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ORIGINAL ARTICLE

Gender inequality in genitourinary malignancies clinical trials leadership

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Abstract

Background Over the past 2 decades, there has been a growing interest in the significance of gender roles in healthcare and several efforts and initiatives have focused on increasing female representation in the medical field. Clinical trials play a very important role in shaping medical practice; moreover, the leaders of clinical trials often represent the upper echelon of researchers in any designated field. Presently, there is no data regarding women's representation in urological oncology clinical trials leadership. Therefore, the aim of this study is to examine the extent of female representation in leading urological clinical trials.

Methodology To thoroughly examine the representation of females as principal investigators (PIs) in urological cancer clinical trials between 2000 and 2020, we conducted a comprehensive search of completed trials focused on kidney, prostate, and bladder cancer on ClinicalTrials.gov. We extracted relevant information regarding the PIs and analyzed the data using univariate analyses to identify any significant differences between male and female PIs.

Results A total of 9145 cancer clinical trials were conducted over the last 2 decades, and 11.3% ($n=1033$) of them were urological cancer clinical trials. We were able to obtain detailed information about the principal investigators (PI) in 79.0% ($n=816$) of the clinical trials, and we found that 16.8% ($n=137$) of them were led by female investigators. Upon evaluating the characteristics of the PIs, female PIs had a significantly lower median age and median total citations as compared to male PIs (55.0 vs 59.0 and 5333 vs 7902; p-value <0.001 and 0.006, respectively). However, there was no statistically significant difference between the termination rate, publication rate, funding source, cancer type, and the subject of conducting the clinical trials between male and female PIs.

Conclusion Between 2000 and 2020, only 16.8% of urological cancer clinical trials were led by a female PI, perhaps reflective of a low percentage of senior female researchers in the fields of urology, oncology and radiation oncology. Universities, research institutes and funding agencies should work to improve mentorship, representation and opportunities for female investigators to encourage more involvement for female researchers in these clinical trials.

Keywords Bladder · Prostate · Kidney · Clinical trials · Health inequity · Cancer

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Introduction

Inequity within the field of medicine is pervasive, particularly concerning leadership positions, compensation, and resource allocation [1]. This disparity is particularly pronounced in critical areas such as cancer, which carries a profound impact on the lives of patients, their families, and society as a whole [1, 2]. However, historical data clearly indicate that women have limited opportunities to assume leadership roles in the medical field, resulting in various consequences such as reduced research funding and limited access to grants compared to their male counterparts [3, 4]. Failing to address this disparity will have far-reaching implications for the academic progress of women, institutional support, and resource management, and ultimately affecting their involvement in decision-making processes [3, 5]. Women's leadership in urological cancer research, particularly studies related to kidney, bladder, and prostate cancer, has not been thoroughly evaluated. It is imperative to highlight the contributions of women in leading clinical trials to facilitate ongoing improvements in women's inclusion initiatives and increase women's participation in policy decision-making.

In this context, we sought to assess the level of female leadership representation in urological cancer clinical trials, in addition to assessing female-led urological cancer clinical trials termination rate, funding resources, and publication rate.

Methodology

A systematic search was conducted by three independent authors (HM, KD, SR) of clinicaltrials.gov/ on April 30th, 2023 [6]. The purpose of the search was to retrieve clinical trials related to urological cancers, specifically kidney, prostate, and bladder cancer. Clinical trials initiated and completed between January 2000 and December 2020 were included to allow adequate time for publication of clinical trial results.

The authors extracted relevant data from these clinical trials which include data pertinent to the principal investigators (PI) including age, gender, and years of experience. To eliminate potential investigator bias based on their assumptions about the gender of the principal investigator (PI), we implemented an alternative method utilizing an algorithm. This algorithm leverages Gender. API (Application Programming Interface) to accurately determine the gender of PIs based on their names (https://gender-api.com). By relying on this objective approach, we were able to minimize any subjective biases that may have otherwise influenced the study as this algorithm has demonstrated a low error rate in gender classifying [7], It also included clinical trial details such as dates, funding sources (such as the National Institutes of Health (NIH), industrial companies, private institutions/hospitals, or universities), interventions (medical, surgical, radiation, device-based, or combinations thereof), enrollment numbers, trial completion dates, trial phases (I, II, III, or IV), clinical trial status (completed or terminated), reasons for discontinuation, masking protocols (none, single, double, triple, or quadruple), single or multi-center locations, and the geographic area of the clinical trial [high-income countries (HICs) or low-middle income countries (LMICs)]. The classification of the clinical trial's location as HICs or LMICs was according to the 2022–2023 World Bank Atlas country income level classification (https://blogs.worldbank.org/opendata/new-world-bank-country-classifications-income-level-2022-2023). To determine publication status, we used the clinical trials identification number which is linked to the publication automatically in the PubMed index, otherwise, if this information was not available, we searched for the publication by using the clinical trials PI name to identify any possible publication of the trial.

