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Women in Orthopaedics—Way Behind the Number Curve

Valerae Olive Lewis, MD, Susan A. Scherl, MD, and Mary I. O'Connor, MD

Background

Women now constitute 49% of medical school matriculants[1]. The percentage of women in orthopaedic surgery training programs has not kept pace with the increase in the number of women medical students. Although the number of female orthopaedic residents has increased and continues to do so slightly over time, the results of the 2008 American Academy of Orthopaedic Surgeons (AAOS) census reveal that only approximately 4% of orthopaedic surgeons responding to the survey are female[2]. As of the year 2009, all other surgical subspecialties (with the exception of cardiothoracic surgery) had a higher percentage of women than orthopaedic surgery had. The factors that dissuade women from pursuing careers in orthopaedic surgery are not entirely clear. Several investigators have attempted to assess the factors that come into play when women choose a medical specialty career. In the past, lifestyle issues have been cited as a deterrent for women entering surgery and its subspecialties; however, while lifestyle choice may play some role, it is no longer a significant factor in the disparity. It has been noted by several authors that, with the current generation of medical students and residents, lifestyle alone is not more of a deterrent for women than it is for men when choosing a specialty. In fact, Saalwachter et al., in their study examining the needs of both male and female surgical trainees, found that male and female surgical residents, fellows, and trained surgeons identified almost identical training needs and priorities[3].

Our report summarizes recent research on women in orthopaedic surgery. Women surgeons, in fact, appear to be very satisfied with their career choice[4]; however; it is apparent that this information needs to be better conveyed to the medical students. Greater exposure to female surgical faculty would help. Neumayer et al. found that medical schools with more women surgical faculty send notably more female graduates to surgical residency programs[5]. It has been postulated that an increase in the number of women on orthopaedic faculty would improve women medical students' perceptions of orthopaedics and hence may increase interest in orthopaedics as a career. Exposure of medical students to women faculty, enthusiastic teaching, availability of female role models, mentoring, and increased involvement in the operating room have been recognized as important factors in career selection. Although perceptions about an "old boys club" culture and sexual discrimination may exist[3], we must work to convey the positive attributes of female orthopaedic surgeons as well as the satisfaction that can be gained from working in the field of orthopaedic surgery. As orthopaedic

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surgeons, we can also help ourselves by taking the "Implicit Association Test" (https://implicit.harvard.edu/implicit)[6], which we can use to test our own biases and perhaps identify where we can improve.

In business and among high-performing companies, the current wisdom is that the winners will be those companies that can attract, develop, compensate, and retain the best talent[7]. If orthopaedic residencies do not attract a more diverse applicant pool, they will miss out on one-third to one-half of the qualified candidates who could potentially choose orthopaedic surgery as a career.

Introduction

Women now make up 51% of the U.S. population (U.S. Census 2010 Projection)[8], which is reflected to some degree in the composition of U.S. medical school classes. According to a recent report of the Association of American Medical Colleges (AAMC), 49% of U.S. medical school graduates are women[1]. As the number of women in the general population and in medical schools increases, it would be expected that this change would be reflected in the number of women in orthopaedic residency training programs. Although the number of female orthopaedic residents has increased and continues to do so slightly over time, the results of the 2008 AAOS census reveal that only 4.3% of orthopaedic surgeons responding to the survey are female[2]. The proportion of women in orthopaedics did vary slightly across the membership groups, with the largest percentage of women noted in the candidate member practitioner group (13.8%)[9]. One must be cautioned that the AAOS data are potentially biased, as they only account for those seeking membership in the AAOS and those who responded to their survey request; even so, from these data, we can infer that the number of women entering orthopaedics over the years has increased. However, this increase not only does not reflect the rise in the number of women in medical schools but it lags behind the increase seen in female physicians within other surgical subspecialties. Blakemore and colleagues pointed out that, from 1970 to 2001, there was a significantly greater increase in the proportion of women in the fields of general surgery, neurosurgery, ophthalmology, obstetrics and/or gynecology, otolaryngology, and urology than there was in the field of orthopaedic surgery[10]. In addition, as of the year 2009, all other surgical subspecialties (with the exception of cardiothoracic surgery) had a higher percentage of women than orthopaedic surgery had[10]. The question arises as to why orthopaedic surgery lags in diversity, and, more importantly, why this lack of diversity matters.

