual harassment	2 (0.09 %)	0 (0.00 %)	
Balancing family and work responsibilities	1219 (55.89 %)	709 (42.63 %)	
Balancing clinical, research, and education responsibilities	162 (7.43 %)	186 (11.18 %)	
Satisfactory professional advancement	54 (2.48 %)	47 (2.83 %)	
TOTAL	2181 (100 %)	1663 (100 %)	
Foreseeable non-work-related responsibilities after residency			**P < 0.0001**
Raising children	2048 (87.97%)	1579 (87.97%)	> 0.99
Taking care of elderly parents	1513 (64.99%)	1150 (64.07%)	0.54
Being a caretaker to others	657 (28.2%)	595 (33.2%)	0.0007
Financial support of others	1184 (50.9%)	1017 (56.7%)	0.0002

[a] Excluding Other/NA

Foreseeable non-work-related responsibilities

Both male and female respondents expected to raise children (1579, 88.0% versus 2048, 88.0%, p > 0.99) and take care of elderly parents (1150, 64.1% versus 1513, 65.0%, p = 0.54), respectively. More male than

female respondents expected to be a caretaker to others (595, 33.2% versus 657, 28.2%, p = 0.0007) and financially support others (1017, 56.7% versus 1184, 50.9%, p = 0.0002), respectively (Table 3).

Perceptions

Intended research/clinical work ratio

Significant gender differences were seen in intended research/clinical work ratios. Female students preferred to have no research component (558, 24.3% versus 348, 19.8%) or 25%-time commitment (1047, 44.6% versus 747, 42.4%), while male trainees preferred 50% research commitment (309, 17.6% versus 370, 16.1%), 75% research commitment (319, 18.1% versus 291, 12.7%) or full-time research (38, 2.2% versus 29, 1.3%) (p = 0.03) (Table 4).

Table 4
Perceptions of Research/Clinical Work Ratio, Feasibility, and Mentoring

RI Ratio (Research/Clinical Work)[a]	**Female, n (%)**	**Male, n (%)**	**P = 0.03**
0%	558 (24.31 %)	348 (19.76 %)	
25%	1047 (44.62 %)	747 (42.42 %)	
50%	370 (16.12 %)	309 (17.55 %)	
75%	291 (12.68 %)	319 (18.11 %)	
100%	29 (1.26 %)	38 (2.16 %)	
TOTAL	2295 (100 %)	1761 (100 %)	
How feasible is a research intense career in acute care medicine specialties?			**P < 0.0001**
Highly feasible	130 (5.87 %)	118 (6.92 %)	
Feasible	750 (33.88 %)	494 (28.99 %)	
Difficult	945 (42.68 %)	700 (41.08 %)	
Highly difficult	359 (16.21 %)	359 (21.07 %)	
Impossible	30 (1.36 %)	33 (1.94 %)	
TOTAL	2214 (100 %)	1704 (100 %)	
How feasible is a research intense career in surgical specialties?			**P < 0.0001**
Highly feasible	156 (7.05 %)	98 (5.74 %)	
Feasible	707 (31.96 %)	466 (27.32 %)	
Difficult	799 (36.12 %)	588 (34.47 %)	
Highly difficult	494 (22.33%)	471 (27.61 %)	
Impossible	56 (2.53 %)	83 (4.87 %)	
TOTAL	2212 (100 %)	1706 (100 %)	
How much importance is given to talents/accomplishments when recruiting applicants for jobs and/or positions in science and medicine?			**P = 0.30**
A great deal of importance	669 (30.72 %)	519 (31.06 %)	
A lot of importance	1070 (49.13 %)	789 (47.22 %)	
Moderate amount of importance	410 (18.82 %)	327 (19.57 %)	
Little importance	28 (1.29 %)	35 (2.09 %)	