Statistical analysis was performed using a significance level (p-value) of less than 0.05. All statistical analyses were conducted using the R software. Categorical variables were evaluated using the Chi-square test and reported as percentages, while continuous variables were assessed for normality using the Shapiro–Wilk test. In cases of non-normal distribution, t tests or one-way ANOVA were conducted to examine differences between two or more groups, respectively. Alternatively, a logarithmic conversion was applied to achieve a normal distribution, followed by the appropriate test for analysis.

Results

We identified a total of 1033 urological oncology clinical trials that were conducted between 2000 and 2020. Among these trials, 816 provided sufficient data on the PI with only 16.8% ($n = 137$) of these trials being led by female PIs, Fig. 1. Specifically, females led 22.7% ($n = 137$) of bladder cancer trials, 20.4% of prostate cancer trials, and 7.60% of renal cell carcinoma trials. Female PIs were younger (55.0 vs 59.0, p-value < 0.001) and had a lower total number of citations (5333 vs 7902, p-value $= 0.006$) compared to their male counterparts, as shown in Table 1.

The analysis conducted on the funding source for the clinical trials, led by a female Principal Investigator (PI), revealed no significant association (p-value $= 0.106$). However, upon further sub-analysis, a notable difference emerged

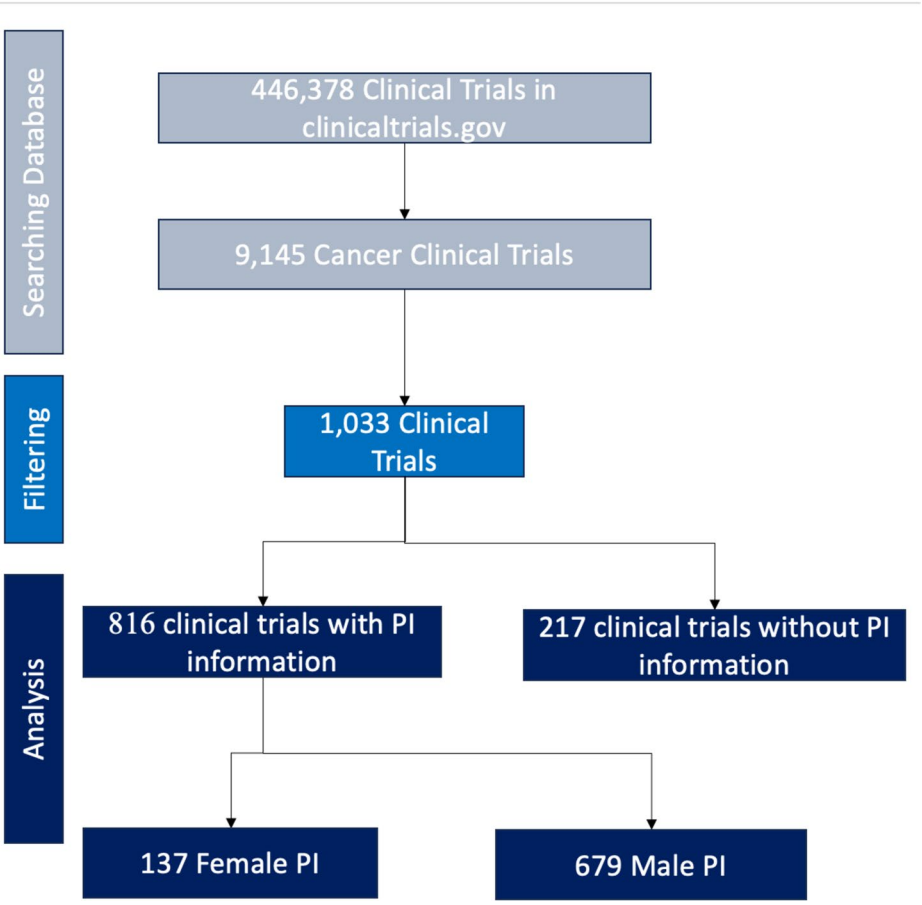

Fig. 1 Illustrate the flow of the included records from ClinicalTrials.gov and the PI gender disparity