Diversity in the physician workforce is critical to the improvement of patient care. In his speech to the AAMC in 2005, Jordan Cohen, MD, stated that the increasingly diverse population of the U.S. requires a more diverse physician population to enhance the quality of patient care[11]. He encouraged those in the medical profession to find ways to partner with medical schools to enhance diversity within the ranks. This statement is particularly true for orthopaedic surgeons, where woman and minorities remain significantly underrepresented. The reason why orthopaedic residency programs do not attract a diverse applicant pool, thus serving to ensure that our demographics more closely reflect those of the potential patient pool, is complex.

Female applicants to orthopaedic residency programs constituted 13% of total applications in 2010, and female applicants are accepted into residency programs at approximately the same rate[12]. The lower rate of applications has been linked to lack of exposure to musculoskeletal topics in medical school, lack of mentoring or role modeling, differential recruitment and treatment by current orthopaedic faculty and residents, and lifestyle perceptions and misperceptions. If, as a specialty, we continue to appeal to men, who, as a group, constitute about 50% of all medical students, we will lose top candidates. As stated by Hariri et al., "Attracting female medical students to orthopaedics and making orthopaedic subspecialties approachable for women should be a priority to ensure that the field attracts the brightest candidates, as this goal will not be possible if essentially half of the candidate pool is not interested in applying."[13]

The Orthopaedic Pipeline

There are several theories as to why female medical students perceive orthopaedics to be a less desirable and hospitable residency than general surgery, urology, or neurosurgery: lack of exposure to the field, lack of mentors and role models, and a perceived negative bias against women in the profession[14]. Because relatively few medical schools require an orthopaedic or musculoskeletal medicine rotation, it is possible for students to graduate with inadequate exposure to the field and its practitioners[15,16]. This can lead to misperceptions about the field, including that one must be physically big and strong to perform orthopaedic surgery well; that all orthopaedics is sports medicine, and that one must be an athlete or interested in sports to succeed; or that the lifestyle of an orthopaedic surgeon is particularly hectic and unpredictable.

Bernstein et al. investigated whether a required course in musculoskeletal medicine in medical school would result in a higher rate of applications to orthopaedic surgery residency programs by underrepresented groups[17]. The authors found that the required musculoskeletal course was associated with a 12% higher rate of application to orthopaedic surgery residency programs among all students, but this increase was particularly pronounced among women (a 75% difference in the rate of application). The authors postulated that the exposure to a musculoskeletal rotation may have helped dispel the perceptions that orthopaedic surgery is overly taxing physically and incompatible with family life—two misconceptions that may discourage women from going into orthopaedics.

Studies have suggested that career choices of medical students are often based on their perception of the job responsibilities and the lifestyle that they will experience[18,19]. Several investigators have cited lifestyle considerations, and the desire for a controllable lifestyle, as an explanation for specialty choice among women. However, as Dorsey et al. point out in their study on the influence of controllable lifestyle and sex on the specialty choices of residents, women account for nearly

three-quarters of the residents in obstetrics and gynecology, a field with an uncontrollable lifestyle[20]. Women still have the societal demands of childbirth, a higher percentage of spouses who work full-time outside the home, and the majority of the child-rearing responsibilities, with twice the number of hours spent on parenting duties[21]. Several authors noted that controllable lifestyle is an increasingly important factor in the specialty choices of both women and men and that the specialty choice trends between women and men were very similar[20,22]. This suggests that lifestyle alone is not more of a deterrent for women than it is for men when choosing a specialty.