RI Ratio (Research/Clinical Work)[a]	Female, n (%)	Male, n (%)	P = 0.03
None at all	1 (0.05 %)	1 (0.06 %)	
TOTAL	2178 (100 %)	1671 (100 %)	
How much importance is given to connections/networking when recruiting applicants for jobs and/or positions in science and medicine?			**P = 0.01**
A great deal of importance	721 (33.04 %)	527 (31.52 %)	
A lot of importance	946 (43.35 %)	675 (40.37 %)	
Moderate amount of importance	456 (20.90 %)	406 (24.28 %)	
Little importance	59 (2.70 %)	62 (3.71 %)	
None at all	0 (0.00 %)	2 (0.12 %)	
TOTAL	2182 (100%)	1672 (100%)	
[a] Excluding Other/NA			
Figure 1a) 1st Sector Choice by Gender[a], P = 0.0004			
Figure 1b) 1st Career Intention by Gender[b], P < 0.0001			
Figure 1c) 1st Specialty of Interest by Gender[c], P < 0.0001			
[a] Top sector choice for participants separated by gender. The following sectors were included in the category “Other” for better visualization: nonprofit, government, industry, and consulting.			
[b] Top career intention for participants separated by gender. The category “Other/NA” was excluded for better visualization.			
[c] Top choice specialty of interest for participants separated by gender. The following specialties were included in the category “Medicine” for better visualization: allergy and immunology, dermatology, family medicine, internal medicine, internal medicine subspecialties, medical genetics, pathology, pediatrics, physical medicine and rehabilitation, preventive medicine, and psychiatry. The following specialties were included in the category “Surgery” for better visualization: surgical subspecialties, obstetrics and gynecology, ophthalmology, otolaryngology, and urology. The following specialties were included in the category “Radiology” for better visualization: nuclear medicine and radiation oncology. The category “Other/NA” was excluded for better visualization.			

Feasibility of research in acute care and surgical specialties

More female than male respondents (750, 33.9% versus 494, 29.0%) believe that research intensive careers in acute care specialties are feasible, while more male than female respondents (359, 21.1% versus 359, 16.2%) believe that research intensive careers in acute care are highly difficult ($p < 0.0001$). As for surgical specialties, more females than males perceive research intensive careers as highly feasible (156, 7.1% versus 98, 5.7%) or feasible (707, 32.0% versus 466, 27.3%), while more males than females

believe research intensive careers in surgical specialties are highly difficult (471, 27.6% versus 494, 22.3%), or impossible (83, 4.9% versus 56, 2.5%) ($p < 0.0001$) (Table 4).

Perceived important factors in job recruitment

During recruitment of applicants for jobs and/or positions in science and medicine, female and male respondents similarly perceived talent and accomplishments to be “a great deal of importance” (669, 30.7% versus 519, 31.1%) and “a lot of importance” (1070, 49.1% versus 789, 47.2%) ($p = 0.30$). Interestingly, more female than male respondents perceived connections/networking to be “a great deal of importance” (721, 33.0% versus 527, 31.5%), whereas more males than females perceived connections/networking to be of “moderate amount of importance” (406, 24.3% versus 456, 20.9%) ($p = 0.01$) (Table 4).

Discussion

There continues to be significant gender disparities in many factors surrounding medical student interest in research. These results, collected from medical students across several large academic centers, are consistent with prior findings in the literature related to gender disparities, and they expand on these findings by detailing several contributing factors for these differences from a medical student’s perspective.

Notably, more males were found through our study to pay for medical school through MD/PhD or DO/PhD program funding, scholarships, grants, and national service, thus leading to a significantly reduced financial/loan burden. The study also found that more females identify loan repayment as a top foreseeable obstacle to pursuing medical research compared to males, consistent with current literature which states that female matriculation rates consistently remain below 50% among all MSTP programs (18). Our data further supports this as male respondents were more likely to be enrolled in MD/PhD programs (25.6% vs 16.9%) compared to female respondents.