Table 1 Shows the difference in the PI characteristics between male and female

	[ALL] $N=816$	Female $N=137$	Male $N=679$	p-value
Experience in the medical filed (SD) year	20.2 (9.71)	18.2 (9.48)	20.7 (9.71)	0.019
PI age	59.0 [52.0; 64.8]	55.0 [48.0; 62.0]	59.0 [53.0; 66.0]	<0.001

when comparing funding from industrial and non-industrial sources with female PIs receiving lower funding from industrial companies (32.8%) as compared to non-industrial sources (48%) (p-value = 0.034). Conversely, there was no statistically significant difference observed between female ratios from HICs and LMICs (p-value = 0.332). Furthermore, there was no difference in the type of intervention being evaluated in the clinical trials the number of centers involved in the clinical trials, and the gender of the PI. Detailed results can be found in Table 2.

The termination rates for both female and male-led trials were similar, with 25.5% for females and 28.3% for males (p-value = 0.585). Similarly, the publication rates for female and male-led trials were also comparable, with 49.6% for females and 43.9% for males (p-value = 0.255). However, there was a significant difference in the reasons for trial termination, as a higher percentage of trials led by female PIs were terminated due to administrative reasons (14.7% vs 8.82%, p-value = 0.027). refer to Table 2 for further details. Looking at trend of female-led trials over time the results show no significant difference between the period between 2000–2010 and 2010–2020 as the percentage was 16.8% vs 16.9% respectively (p-value = 1.00).

Discussion

In this study, we assessed female representation in the leadership of urological cancer clinical trials between 2000 and 2020. The findings reveal a significant disparity, with a lower number of female PIs as compared to males over the past 20 years. Specifically, the analysis demonstrates a significantly

Table 2 Shows the difference in the female clinical trials characteristics between female and male PI's

	[ALL] *N* = 816	Female *N* = 137	Male *N* = 679	*p*.overall
Funding source:				0.106
Industrial	336 (41.3%)	45 (32.8%)	291 (43.0%)	
NIH	278 (34.2%)	50 (36.5%)	228 (33.7%)	
Private	82 (10.1%)	19 (13.9%)	63 (9.32%)	
University	117 (14.4%)	23 (16.8%)	94 (13.9%)	
Funding source:				0.034
Industrial	336 (41.3%)	45 (32.8%)	291 (43.0%)	
Non-industrial	477 (58.7%)	92 (67.2%)	385 (57.0%)	
Intervention:				0.432
Device	27 (3.32%)	1 (0.74%)	26 (3.84%)	
Medication	625 (76.9%)	107 (78.7%)	518 (76.5%)	
Medication/surgery	39 (4.80%)	5 (3.68%)	34 (5.02%)	
Medication/radiation	21 (2.58%)	1 (0.74%)	20 (2.95%)	
Other	48 (5.90%)	16 (11.8%)	32 (4.73%)	
Radiation	31 (3.81%)	4 (2.94%)	27 (3.99%)	
Surgery	22 (2.71%)	2 (1.47%)	20 (2.95%)	
Enrollment	34.0 [15.0; 80.0]	37.0 [11.0; 89.0]	34.0 [15.0; 78.5]	0.861
Number of agents:				0.959
1	319 (46.8%)	52 (46.0%)	267 (47.0%)	
2	230 (33.8%)	37 (32.7%)	193 (34.0%)	
3	77 (11.3%)	14 (12.4%)	63 (11.1%)	
More than 3	55 (8.08%)	10 (8.85%)	45 (7.92%)	
Is it published or not:				0.255
No	447 (55.2%)	68 (50.4%)	379 (56.1%)	
Yes	363 (44.8%)	67 (49.6%)	296 (43.9%)	
Impact factor of the journal	6.11 [2.90; 13.8]	6.12 [2.48; 10.3]	6.07 [2.95; 13.8]	0.522
Status:				0.585
Completed	589 (72.2%)	102 (74.5%)	487 (71.7%)	
Terminated	227 (27.8%)	35 (25.5%)	192 (28.3%)	
Reason for discontinuation:				0.027
Administrative reasons	20 (9.80%)	5 (14.7%)	15 (8.82%)	
Funding	26 (12.7%)	0 (0.00%)	26 (15.3%)	
Low accrual	111 (54.4%)	23 (67.6%)	88 (51.8%)	
Other	9 (4.41%)	0 (0.00%)	9 (5.29%)	
Patients safety	38 (18.6%)	6 (17.6%)	32 (18.8%)	
Masking:				0.061
None	687 (84.8%)	105 (77.8%)	582 (86.2%)	
Single	22 (2.72%)	6 (4.44%)	16 (2.37%)	
Double	48 (5.93%)	14 (10.4%)	34 (5.04%)	
Triple	32 (3.95%)	7 (5.19%)	25 (3.70%)	
Quadruple	21 (2.59%)	3 (2.22%)	18 (2.67%)	
Centers:				1.000
Multi	385 (47.9%)	66 (48.2%)	319 (47.8%)	
Single	419 (52.1%)	71 (51.8%)	348 (52.2%)	
Country:				0.332
HICs	752 (97.8%)	132 (99.2%)	620 (97.5%)	
LMICs	17 (2.21%)	1 (0.75%)	16 (2.52%)	
Sample size:				0.427
Less than 50	504 (61.8%)	80 (58.4%)	424 (62.4%)	
More than 50	312 (38.2%)	57 (41.6%)	255 (37.6%)	