Access to role models and mentors has been cited as a factor that influences women to choose orthopaedics and facilitate success in residency. However, there is a dearth of attending-level female orthopaedists to emulate. As of 2007, only 7% of academic orthopaedic faculty were women, with fifteen full professors and one academic department chair in the United States[23]. There are many residency programs in which there is no female orthopaedic faculty member. Effective mentors have many roles in the advancement of those they mentor: they can act as role models, are a source of professional advice and training guidance, provide an existing network of contacts, and can facilitate career advancement opportunities[24,25]. Same-sex mentors can validate the difficulties women face in their academic careers, offer specific strategies for balancing family and career commitments, and protect women from the pressures of accepting less rewarding roles in academic medicine. Although most women have had male surgical mentors, it is important to recognize that female surgical mentors will have an improved understanding of matters that are unique to the female sex. Studies have shown that women were less willing to ask for advice from opposite-sex mentors, especially when it comes to issues that concern only women[26–28].

This scarcity of role models may be a factor in how students perceive the specialty and their potential place in it. Although satisfaction among women orthopaedic surgeons is high[4], because of their scarcity, this job satisfaction may be viewed as the exception rather than the rule. This is reflected in the fact that medical schools in which the faculty is composed of 40% women send notably more female graduates to surgical residency programs than do schools in which the faculty is composed of <15% of female surgical faculty members[5]. It has been postulated that an increase in the number of women on an orthopaedic faculty would improve the perceptions that female medical students have of female orthopaedic surgeons. More importantly, in residency programs that have no female residents, the lack of a peer group may be a detriment in attracting potential residents who are female.

The question of negative bias in the recruitment process is a complicated one. Scherl et al. performed a study in which sex-blinded orthopaedic residency applications were ranked by reviewers who were also blinded to the purpose of the study[29]. No significant difference in the rankings of the identical male and female chart pairs was found. In fact there was a slight trend toward a higher ranking of the "female" versions of the charts. It is possible that bias is introduced later, in the face-to-face interview stage of the application process. However, it is impossible to design a blinded study to test this.

Moreover, this may be a situation in which "perception is reality." Millennial generation medical students and residents communicate and gather information largely through electronic media and social networking sites. Online communities such as http://www.orthogate.org and http://studentdoctor.net have forums and chat threads in which residency training is discussed in detail. Much of the information on these web sites is anonymously provided and not vetted; nonetheless, students seek it out. It can be instructive and eye-opening to see what is written in these forums. The threads on the topic of "Women in Orthopaedics" contain the following themes: orthopaedics is physically demanding and one needs to be strong, orthopaedics is an "old boys' network" and "girly girls" won't fit in and need not apply, and the orthopaedic lifestyle is bad and not conducive to a satisfying personal life (See Appendix).

Another item revealed on an Internet search is a blog entitled "Orthopaedic Residency: The Attending Perspective" (http://orthopaedic-residency.blogspot.com). It is written under a pseudonym. The entry dated February 25, 2007, is entitled "There is no crying in orthopaedics. . .Do women really belong in orthopaedics?" The author begins by stating, "Orthopaedics is such a male dominated sub-specialty. You walk into the orthopaedic resident's area, and you are likely to smell the testosterone." He goes on to classify female orthopaedists as three types: "The B*t*h," who is "aggressive," "dominant," and "disliked by other women"; "The Star," who is "able to tow the line" and "understands men and works with our flaws"; and "The Crier," who "cannot understand why the men act like men" and "lets her emotions get the best of her." The author concludes that "orthopaedics needs less testosterone and the addition of some estrogen. So are we as a specialty ready, I don't know; but, the writing is on the wall and they are coming. So, all you rock star men get ready; bring some tissue and a Hugh Grant movie, and we'll all get along just fine."

Admittedly, this may have been intended as satire, but that degree of nuance is hard to convey online. Also, the author did publish a more balanced blog entry entitled "Does diversity matter?" on February 17, 2008. However, keep in mind that the initial entry is one of the first hits one gets when doing an online search for "women in orthopaedics," and its tone may not assist in convincing a female medical student of the hospitality of our specialty.

