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# Gender Disparities in Faculty Rank: Factors that Affect Advancement of Women Scientists at Academic Medical Centers

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**Abstract:** While a significant portion of women within academic science are employed within medical schools, women faculty in these academic medical centers are disproportionately represented in lower faculty ranks. The medical school setting is a critical case for both understanding and advancing women in basic sciences. This study highlights the findings from focus groups conducted with women faculty across Assistant, Associate, and Full Professor ranks ( $n = 35$ ) in which they discussed barriers and facilitators for advancement of women basic scientists at an academic medical center. Qualitative analysis demonstrated several emergent themes that affect women's advancement, including gendered expectation norms (e.g., good citizenship, volunteerism), work-life balance, mentorship/sponsorship, adoption of a team science approach, tenure process milestones, soft money research infrastructure, institution specific policies (or lack thereof), and operating within an MD-biased culture. These findings are compared with the extant literature of women scientists in STEM institutions. Factors that emerged from these focus groups highlight the need for evidence-based interventions in the often overlooked STEM arena of academic medical centers.

**Keywords:** women in science; academic rank; gender disparities; gender bias; academic medical centers; women faculty; medical schools; tenure and promotion

## 1. Introduction

Women faculty remain underrepresented within academic science, especially at the more advanced ranks (i.e., Associate and Full Professors). A significant portion of women within academic science are employed within medical schools: 33% of all women basic scientists are employed by medical schools, compared to 24% of all men basic scientists ([National Science Foundation, National Center for Science and Engineering Statistics NCSES; National Science Foundation SESTAT Scientist and Engineers Statistical Data System](#)). As within academia at large, the distribution of women science faculty within medical schools shows women disproportionately represented at lower ranks. In 2016, according to the Association of American Medical Colleges, women made up 44.78% of Assistant Professors in U.S. medical schools but only 35.62% of Associate Professors and 22.77% of Full Professors ([Association of American Medical Colleges 2016](#)). The advancement of women faculty (that is, women moving into the more advanced faculty ranks of Associate and Full Professors and

taking on administrative leadership) is necessary to achieve equity for women in male-dominated domains. Despite progress with laws and policies that aim to level the playing field for professional advancement and increasing evidence that gender equity in leadership has organizational benefits, gender equity in academic medicine remains a problem (Ehrenberg et al. 2010). The medical center setting is a unique and particularly difficult setting for women with PhDs and/or in basic sciences. To truly advance women in science, one must understand the factors impacting the promotion and tenure process for women as scientist faculty in medical academic centers.

The majority of prior research on factors impacting promotion and tenure for women faculty in basic sciences has been conducted within general academia, not specifically within medical schools. We review these factors here with the understanding that the career trajectories of women academics are the result of dynamic interactions between individual choices and institutional, cultural, and structural contexts (Magrane et al. 2012). The Systems of Career Influences Model provides a conceptual framework for examining how individual women academics navigate medical universities, exerting agency within structural constraints (Magrane et al. 2012).

Research has demonstrated that self-efficacy, defined as the confidence in one's ability to successfully perform a task (Bandura 1977), impacts career-related behavior and is an important mediator of women's persistence in science (Betz and Hackett 1981; Lent et al. 1987; Lent and Hackett 1987; Zeldin and Pajares 2000). Strong self-efficacy in women academics is necessary to overcome external barriers such as gender discrimination; however, studies have repeatedly found women reporting decreased career self-efficacy relative to men (Betz and Hackett 1981; Landino and Owen 1988; Vasil 1996; Pololi et al. 2013). In a study examining the gender differences of self-efficacy among academics, Vasil (1996) suggested that lack of mentoring for women may play a role by decreasing women's knowledge of the implicit rules of academia leading to lower self-efficacy. Indeed, prior research has found that a decreased sense of belonging, from a lack of mentors, role models, and peer networks, leads to a lack of socialization to faculty life (Bickel et al. 2002; Stout et al. 2007).

One of the most relevant differences between medical schools and general academia is the way in which basic science faculty are compensated. In (non-medical) universities, while securing grant funding is rewarded and often expected, tenure-track faculty salary is typically covered with hard money, and receiving grant funding is not required in order to be paid. In medical schools, tenure-track science faculty are expected to support nearly all of their salary through grant funding (Barinaga 2000; Liu and Mallon 2004; Shea et al. 1996). Ultimately, this situation means that even temporary, small lapses in the time needed to secure grant funding threaten retention of scientist faculty in medical schools. The likelihood of these lapses increases when family demands occur, especially for women, who typically shoulder greater responsibility than men for family care (Carr et al. 1998; Ash et al. 2004; Stout et al. 2007). Indeed, work-life balance poses a greater challenge for women faculty; women faculty with children experience greater stress, relative to men faculty with children, in balancing work and family demands and perceive less institutional support (O'Laughlin and Bischoff 2005).

Prior research has also shown how gender schemas may skew perceptions of performance within academia, leading to women being consistently underrated (Valian 2004). For example, Trix and Psenka (2003) found that letters of recommendation written for medical faculty at a large American medical school differed systematically by gender—women's letters portrayed them as teachers and students, whereas men were portrayed as researchers and professionals. The mismatch of work roles with gender schemas leads to negative performance expectations, biased evaluations, and discrimination (Prentice and Carranza 2002; Stout et al. 2007; Heilman and Eagly 2008). While prejudice and discrimination are commonly understood as intentional and explicit, bias is actually often unintentional, implicit, and outside of our awareness (Greenwald and Krieger 2006).