lower number of female PIs in renal cell carcinoma (RCC) clinical trials compared to bladder and prostate cancer trials.

Interestingly and encouraging, our results indicate a similar rate of trial termination and publication between male and female-led trials. Furthermore, female PIs exhibit fewer years of experience, showcasing the considerable potential of female leaders in achieving comparable outcomes to their male counterparts in clinical trials. This underscores the efforts made by different initiatives and societies to enhance female representation in the urology and research community [8, 9].

Although the results show no significant difference in terms of funding subgrouping, the analysis reveals that females receive lower funding from industrial companies compared to others. Given the rise in sponsored clinical trials and the disparity in female representation within industrial-sponsored studies, it is crucial to underscore the necessity for industrial companies to enhance the visibility of women in leadership roles within these trials [10].

While there were different reasons for trial termination between the two groups. Concerningly, there was no longitudinal increase in the number of female PIs over the past 2 decades, indicating the persistence of this disparity despite an increase in the number of practicing female physicians in urology and radiation oncology [9, 11]. In fact, during our study period there was a non-significant decrease in the level of female PIs over time.

It is noteworthy that despite the presented data demonstrating a substantially lower level of female PIs in urological clinical trials when compared to other specialties such as gynecological oncology where at least 38% of PIs in phase 3 clinical trials are females [13]. Historically, urological oncology is widely known as a male-dominated field which is seen in these results [12–14]. Nonetheless, this does not invalidate the fact that comprehensive efforts should be made to improve female representation as PIs and leaders in clinical trials given that the presented data demonstrates females have the necessary experience to conduct and run clinical trials despite having less period of practice when compared to their male counterparts. Clinical trials occupy the pinnacle of evidence-based medicine, and the individuals leading them hold the highest level of influence within the research community as it reflects the high level of experience, knowledge, and training [15]. The higher presence of females in clinical trials as PIs undoubtedly paves the way for future generations of female urological oncologists and other urological-related fields. Therefore, effective measures are necessary to tackle the specific challenges, and obstacles that are encountered by females in the field of academia and research given that the predominant number of clinical trials are conducted in academic institution settings [18]. Moreover, it is important to note that this issue extends beyond gender only as it also affects individuals from different ethnicities and social backgrounds, further exacerbating the lack of equal representation among scientists [16, 17]. The significance of diversity is highlighted by the broader range of ideas, resulting in improved clinical trial outcomes and optimized resource utilization for enhanced patient outcomes [18, 19]. Holistic and effective tackling of the barriers that females face will unequivocally not only affect academic achievements and female representativeness in decision-making policies but also have societal implications, as the effects of this issue are evident in the disparity of earnings and employment opportunities experienced by female practitioners [20, 21]. Females not only earn lower salaries but also face significant hurdles when it comes to securing employment, obtaining research funding, and receiving grants [5]. Given that despite all of the challenges and obstacles females encounter, they consistently demonstrate remarkable dedication and contribute greatly to the field of medicine. Their commitment translates into providing superior clinical care and generating substantial savings within the healthcare system compared to their male counterparts [22, 23].