Furthermore, fewer females identified under-compensation as a top foreseeable obstacle to pursuing a career in research. However, females in the medical profession continue to experience the wage gap which persists through all sectors of society (19). There may be many reasons for this discordance, one of which may be societal pressure on women to fulfill the heteronormative gender role as the primary caregiver for the family and children, though the contribution of this factor is still debated (15). Our study further supports this possibility in the finding that a greater percentage of females chose “balancing family and work responsibilities” as the number one factor for both their specialty choice and foreseeable obstacle in pursuing research. A related factor that may contribute is that women are much less likely to promote themselves or negotiate on their behalf in the workplace (20).

Along with work/life balance, female respondents reported significant expected non-work-related factors that would impede their ability to pursue a career in research, all of which were reported at higher rates compared to their male colleagues. These factors include raising children, caring for elderly parents,

being a caretaker for others, and financially supporting others. These responsibilities have been magnified more than ever by the COVID-19 pandemic, leading to more women having to take time off from clinical duties due to increasing demands outside of work (21). Additionally, a larger portion of male respondents reported having children (7.8% vs 4.3%) while completing their studies. This could potentially be explained by the fact that male students had spouses who shouldered the childcare responsibilities while female students did not.

Finally, a notable finding in our study was that while more females saw research intensive careers in surgical and acute care specialties as feasible, fewer females indicated an intent to pursue basic and translational research. This discrepancy is consistent with the continued minority of women entering surgical and acute care specialties, despite recent parity in absolute numbers of students entering the resident workforce (22). Even with apparent knowledge of the opportunity to conduct research in these specialty areas, there are still factors that dissuade entry into these procedural career options. Of course, this decision is multifactorial, but a lesser desirability in pursuing a research career may play a role.

Although this is a large cross-sectional cohort analysis, with a total of 4,433 respondents from a nationally representative cohort of medical schools, there are a few limitations to this study. First, this was only a snapshot in time of what trainees are interested in and intending to pursue as a career, and thus a follow-up study to determine their ultimate career choice will be important. Second, given the nature of self-reported surveys, there was the inherent limitation in being unable to assess more deeply the motivations behind the answers of the respondents.

There are a multitude of factors that contribute to the continued disparities in interest in pursuing a career in medical research among medical students. These factors are still largely unknown, but by the merits of this study, may include financial burden from student loans, under-compensation, work/life balance, and expected familial/caretaker obligations among other factors. Without concerted efforts to bridge this gap between men and women, these disparities will persist. With the current focus on inclusion and diversification in academic medicine, these efforts must target minority populations to ensure these changes come to fruition in the coming years (23, 24).

Abbreviations

APSA - American Physician Scientists Association

Declarations

Ethics approval and consent to participate: The study was reviewed and exempted by the Institutional Review Board.

Consent for publication: Not applicable.

Availability of data and materials: The datasets used and/or analyzed during the current study are available from the corresponding authors on reasonable request.

Competing interests: The authors declare no competing interests.

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Authors' contributions: AS and DX analyzed and interpreted the survey data, created the figures and tables, and contributed to writing the manuscript. AS, SE, OT, JD, JMK, and DD contributed to creating the survey instrument and writing the manuscript. All authors read and approved the final manuscript.