Stereotypes also contribute to a view of women as more "communal" and "nurturing" and can also affect work culture with studies showing that female faculty are typically assigned more to "clinical-track positions" (Waljee et al. 2015; Burgess et al. 2012). Waljee and colleagues examined faculty turnover and found that male faculty were more likely to resign to accept a leadership position

or a higher salary at another organization, while female faculty were more likely to leave due to personal responsibilities (Waljee et al. 2015).

Given that surprisingly little research is available to explain the lack of gender equity in advanced academic ranks (Cook et al. 2008; Magrane et al. 2012), the current study aims to explore factors that contribute to the gender disparity in academic rank for women scientists, who exist as minorities both within their field and within the academic medical center. Similarities and differences across women scientists at different levels of academic rank are also examined.

## 2. Materials and Methods

### 2.1. Design

This was a partly funded (through an NSF PAID [National Science Foundation Partnerships for Adaptation, Implementation, and Dissemination] award #NSF HRD-1310268) pilot project to examine advancement and retention of women PhD faculty in tenure track positions in a stand-alone academic medical center, the Medical University of South Carolina (MUSC). By conducting several focus groups with women faculty with PhD degrees across different levels of faculty rank (Assistant Professors, Associate Professors, and Full Professors), we performed an examination of the factors impacting women faculty's retention and advancement. Thirty-five women faculty members participated in five focus groups and represented different ranks across several divisions and departments. To select participants, a series of mass recruitment emails were sent to a campus-wide listserv of women faculty with PhD's that had participated in NSF-funded PAID award events at the institution within the prior three years or were affiliated with a campus-wide advocacy group (Women Scholars Initiative, or WSI). Interested women contacted the research team and gave availability of times to attend one of the 45–60 min focus group interviews. Our two facilitators of the focus group sessions were a PhD-trained psychology researcher and a doctorally-trained health analyst; each had expertise in qualitative interviewing and familiarity with relevant literature and campus activity related to diversity and inclusion in an academic health center. All focus group discussions were conducted within a three-week time period at the end of the Fall semester of 2016. Participants were not compensated. Participants were informed that the project was not a condition of employment, that they would not be penalized if they declined to participate at any time during the focus group interviews, and that their responses would remain anonymous. The project was approved as an exempt study by the [blinded for review] Institutional Review Board (Project #59393), ensuring that the study was conducted in accordance with ethical principles and informed consent of all participants.

### 2.2. Participants

Participants were the first set of respondents that reported interest in the initial recruitment email. Figure 1 provides a summary of the breakdown of participants in the semi-structured focus groups by faculty rank and their affiliated departments. Only full-time tenure-track faculty women were invited to participate, in an effort to focus on issues related to gender without misattribution of similar concepts related to the status of track. All ranks were represented across the participant pool. All focus groups were carried out within the parameters of what constitutes a recommended number of participants to conduct an effective focus group (i.e., 4–12 participants; (Krueger and Casey 2014; Kitzinger 1995; Bender and Ewbank 1994; Stewart and Shamdasani 2014)). Five separate semi-structured focus groups were conducted: two groups for Full Professors ( $n = 6$ ,  $n = 4$ ), one group for Associate Professors ( $n = 12$ ), and two groups for Assistant Professors ( $n = 7$ ,  $n = 6$ ; see Figure 1 for university wide representation). The number of focus groups conducted at each rank was determined by the number of responses and scheduling availability. The protocol for facilitators moderating the groups were slightly different for junior faculty (i.e., Assistant Professor group; see Appendix A) and faculty that had completed at least one cycle of promotion (i.e., Associate and Full Professors; see Appendix B). Participants were reminded that they would be audio recorded during the semi-structured focus group

interview protocol and that recorded interviews will be kept in a secure location on the MUSC server with a password only known by the interviewers. All audiotapes were deleted upon transcription. Any identifiable information that may have been gathered initially (e.g., email address) was discarded after conducting the focus group interviews. These procedures were chosen in order to protect confidentiality of the individuals.

College		Number of Participants
College of Health Professions		2
College of Nursing		3
Academic Affairs Faculty		1
College of Medicine	Department of Medicine	4
	Department of Neurology	1
	Department of Neuroscience	3
	Department of Pathology and Laboratory Medicine	1
	Department of Psychiatry and Behavioral Sciences	9
	Department of Cell and Molecular Pharmacology and Experimental Therapeutics	1
	Department of Regenerative Medicine and Cell Biology	3
<b>TOTAL</b>		<b>35</b>

**Figure 1.** Demographics of Colleges and Departments Represented.

### 2.3. Data Collection and Analysis

The constructivist grounded theory approach ([Charmaz 2006](#)) was utilized to identify emergent themes from the focus group data. The constructivist grounded theory comparative method to code incident by incident approach was well suited for these data, as it takes the context of the question into account, acknowledges coders' prior knowledge of research related to facilitators and barriers of promotion and the influence of this experience on the coding processes, and provides guidelines for building conceptual frameworks between coded constructs. First, a content analysis of the responses was conducted through multiple close readings of the transcriptions by two independent coders. Each coder generated an independent list of thick descriptor categories and subcategories based on line by line review of the transcribed data. Secondary and focused coding were then conducted by the first author to impose superordinate thematic codes and hierarchical structure (e.g., subcategories; [Glaser and Strauss 1967](#)). The authors then met in a consensus conference to discuss the categories, resolve questions, and refine the thematic categories prior to developing the final thematic categories ([Figure 2](#)). Recent projects evaluating pilot data and focus group feedback have used similar analytic approaches to qualitative research (e.g., [Grubaugh et al. 2014](#); [Hanson et al. 2014](#)).