It is important to acknowledge that our study focused exclusively on urological cancer clinical trials, and therefore, the participation of females in the broader spectrum of urological clinical trials might differ from our results. In addition, the lack of mention of certain details about the PIs, such as their medical background, ethnicity, and social background, could obscure the true extent of female leadership in clinical trials. Moreover, the gender identification algorithm used in our analysis only categorized individuals as male or female, excluding other diversities such as gender non-conforming, non-binary, and trans individuals. These groups may have different outcomes and forms of representation. Furthermore, our analysis was limited to clinical trials, excluding other types of research, such as cohort studies, observational cross-sections, reviews, and meta-analyses which may have different levels of female leadership. Evaluating these aspects is crucial for a comprehensive understanding of the research community and academic progress. Moreover, we utilized the 2022–2023 World Bank Atlas country income level classification to classify countries into HIC and LMIC, while this classification changes every year, only a few country's statuses might have changed from HIC into LMIC or vice versa. In addition, because our analysis relied on data from clinicaltrials.gov, clinical trials not registered in this dataset were not considered, and their gender diversity could not be assessed. Despite these limitations, it is worth mentioning that this dataset provides a good representation, encompassing the majority of clinical trials conducted worldwide. Finally, while our utilization of the Gender API machine learning algorithm introduces some level of uncertainty in the results, the notably low count of females falls well beyond the margins of error.

In conclusion, it is evident that urological cancer clinical trials exhibit a significantly lower representation of females in leadership positions, despite comparable rates of trial termination and publication. This study underscores the urgent need to address this issue and rectify the gender imbalance, as it serves as a prominent source of bias and restricts the advancement of patient management by limiting perspectives and insights in this field. We strongly advocate for the academic empowerment of women in the field of urology to enhance their representation and influence. One way could be encouraging female representation in academic leadership positions, which is a known disparity in the field of urology [24, 25]. Providing ample opportunities for female urologists to engage in scholarly pursuits not only bolsters their involvement in clinical trials but also elevates their role in broader research endeavors, for example, there could be incentives by organizations like the American Urological Association or the European Association of Urology to encourage female PIs and increase their representation to avoid future bias in clinical trials. By fostering a conducive environment for women to lead such initiatives, we aim to amplify their impact within the field and thereby attract more women to pursue careers in urology. This proactive approach not only enhances diversity but also cultivates a supportive ecosystem wherein experienced female urologists can mentor and guide aspiring young investigators—a pivotal factor known to profoundly shape career trajectories in medicine [26]

Conclusion

Based on the aforementioned findings, this study draws significant conclusions regarding a lack of females in leadership roles within urological clinical trials. Despite demonstrating similar clinical trial outcomes, a persistent gender disparity in clinical trial leadership remains evident. This issue highlights the urgent need to address the underrepresentation of female PIs, which poses a serious challenge and it is imperative to address this issue to uphold gender equality, prevent further bias, and safeguard optimal patient management in future.

Authors declarations

The authors assert their absence of conflicts of interest or any personal relationships that might influence or bias the findings and conclusions in this study.

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Data availability All data generated or analyzed during this study are included in this published article. The raw datasets used and/or analyzed during the current study can be obtained from the corresponding author upon reasonable request.

Declarations

Ethical approval Not applicable.

Consent for publication All the authors confirm the transfer of publication rights to the journal upon acceptance.

Conflict of interests The authors affirm the absence of conflicts of interest.