It has been suggested that the glass ceiling for women in academic medicine not only exists but may be the thickest for women in academic surgery. A recent study examined the manifestations of the glass-ceiling phenomenon in academic surgery and its subspecialties and identifies some of the causes of the inequalities[30]. Zhuge et al. noted three major constraints that contribute to the glass-ceiling phenomenon: (1) traditional sex roles, which may contribute to unconscious assumptions that have little to do with the actual knowledge and abilities of an individual and thus may have negative influence on decision-making when it comes to promotions, (2) manifestations of sexism in the medical environment—from subtle

to explicit forms, and (3) lack of effective mentors[30]. Several explanations have been proposed to dismiss the glass-ceiling effect, including (1) the pipeline effect—which suggests that there is an insufficient number of women who have been in academia long enough to have reached the rank of full professor; (2) women's purported lack of innate leadership skills; and (3) the theory that women may be less serious about their careers than men are, therefore making women less productive. However, analysis of sex differences in rank studies assessing women as leaders (which have shown that woman may be more effective leaders) and objective measures of productivity do not support these arguments[31–35]. In 1998, Tosi and Mankin conducted a survey in which they identified twenty-six obstacles to academic advancement for women in orthopaedics[36]. The following were the top five obstacles: lack of protected research time, need to increase clinical productivity, inadequate mentoring, lack of reward for clinical teaching, and lack of methodological assistance for research. "Gender bias" was number 14 on the list. The authors went on to identify six areas for action to mitigate the obstacles: increasing mentoring, overcoming sex bias, reducing social and professional isolation, instituting promotion and salary equity, accommodating for family responsibilities, and expanding recruitment efforts.

The goal of orthopaedic residency recruitment efforts is not one of strict parity. In other words, just because 49% of medical students are women doesn't mean that 49% of orthopaedic residents should be female. However, since there is currently such a big divide between the number of women matriculating in medical school and the number applying to orthopaedic training programs, especially compared with the numbers applying to other surgical specialties, efforts should be made to ensure that every student who might potentially be interested in orthopaedics has the opportunity not only to learn what a great profession it is, but to become familiar with it early enough to compile a competitive application.

Sex Bias

Bias, according to the Merriam-Webster online dictionary (http://www.merriam-webster.com), is defined as a "personal and sometimes unreasoned judgment." Persons of both sexes and all ethnicities have bias. Bias is part of the human condition and can exert both positive and negative influence. Bias can be viewed as either conscious or unconscious. Both forms of bias affect the spectrum of the orthopaedic profession, from workforce and career advancement to direct patient care.

Conscious bias in medicine is exemplified by sex-biased clinical trials for conditions that affect both sexes. While the policy of the National Institutes of Health was changed in 1986 to urge the inclusion of women (and subsequently minorities) in clinical research and this policy was subsequently made into public law in 1993[37], sex equity in clinical trials has remained elusive. Women suffer from more adverse drug reactions than men, which may be related to women being viewed as "small men" with the dosing of drugs based on clinical trials performed primarily in men[38]. In reality, men and women have differences in the distribution, metabolism, and excretion of drugs and some researchers suggest that sex-specific pharmacologic guidelines will be the only effective strategy to minimize the prevalence of sex-specific side effects and adverse drug reactions[39].

Sex bias against men also exists in clinical trials. A stunning example is the lack of male representation in clinical trials for osteoporosis. While the lifetime risk of fracture from age sixty years is higher in women than it is in men (44% vs. 25%, respectively) and is further increased in the presence of osteoporosis (65% vs. 42%, respectively)[40], the incidence of osteoporosis-related fracture for men exceeds that of lung and prostate carcinoma combined and is similar to that of myocardial infarction[41]. Moreover, mortality after hip fracture is higher in men than in women[41,42]. However, of the nearly 30,000 patients enrolled in several randomized clinical trials of osteoporosis medications, none have been men[43–46]. The exclusion of men from these large osteoporosis randomized clinical trials was based on conscious bias: the researchers were fully aware of the exclusion of men. Most likely this decision was influenced by the cost of conducting a study with a larger number of enrolled patients to demonstrate a significant reduction in fracture risk, given the lower risk of fracture in males. While some recent nonrandomized studies of high-risk patients do demonstrate reduction in fracture risk among men treated with osteoporosis medication[47,48], these studies included a few hundred patients as compared with several thousand in the larger randomized clinical trials. Both men and women with osteoporosis are currently being treated with medications on the basis of the results of predominantly clinical trials involving only women.