Common Theme	Unique Theme	Rank		
		Assistant	Associate	Full
Mentorship	Junior vs. senior mentors: senior mentors help identify “landmines”	•		•
	Informal vs formal mentors	•		
	New faculty, no mentors	•		
	Peer mentors	•		
	Independence from mentor		•	
	Lack of mentors			•
	Mentor training		•	
	Leadership as a focused “climb”	•		
	Valuable workshop by WSI; AAMC workshop	•		•
	Female mentors; in previous ranks		•	•
Promotion and Tenure Guidance	Bad mentors		•	
	Female sponsorship support	•		
	Tenure granted at another workplace before accepting a faculty position at MUSC			•
	Male faculty tenure	•		
	Promotion criteria more transparent—what is more mysterious is tenure		•	•
	National recognition			•
Team Science vs. Solo Promotion for Promotion Criteria/Grant Funding	Build on relationships with past classmates			•
	Asst. Professors know the APT criteria (versus Full Professors, who were told when to move up in rank)	•		
	Unspoken promotion rules	•	•	
	Types of product in tenure packets count more for activities males are in, women work on more collaborative items, and the points do not count the same way	•		•
	Author rank	•		
	Junior faculty on K grants	•		
	NIH funding/R01 importance	•	•	•
	Promotion timeline and prep			•
	Promotion criteria			•
	Promotion from Associate Professor to Full Professor		•	
Recruitment and Retention	Promotion and tenure packets submitted simultaneously		•	
	Principal Investigator emphasis for promotion; importance of gaining national presence			•
Work-Life Balance	MUSC odd/does not emphasize old-school (credible scholarly) journals for APT.			•
	Lack of support for retention	•	•	
	Child care/parental leave as barrier of female retention here	•		•
	Maternity leave/taking time off	•		•
Gendered Expectations	Childcare facility in the workplace	•		
	Stretched way too thin by being too excited about every opportunity that came along (worse when Asst. Prof.)		•	•
	Personality/need to be more aggressive	•		
	Women do more coordination in female roles (planning office parties)	•		
	Personalities affecting payment inequalities: ask for raise because you are doing xyz work but then receive no income increase (while others do) because you are already doing the work	•		•
	Salary inequality		•	
	Volunteerism	•	•	
	Take on too much without removing other roles			•
Soft Money Research Infrastructure	Women often more collaborators vs. being PI	•		•
	Women undervalue themselves (hesitancy to go up for promotion)			•
	Job security	•		
	Bridge funds support labs but not salaries	•		
Culture & MD bias	Burnout; need to make salary but not enough time	•		
	Lesser value of PhD (in a medical college)	•		
	Hierarchical structure so Asst. Prof. here at MUSC has to work harder (which is even harder to do as a mom)	•		
	MD bias at MUSC			•
	Unconscious bias	•	•	•
Institution-Specific Policies	Expectations of women in a teaching role	•	•	
	WSI-invalidated			•
	Barely any pilot opportunities compared to previous institute			•
	No travel money			•
Institution-Specific Policies	This is like a breeding ground; more help in getting people to next step rather than keeping people here			•
	Appreciate flexibility, but it must vary across different divisions. My division’s flexibility made way. Very flexible but should be official policy			•

Figure 2. Emerging Themes and Subthemes Across all Focus Group Sessions (n = 5).

### 3. Results

The findings demonstrate valuable insight into the perceptions of women scientists in academic medicine regarding the common factors related to women STEM scientists in general, as well as unique issues for women scientists in the context of a medical university. There were common factors identified by women scientists across all academic ranks who work in an academic medical center (see Figure 2). Several of the common core themes included work-life balance and gendered expectations reported across multiple settings, with certain subthemes that were unique to Assistant, Associate, or Full Professors. These core themes and subthemes are discussed in greater detail below.

#### 3.1. Mentorship

Mentorship was a common theme that emerged across all four focus groups, and several subthemes were identified that demonstrated both helpful and detrimental effects of mentoring depending on the quality and context. Assistant Professors commented on the importance of peer mentors and senior mentors in identifying “landmines” to avoid (i.e., feeling that they were lucky because mentors helped shelter and protect them). Another Assistant Professor met a lot of group agreement when she stated: “I have a formal mentor and formal mentoring committee, but the people who have been helping me the most are my informal mentors. Those faculty that I have developed friendships or relationships and those who I got out to lunch with once in a while those are the ones who actually listen when I ask and give me the more specific and concrete advice.” Full Professors provided feedback on the help they received from the few women that had “blazed the path ahead” and receiving advice from them while moving among new strange places and challenging potential self-doubt: “I would still say that our mentoring network is still not strong at our college, but the informal relationships that you find with other women, that’s what helped me. It even gave me the courage to continue on when perhaps a traditional pattern would have been ‘oh don’t go up this year, wait another year’. But I had someone saying ‘no you are ready do it, do it, do it.’”

While a great mentor was identified as a facilitator to promotion, several women also reported that no mentoring may provide fewer obstacles than “bad” mentoring. An Associate Professor mentioned that:

Bad mentors almost know who to choose to mess with. If they know that they can take advantage of you or push you harder, then they will. I wonder if it is a female thing and I really feel that it is a female thing. That they don’t try to pull that with men. Because I know a lot of colleagues of mine that are men that have never had to go through what we have had to go through. Had to fight for everything.

This distancing effect of mentors mistreating junior faculty was not associated with the gender of the mentors. Participants focused on wanting to see mentors setting good examples of character traits and skills, like time management or not showing a preference for male or female mentors. However, some Assistant Professors mentioned the importance of female sponsorship support, especially for learning what to do when expecting to start a family.