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Figures

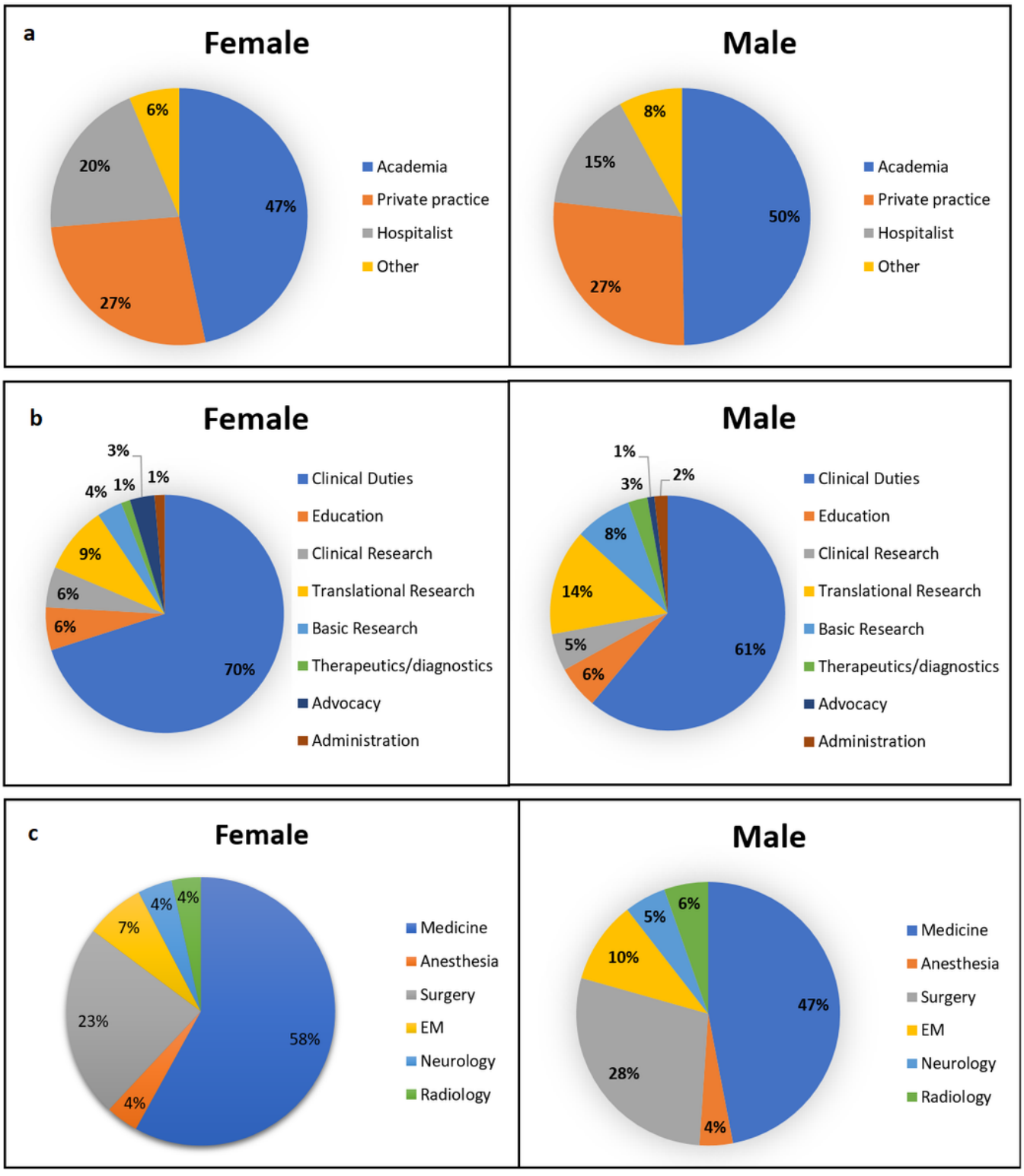

Figure 1

a) 1st Sector Choice by Gendera, P=0.0004. b) 1st Career Intention by Genderb, P<0.0001. c) 1st Specialty of Interest by Genderc, P<0.0001. a Top sector choice for participants separated by gender. The following sectors were included in the category “Other” for better visualization: nonprofit, government, industry, and consulting. b Top career intention for participants separated by gender. The category “Other/NA” was excluded for better visualization. c Top choice specialty of interest for participants separated by gender.

The following specialties were included in the category “Medicine” for better visualization: allergy and immunology, dermatology, family medicine, internal medicine, internal medicine subspecialties, medical genetics, pathology, pediatrics, physical medicine and rehabilitation, preventive medicine, and psychiatry. The following specialties were included in the category “Surgery” for better visualization: surgical subspecialties, obstetrics and gynecology, ophthalmology, otolaryngology, and urology. The following specialties were included in the category “Radiology” for better visualization: nuclear medicine and radiation oncology. The category “Other/NA” was excluded for better visualization.