References

1. Ma L, Zhu K, Shi C, Chen X, Gao Y, Cai C et al (2023) Association between the patients' symptom burden and their family caregivers' benefit finding in non-small cell lung cancer receiving combined chemotherapy. Support Care Cancer 31:148
2. Borges EL, Franceschini J, Costa LHD, Fernandes ALG, Jamnik S, Santoro IL (2017) Family caregiver burden: the burden of caring for lung cancer patients according to the cancer stage and patient quality of life. J Bras Pneumol 43:18–23
3. Pérez-Sánchez S, Madueño SE, Montaner J (2021) Gender gap in the leadership of health institutions: the influence of hospital-level factors. Health Equity 5:521–525
4. Nonnemaker L (2000) Women physicians in academic medicine—new insights from cohort studies. N Engl J Med 342:399–405
5. Jagsi R, Biga C, Poppas A, Rodgers GP, Walsh MN, White PJ et al (2016) Work activities and compensation of male and female cardiologists. J Am Coll Cardiol 67:529–541
6. ClinicalTrials.gov. ClinicalTrials.gov Background. https://clinicaltrials.gov/ct2/about-site/background (30 October 2020).
7. Sebo P (2021) How accurate are gender detection tools in predicting the gender for Chinese names? A study with 20,000 given names in Pinyin format. J Med Lib Assoc 110:205–211
8. (2023) Women in urology—closing the gap. Nat Rev Urol 20:385–385
9. Nam CS, Daignault-Newton S, Herrel LA, Kraft KH (2021) The future is female: urology workforce projection from 2020 to 2060. Urology 150:30–34
10. Gresham G, Meinert JL, Gresham AG, Meinert CL (2020) Assessment of trends in the design, accrual, and completion of trials registered in ClinicalTrials.gov by sponsor type, 2000–2019. JAMA Netw Open. 3:e2014682
11. Odei B, Kahn J, Holliday EB, Diaz DA, Bello-Pardo E, Odei J et al (2021) Where are the women in radiation oncology? A cross-sectional multi-specialty comparative analysis. Adv Radiat Oncol 6:100735
12. Reale S, Orecchia L, Ippoliti S, Pletto S, Pastore S, Germani S et al (2022) Is Urology a gender-biased career choice? A survey-based study of the Italian medical students' perception of specialties. Front Surg. 9:1014036
13. Adams EJ, Louters MM, Kocsuta VA, Ganesh MB, Jang A, Ansbro B et al (2023) Gender disparities and differences among urologists included in top doctor lists. Urology 173:215–221
14. Solomon E, Reeves F, Challacombe B (2023) Women in urology: breaking down the barriers. Trends Urol Men's Health 14:2–4

15. Feehan AK, Garcia-Diaz J (2020) Investigator responsibilities in clinical research. Ochsner J 20:44–49
16. Nielsen MW, Bloch CW, Schiebinger L (2018) Making gender diversity work for scientific discovery and innovation. Nat Hum Behav 2:726–734
17. Gabster BP, van Daalen K, Dhatt R, Barry M (2020) Challenges for the female academic during the COVID-19 pandemic. The Lancet 395:1968–1970
18. Gomez LE, Bernet P (2019) Diversity improves performance and outcomes. J Natl Med Assoc 111:383–392
19. Swartz TH, Palermo A-GS, Masur SK, Aberg JA (2019) The science and value of diversity: closing the gaps in our understanding of inclusion and diversity. J Infect Dis 220:S33-41
20. Boiko JR, Anderson AJM, Gordon RA (2017) Representation of women among academic grand rounds speakers. JAMA Intern Med 177:722
21. Files JA, Mayer AP, Ko MG, Friedrich P, Jenkins M, Bryan MJ et al (2017) Speaker introductions at internal medicine grand rounds: forms of address reveal gender bias. J Womens Health 26:413–419
22. Butkus R, Serchen J, Moyer DV, Bornstein SS, Hingle ST (2018) Achieving gender equity in physician compensation and career advancement: a position paper of the American College of Physicians. Ann Intern Med 168:721
23. Woolley AW, Chabris CF, Pentland A, Hashmi N, Malone TW (1979) Evidence for a collective intelligence factor in the performance of human groups. Science 2010(330):686–688
24. Han J, Stillings S, Hamann H, Terry R, Moy L (2017) Gender and subspecialty of urology faculty in department-based leadership roles. Urology 110:36–39
25. Baqain L, AlMajali R, Khanmammadova N, Dobbs RW, Nguyen TT, Semins MJ et al. (2024) Who are the mentors of the future endourologist? An analysis of Endourological Society Program Directors. J Endourol
26. Iversen AC, Eady NA, Wessely SC (2014) The role of mentoring in academic career progression: a cross-sectional survey of the Academy of Medical Sciences mentoring scheme. J R Soc Med 107:308–317