Participants from the Assistant Professor focus groups felt that many of the senior mentors were too busy to take on new mentees and suggested a formal mentoring program to help with enhancing important professional skills like grant writing and getting grant feedback. In both Assistant Professor and Full Professor focus groups, valuable workshops by an institutional advocacy group (WSI), a funded NSF PAID institutional grant (awarded to the leaders of WSI), and national workshops (e.g., American Association of Medical Colleges) were reported as helpful mentorship programs, especially with regard to developing one’s own leadership skills and being a purposeful networker (e.g., to have an existing relationship with someone in a different area to be able to mention “I would like to be considered for the next xyz opportunity”). Thus, these structural-level interventions helped mitigate the isolation and lack of mentors that many of the women faculty within academic medical centers faced.



### 3.2. Promotion and Tenure Guidance

Discussions regarding Advancement, Promotion, and Tenure (APT) criteria demonstrated a shift between Full Professors explaining how someone told them that they should go up for promotion versus Assistant Professors who were explicitly told to know the APT checklist for promotion from day one. All across ranks, participants commented on “unspoken” rules or specific unwritten procedures that were affiliated with the APT process. An Assistant Professor stated: “It still seems to be kind of a secret as to how you get promoted—almost every APT committee should have to do some sort of formal education or some sort of faculty required sit down coffee with APT or something because it is the most mysterious thing.” A Full Professor explained how opportunities “to revise promotion and tenure criteria can be an enabler for women to progress and not living by archaic standards.”

While the obstacle of implicit APT criteria can contribute to delays in career advancement, some of the data collected also suggested individual choices that could promote better navigation of the APT guidelines. Assistant Professors highlighted how they have noticed that senior men and women faculty members work on equally impactful projects, but that the projects completed by women seem more collaborative and do not obtain the same “points” as male-led activities for promotion and tenure. Some of these decisions could reflect a lack of effective mentoring and/or lack of role models (Vasil 1996; Stout et al. 2007). Another recommendation involved being proactive and meeting monthly with the Chair to review progress and demonstrate better “preparedness” by more visibility of her activities. Consistent with the Systems of Career Influences Model, dynamic systems of individual choices and decisions, such as personal and professional roles and values, can complement (as in these examples) or compete with dynamic structural elements to affect career trajectory.

With a focus on tenure, several participants verbalized organizational factors about how the tenure process looked different at different institutions. There seemed to be consensus among the Associate and Full Professors that promotion criteria seemed even more transparent than tenure criteria. One Associate Professor felt misguided after being “shut down” for tenure and described the message she received as “some unwritten boys’ club rule.” Other Associate Professors explained some unforeseen obstacles of the tenure process, including how to demonstrate independence while still publishing with your mentor. Full Professors also reported that showing national recognition often required more proactive relationship building. Maintaining ties with previous classmates and colleagues at other institutions was a facilitator in obtaining national recognition necessary for their tenure process.

### 3.3. Team Science vs. Solo Promotion for Promotion Criteria/Grant Funding

While there has been a general movement by national funding agencies towards “team science” to embrace more interdisciplinary teams, participant responses highlight how team science might serve as an obstacle for women in meeting the same criteria as male colleagues for promotion, as well as subsequent funding. A participant from the pool of Full Professors explained that “this is a generalization, but I think that women are much more willing to be team players and help out groups of people, more so than looking out for number one.” An Associate Professor’s comment in a different focus group corroborates this view: “in my little world it feels like frankly most of the women faculty are much more willing to be community citizens and look to the good of the department and willing to do things, ‘okay I’ll take that on and yes it is good for my department’ whereas men faculty do it only if it comes with some sort of title or compensation or something.”

### 3.4. Recruitment and Retention

In general, participants agreed on the successful recruitment of female colleagues. However, participants of the Assistant and Associate Professor focus groups (three out of the five focus groups) highlighted the need for more supportive programs and/or mentorship activities to help support women in navigating structural obstacles, thus focusing on successful retention of women scientists that have been recruited. As mentioned, many participants reported that the way to get promoted

was to apply to jobs at other institutions. More effort to maintain recruited women scientists at this institution was recommended as a strategy to address gender disparities in academic rank. Interestingly, participants of the Full Professor focus group highlighted their own personal experiences for staying in academia and moving successfully through the ranks but did not suggest proactive institutional strategies that could increase the likelihood that the facilitators that worked for them could also be present for subsequent pools of women scientists.

### 3.5. Work-Life Balance

A common theme that emerged from discussing barriers to career advancement for women was the lack of institutional support regarding childbearing: “We don’t have childcare, and there is no [paid] maternity leave. There is no flex time; it’s like we are back in the dark ages. It’s one thing if you are clinical and you see patients, but if you are a PhD, it doesn’t matter where you are [to get work done].” The perceived lack of support from institutional policies like lack of paid maternity leave (i.e., ‘maternity leave’ consists of someone using their sick leave and vacation days) was not only seen as a barrier to advancement, but also as a barrier to retention of women faculty members.

Despite the institution-wide barrier, some participants responded positively to flexibility from their specific divisions to offset the potential strain of no paid maternity leave or lack of childcare on campus. A Full Professor explained, “flexibility unique to divisions makes a tremendous difference and that for me has been the reason that I have stayed because I have that flexibility. Even if we don’t have the flex time, my division allows me to come and go. I have two kids and brought them with me the first six months, but had that been replaced I don’t think I would have stayed.” Thus, localized cultural norms within different divisions may have a big impact on facilitating healthier work-life balance that contributes to female faculty success in advancing faculty ranks. These data corroborate the Systems of Career Influences Model (Magrane et al. 2012) by demonstrating how career advancement can be promoted or inhibited by a dynamic system of organizational culture. Full Professors also highlighted feeling stretched too thin when they were Assistant Professors (with some raising young families), because they were so excited to be invited to an opportunity that may lead to future collaborations and funding. The pressure to support one’s salary (soft money research infrastructure) affected other factors, such as work-life balance and potential burnout.

### 3.6. Gendered Expectations and Stereotypes

Participants consistently expressed several expectations around gender norms associated with more departmental “housekeeping” tasks, lack of assertive negotiation skills, over-volunteerism, female expectations, and general undervaluing that contributed to the lack of advancement of women scientists across academic rank when compared to male counterparts. For example, one participant [Assistant Professor] explained differently interpreted behavior of two senior faculty in her department: “one is a man, and one is a woman; and they can exhibit the exact same behavior. She comes off as crazy, but he’s just that way.”

In addition to colleagues’ different interpretation of similar behavior across men and women, others corroborated that they feel like they need to “adhere” to less assertive interactions and demonstrate good citizenship to be accepted by coworkers: “like you said, you need to act like a woman to some extent because if you go overboard [on assertiveness], then you are blacklisted and you know people are not here anymore because of being too assertive.”

Other participants spoke to the expectation that women would take on additional roles or tasks as taking time away from activities that count for promotion and tenure review. Consequently, women are left with less time to work on career-building activities compared to their male counterparts. For example, an Assistant Professor stated that “it definitely seems like there is a discrepancy in how things get done in the coordination work; things that might have been done at a staff level previously might be assumed that they will be done by the female faculty members as opposed to, well why would you give it to Dr. Boy because he may or may not be able to actually throw together a Christmas party.”



Women in Full Professor rankings also highlighted that a few of them that had previously been at other institutions had received the message to not waste time on service and to maintain focus on publications and national visibility. While the issue of acceptance by colleagues did not arise in the conversation among Full Professors, comments about aspects of one's personalities affecting payment inequalities were discussed. They explained that they observed women asking for raises because they were doing additional work, but that these requests were denied (despite others getting income increases), because the chairs had no incentive, since the work was already being completed.

### 3.7. *Soft Money Research Infrastructure*

Assistant Professor participants predominantly discussed content within this theme, conveying worries about job security and feelings of being valued less as PhD faculty in a medical college. Several Assistant Professors agreed when one participant stated:

There is that job security fear and so it is very difficult to say no to things when you know that that could potentially be the percent effort that you need to cover yourself [salary]. So especially as junior people and especially people who are on Ks [faculty development grants] who are free on other grants, sometimes you can kind of feel taken advantage of because you are free labor on that grant, yet you cannot take percent effort if you are on a K or another NIH funded grant so you say 'yes yes yes because eventually I will need that funding' but in the meantime, you are working really, really hard on many, many different studies without compensation.

This quote illustrates how the soft money infrastructure compounds the challenge of gendered expectations (as discussed above in Section 3.6). Given that administrative leadership positions are predominantly awarded to men (with potential salary support), women faculty are disproportionately represented in soft money positions within academia (Lund 2001). Another participant also commented that while "bridge" funding (funding to continue research in between grant budget periods) exists in some departments, the money supports the laboratory materials and procedures, not the salaries of the faculty as primary investigators.

Various Assistant Professors explained that some of their female colleagues that left the institution also left soft money positions in general because "some of them wanted to have families as well and didn't want to deal with that insecurity of being the primary bread winner without stability."

### 3.8. *Culture and MD-Bias*

Participants expressed specific cultural aspects in their work environment that may lead to lack of promotion of women scientists. Early career faculty commented on the hierarchical structure of their departments and feeling pressured to "show your worth" and pay service/teaching "dues" that do not necessarily count towards promotion and advancement criteria, but affect one's support by senior faculty. Full professors also commented on the heavy bias of promoting colleagues with medical degrees and feeling less valued than clinician colleagues. A participant at the Full Professor ranking stated: "the flexibility that is offered in academic medicine is quite nice and you have access to the populations you want to study; depending on the department you are in, the teaching load is not going to be what it would be in a hard money position. But if you don't feel supported, if your morale is down, then you kind of have those times that you think 'oh research loses money.' Then if you're not at a place that values research, that doesn't bode well if you're a researcher." This bias for reporting to a clinically-focused chair or comparison to majority clinical faculty (MD bias) is also associated with salary inequity and lack of research support. For example, an Assistant Professor described a recent experience of a colleague of hers that was not aggressive about negotiating salary in a predominantly MD faculty department: "you can make a really strong argument if you can get other mentors or sponsors to back you up, but being a PhD in an MD environment of a clinical department can make that challenging. Because they don't, some chairs don't necessarily understand, others do which is great, but many don't."

Paying dues to one's department may also include teaching, which is often not associated with individual compensation (e.g., even if some funds are provided to the department for a faculty member's teaching contribution, the money does not trickle down to the faculty member). Some commented that educator roles were expected of female faculty even though this service did not count for their promotion and tenure. An Assistant Professor explained:

There does seem to be an 'it has always been done this way' idea. It sort of seems like because it was that way when certain people went through that you have to pay your dues. You have to serve on the committees, get your own grant funds, and do the teaching which may or may not be a part of your job. When you check all those boxes, then the consideration might be that you are worthy. I am not saying that it is not impossible, but I think that there is a history of 'it was done this way,' and it is hard to change that part.

Additional comments about the hierarchical structure in an academic health center were made by Associate Professors who reported the importance of "being proactive to meet with the Chair on a quarterly basis" and developing "a one-on-one relationship so that people see your ambition and interests."

### *3.9. Institution Specific Policies*

Several participants at the Full Professor ranking mentioned that other institutions helped facilitate the success of their faculty by providing travel money or pilot funding opportunities, since pilot funds can help increase the likelihood of obtaining larger grant funding with the presentation of feasibility data. A Full Professor stated "I could not believe, I just assumed because I was coming from another health science center that there would be pilot money opportunities. I would have negotiated for a lot more start-up funds if I had realized there were no pilot funds on campus. Even now they are very limited." Other comments also addressed an institutional effect where "it seems like everybody who leaves here gets an amazing position wherever they go and so, they never leave to become faculty members, but they are advanced to department chair, associate dean. I remember I noticed that when I first came here that people were leaving and they had these amazing positions." Faculty from Assistant and Associate faculty rank did not report institution-specific policies that affected female colleagues staying or getting promoted in academia (other than work-life balance related to maternity leave), but a statement from another Full Professor identified faculty expectations of their institution as a potential underlying factor that affected retention: "I am very loyal to this institution; the institution has not been as loyal to me. I think I would warn any mentees that you cannot expect institutional loyalty." Consistent with other themes that emerged, data suggest that organization-specific practices such as pilot money, as well as individual decisions (e.g., loyalty to an institution), again have synergistic effects on career advancement of women in the dynamic setting of academic medicine.

## **4. Discussion**

Academic medical centers are often comprised of many women PhD scientists, yet typical supports for retention and advancement in these institutions assume that women faculty members are in a clinical role (Verma et al. 2016). Similarly, recent attention on women scientists in STEM careers has led to increased support and interventions for addressing barriers to retention and success of women scientists in private industry or university settings, but the first national project to address barriers specific to women scientists in an academic medical center only began in 2012. This paper highlights the importance of considering the individual and structural needs of women scientists in an academic medical setting and can help inform the initial development of effective interventions and support to help eliminate the gender disparity in academic rank and improve the retention and advancement of women scientists. Using the data from focus group responses of thirty-five women PhD scientists at an academic medical university, we have identified several emerging themes that warrant further attention in the tailoring of effective interventions to address this gender disparity

in academic medical centers. As this sample was limited to women faculty at one academic medical center, the findings presented here may not be fully generalizable to other academic medical centers.

While certain themes were unique to Assistant, Associate, or Full Professors, there were common factors identified by women scientists across all academic ranks that work in an academic medical center. Several of the common themes included work-life balance and women's gendered expectations reported across multiple settings. Not surprisingly, different subthemes across rank were identified, but overall, several of these themes have been captured in other literature that assess factors related to dropout of women in academic careers (either clinical or research-oriented).

One recurring theme across all ranks was work-life balance. Family-friendly policies have been linked to career satisfaction, especially for women working in biomedical sciences (Villablanca et al. 2011). Family-friendly policies include policies for maternal (and paternal) leave, modified duties, deferral of academic reviews, and reduction to part-time status; however, research studies have observed that faculty may be reluctant to use family-friendly policies due to fear of repercussions, inability to stop working on grant-funded projects, association with slower career progress, and the increased workload on colleagues (Villablanca et al. 2011). Subsequent studies that further investigate how to make family-friendly policies more acceptable (both to the institution and to the individuals making use of them) are needed. Other divisional policies that directly impact women at an academic institution (e.g., implementing quarterly meetings with Chair rather than waiting for individuals to be proactive) also warrant more attention and consideration.

Other pre-identified themes in the literature that emerged in these qualitative results as contributors to dissatisfaction of women in the academic workplace are the "lack of mentorship, work culture, and barriers to research" (Waljee et al. 2015). The decrease in female faculty at higher ranks results in a lack of exceptional female mentors and role models to help trainees to join academia successfully, resulting in further gender disparity. As previously noted, research has shown this lack of mentorship can be related to lower self-efficacy by decreasing women's "grooming" or lack of socialization to faculty life (Stout et al. 2007). A decreased sense of belonging in the work place, lack of knowledge of implicit rules of academic culture, and lack of peer networks for collaboration are indeed emerged themes in our sample that corroborate other recent findings (Pololi et al. 2013; Stout et al. 2007; Bickel et al. 2002).

However, in addition to the "usual suspects," participants of the focus groups spoke about the medical degree bias, the emphasis on NIH R01 funding and soft money environments, implicit promotion criteria, and salary inequity (in comparison to MD's). Indeed, these unique risk factors that arose from qualitative data are corroborated by recent (yet scarce) literature. The stress associated with reliance on soft money is compounded for those in basic science departments, as recent trends show that private and government support for research is growing quickly for those involved in clinical work, but declining in basic science departments. These are unique pressures confronted by scientists in public academic health centers, with more interest in translational research over fundamental research leading to research revenues growing up to 57% in clinical departments yet falling by 18% in basic science departments in the same academic medical center (Bourne and Vermillion 2017).

Burgess et al. (2012) argue that the environment in academic medicine reinforces gender stereotypes through occupational sex segregation, expended cognitive resources suppressing concerns related to overt discrimination, and social penalties for women who violate prescriptive gender stereotypes. As they point out, in academic health centers, most women to whom faculty are exposed are in predominantly female occupations (i.e., nursing, social work, allied health professions) in roles subordinate to predominantly male leaders and chairs. Thus, women scientists in academic medical centers are victims of gender stereotype priming, in which the stereotypes are activated, and the probability that women scientists are perceived in terms of these detrimental stereotypes is increased. For these women scientists, this results in detrimental individual level effects, including stress, negative mood, anxiety, frustration, disappointment, and sadness, thus leading to potential behavior change and less perceived self-efficacy (Burgess et al. 2012). Results from this exploratory study suggest that

gender stereotypes might affect women's own behavior in order to act "in accordance" with these gender stereotypes (e.g., take on more community service, team science collaborations, serving an educator role) and emerged as a theme in qualitative analyses.

The data presented here reinforce the notion that hiring more women at the junior levels will not necessarily yield more senior women faculty and will thus not address the bottleneck noted in the career transition to more senior ranks. Some catalysts to success of women in higher academic rank involved several workshops conducted by the NSF ADVANCE PAID awarded to the institution in 2013, but there is room for improvement. Workshops can help target individual level factors like self-efficacy, but they are not sustainable and not everyone can benefit—either because of lack of attendance or lack of knowledge to be able to identify areas to intervene. Again, while this literature is scarce, some of the extant studies highlight larger societal biases that influence women in their careers. Through more quantitative survey methodologies, Williams (2015) identified that 68% of women in STEM field endorsed a "prove-it-again" theme, in which they are constantly proving themselves over and over compared to men to show their competence and skills rather than luck. Confirmation bias often exists under this umbrella, with evidence showing that mistakes made by women are noticed more and remembered longer than mistakes made by men. The leniency bias is also encountered by many women in STEM, reporting that objective rules are applied rigorously to women but loosely to men (Biernat and Kobrynowicz 1997; Brewer 1996; Williams 2005). Data from this study corroborates how women scientists in an academic health center are also having to repeatedly prove their competence (with regard to men as well as clinicians) and struggling with promotion rules that are selectively applied by gender.

Similarly, the identified theme of gendered expectations in our qualitative analyses has been described by Williams as the tightrope to depict how women have to behave in masculine ways to advance but are also expected to be feminine to be accepted (Williams 2015). The tightrope is a constant task for women in STEM who perceive that they cannot behave too masculine to be likeable or too feminine to be seen as competent (Phelan and Rudman 2010; Rudman and Fairchild 2004). Corroborating the qualitative data of this study, Williams (2015) explains how the added pressure of the tightrope often leads to more organizational citizenship behavior by women. As with the data from women scientists in an academic medical setting, Benard and Correll (2010) also report that women in STEM fields encounter a maternity bias, where they are judged for poor mothering skills if they are viewed as competent in the workplace or are not considered as valuable and dedicated professionals because of family responsibilities.

Despite the confirmation of several biases that may impede women scientists from advancement, our findings also provide recommendations and identify facilitators that can help promote women's advancement in faculty rank at academic medical centers. Our participants highlighted the importance of having a dedicated individual to meet with about promotion processes. Faculty mentors can also be very blunt and let colleagues and junior faculty know when they should go up for promotion. Women also should become aware of promotion criteria very early on after being hired as an Instructor or Assistant Professor to know what is counted in their specific division or track. Identifying and knowing specific promotion criteria overlaps with strategies provided by Williams (2015) that address the prove-it again and leniency bias challenges. Having a sponsor and keeping full record of the rubrics or objective metrics can help prevent rules being applied rigorously to women but loosely to men (i.e., leniency bias).

In addition, several women reported the importance of tailored workshops and seminars sponsored by WSI (institution's employee advocacy group) or external funding like the NSF ADVANCE PAID or IT awards. These groups often provide mentoring networks, as well as targeted seminar topics such as how to confront unconscious bias, skills for negotiating, preparation of a promotion packet, conflict management on how to say "no", etc. For example, a workshop designed to help women with strategies for responding to bias was delivered to women scientists by a social psychologist with expertise in unconscious bias (Goodwin 2017). The four strategies included Question/Interrupt (e.g., "I'm sorry, could you repeat that because I am not sure I understood you correctly"), Arouse

Dissonance (e.g., “I’m surprised to hear you say that since you’ve always supported equity. This doesn’t sound like you”), Disagree (e.g., “Do you mean just her, or all women?”), and Express Emotions (e.g., “I’m really disappointed by this comment” or non-verbal reactions to communicate how biases make you feel). The content of the workshop also helped identify potential appropriate times and contexts for bystander intervention (e.g., later may be better, remember not to speak for others, etc.). Internalizing the power to use these strategies could increase an individual’s self-efficacy. Several Associate and Full Professor participants also highlighted the importance of a career development seminar organized by WSI (with support from the NSF ADVANCE PAID award) that helped with reviewing their promotion packet before submitting to their respective APT committees. Traditional STEM institutions may also benefit from similar programming, but the tailoring of effective interventions to address the unique barriers present for women scientists in an academic health setting warrants further attention.

Of note, these exploratory findings from an academic medical center are the results of data collected from women scientists across several different disciplines, which is different from previous studies that assess women scientists in specific disciplines of STEM. This unique aspect of an interdisciplinary setting is captured by the structural level factors in the Systems of Career Influences Framework. The several themes that emerged as the result of the focus groups highlights that several complex systems interact: individual women negotiate specific circumstances in their professional role and gender within a culture that can hinder or enable their achievement in several ways. The model highlights the importance of congruence of an organization’s goals, with individual roles and responsibilities, policies that promote gender-equitable practices, effective mentorship and engagement in career development activities, and valuing of women’s contributions to the organization. In the context of a dynamic and complex organization like an academic medical center, some unique intersections emerged from the qualitative data. For example, the uncertainty of soft money funding can be a greater deterrence for women as compared to men. While this trend is in line with general characteristics of “riskiness” profiles for men and women, in which men can achieve more leadership and exponential leadership growth, higher stakes may be involved in academic medical settings in which tolerance of riskiness has a direct pay off with income and financial stability. Future studies should examine whether women in STEM at an academic medical center are even more reluctant to engage in “risks” (e.g., PI on soft money research vs. team member of existing project) than women in other settings, since the cost associated is not just prestige and reputation of a women’s research capabilities but financial livelihood. Similarly, while men and women STEM scientists in academic medical centers may both experience increased stress related to unclear promotion criteria, the general success of men in self-promotion and making their work more visible may result in increased facilitation of a senior sponsor advising them on APT steps. Subsequent studies should also examine feedback of male STEM scientists in academic medical settings to better understand the influence of different attributions and structural factors (e.g., gender-related vs. MD bias related).

### *Limitations*

While this exploratory study started with a convenience sample from a university in the Southeast, a more representative sample should be included to account for potential regional effects on women’s perceptions. More inclusion of underrepresented racial minority women would also strengthen the generalization of these findings. Many more biases are endorsed when a woman is also a member of a minority racial or ethnic group. Furthermore, additional campus diversity work is often considered “housework” for departments, resulting in the phenomenon of the “minority tax” in which minority faculty are pressured into more community outreach activities and committee service than their non-minority colleagues (Rodríguez et al. 2015). These additional time-consuming activities can take away time from participating in other activities that are more highly valued by Promotion and Tenure committees, thus resulting in further disparities in academic rank or demanding more professional time of minority faculty members to achieve the same level of APT criteria as their non-minority colleagues. Thus, it is important for subsequent examination of gender disparities in academic medical



centers to purposefully sample from minority women scientists, since minority women may have additional unique obstacles to overcome in pursuit of leadership positions, such as nontraditional educational histories, significant family and community obligations, and less developed professional networks (Kachchaf et al. 2015; Grossman and Porche 2014; Ong et al. 2011). While looking at barriers to career advancement for non-tenure track female faculty is beyond the scope of this article, a similar assessment of female adjunct faculty members (with PhD's) warrants further attention given that a majority of adjunct faculty employed at academic medical centers are women. Finally, it would also strengthen this study to include a comparison group of men faculty, to further identify how gender interacts with barriers faced by all faculty.

## 5. Conclusions

These findings highlight the importance of investigating specific factors that contribute to gender disparities within academic medical centers. The current study serves as an initial first step to raise awareness for the need of tailored interventions. Subsequent research is needed to corroborate these findings with more quantitative data focused on women scientists in academic medical centers. In order to help medical center administration implement effective strategies to create more equality, more investigation of the individual, institutional, cultural, and structural contexts that contribute to the gender and ethnic minority disparities in academic rank is needed to propose potential mechanisms of action that can be targeted by effective interventions and institutional strategies.

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## Appendix A. Protocol for Assistant Professor Focus Groups

Assistant Professor Focus Group Questions	Facilitator Prompt
1. Have you noticed particular barriers to the retention and advancement of female academic scientists at MUSC?	<ul style="list-style-type: none"> <li>How do these obstacles compare to other institutions you may have worked at or are familiar with?</li> <li>Is retention and advancement of women with PhDs more difficult than recruitment? Vice versa?</li> </ul>
2. Literature suggests that lack of strong role model/mentoring programs, family demands, unconscious bias, and personal value placed on career advancement contribute to the disparity in faculty rank of women with PhDs compared to men with PhDs. Are there still other barriers even when these needs are met? (e.g., mentoring programs in place, unconscious bias training conducted on campus, attending workshops to prepare promotion packets, etc.)	<ul style="list-style-type: none"> <li>What are unique barriers at MUSC, specifically?</li> </ul>
3. What has motivated/could motivate your female colleagues to leave an academic medical center?	<ul style="list-style-type: none"> <li>Are these factors different for women faculty that have different degrees than a PhD (e.g., MD) or women faculty across different fields?</li> </ul>
4. What have you/your mentors learned in your time at MUSC that acts as a facilitator to achieving promotion goals?	<ul style="list-style-type: none"> <li>What additional services/supports can be implemented?</li> </ul>
5. Are there any other comments you would like to add about your experience as a woman with a PhD at MUSC?	N/A

## Appendix B. Protocol for Associate and Full Professor Focus Groups

Full and Associate Professor Focus Group Questions	Facilitator Prompt
1. Thinking back to your successful career pathway, what were some supports that facilitated the promotion process? Were there certain people or processes in place there were particularly helpful?	<ul style="list-style-type: none"> <li>Where did you get information about the process and/or supports?</li> </ul>
2. Did you encounter any unforeseen obstacles in the promotion process? How did you overcome these?	<ul style="list-style-type: none"> <li>How do these obstacles compare to other institutions you may have worked at or are familiar with through conversations with external colleagues?</li> </ul>
3. Were there other factors (i.e., perhaps those peripheral to the Promotion and Tenure process) that affected your decisions and actions during this time (and about which you feel comfortable talking)?	N/A
4. Knowing what you know now, what specific advice would you give to a female colleague in her pathway from assistant to associate professor? What about advice specific to promotion from associate to full professor?	N/A
5. Knowing what you know now, what specific advice would you give your institution in supporting women with PhD's in their career pathways? Please speak to specifics about assistant to associate and associate to full professor.	N/A
6. What has motivated/could motivate your female colleagues to leave an academic medical center?	<ul style="list-style-type: none"> <li>Are these factors different for women faculty that have different degrees than a PhD (e.g., MD) or women faculty across different fields? Do motivations to leave vary across different academic ranks?</li> </ul>
7. Are there any other comments you would like to add about your experience as a woman with a PhD at MUSC?	

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