Unconscious bias develops from our human trait to organize our social worlds by categorization: outside of conscious awareness, humans form stereotypes of certain groups of people[49]. While many people may equate unconscious bias with prejudice, that supposition would be incorrect. The assumption that human behavior is always a result of knowledge and conscious intention is false; rather, human behavior can be a product of unconscious forces. The "hidden brain" is the term created by Shankar Vedantam to represent the range of influences that manipulate us without our awareness[50]. Vedantam described our conscious brain as being designed for slow and deliberate thought; our hidden brain, for fast, quick approximations and instant judgments. Our hidden brain is designed for our survival and is the source of our "intuition." In his book *The Gift of Fear,* Gavin de Becker provides numerous examples of individuals who listened to their inner voice in sensing danger; he stated that only in retrospect could the individual process, in his or her slower conscious brain, the sensory, visual, or auditory information that resulted in a sense of fear[51].

Unconscious sex bias against women as leaders results when the stereotype of a leader (strong, determined, and decisive) comes into conflict with the stereotype of a woman (soft, caring, and gentle). Vedantam proposed that our hidden brain reconciles this disparity by making women leaders appear more ruthless and dislikable for no other reason than the fact that they are women[50]. In a study in which both male and female

volunteers were given a description of two potential managers that was identical except for the male or female name of the manager, four in five volunteers preferred the male as their boss. The female leader was viewed to be less likable simply because of her sex[52].

In medicine, such unconscious bias influences academic hiring, promotion, and patient care. In a study of faculty hired at major U.S. medical schools, recommendation letters for women were shorter and less focused on the candidate's record of accomplishment. Adjectives that described ability (e.g., "excellent" or "superb") were more frequent in male letters and adjectives to describe effort (e.g., "hardworking," "dependable") were more common in female letters[53]. Furthermore, when 238 randomly selected evaluators were asked which candidate they would likely hire for an entry-level psychologist position, the male applicant was much more likely to be hired than the female. Males ranked higher on research, teaching, and service, despite the curriculum vitae being identical with the exception of the male versus female name of the applicant[54]. Although a study of ten paired sets of electronic orthopaedic residency applications (each set having the male and female applicant names reversed) showed no difference in rating by 125 faculty reviewers and concluded that the low percentage of female residents in orthopaedic surgery was not due to a bias against female applicants in the initial chart review[55], the pervasiveness of sex bias remains a concern.

A conscious approach to selecting the "best and the brightest" may seem, at first, to be a suitable strategy for use in the fields of medicine, science, and orthopaedic surgery. In 2005, *The Boston Globe* reported that Harvard President Dr. Larry Summers stated in a conference that women do not have the same innate ability in math and science as men[56]. While the sex gap on standardized math tests now shows that, overall, high school girls outperform boys[57], research focusing on the extreme high scorers[58] shows a narrowing of the sex gap but still a difference. Isolation of the top 0.01% of math scores revealed that boys outnumbered girls by 13 to 1 in the early 1980s; however, by 1991, this ratio had improved to just 4 to 1. When verbal reasoning scores and writing-ability scores are analyzed, girls outperform boys and score in the top 0.01%. The authors concluded that there is a "sex difference in cognitive abilities in the extreme right tail, with some favoring males and some favoring females."[58]

If males have a sex-based ability to excel in mathematics and science, then the vast overrepresentation of men in orthopaedics should be favorable for the profession from a research and scientific standpoint. The flaw in this logic is the unconscious bias that is brought by individuals and sexes to their professional teams, which can, unfortunately, result in less than optimal or even tragic outcomes. Introduced as safety features in automobiles in the early 1990s, airbags in their early versions resulted in many deaths of women and children. These airbags were designed by a team of predominantly male engineers[59]. Certainly these engineers did not intentionally design a safety device that would kill individuals who were unlike the average male passenger model, yet such a tragic error did occur. As earlier stated, the assumption that human behavior is always a result of knowledge and conscious intention is false; rather, human behavior can be a product of unconscious forces. It is unknown what the outcome would have been if the engineer team designing the first airbags had been predominantly women. One of the many values of diversity on teams is to minimize the risk of such unconscious bias error.

Unconscious sex bias may also influence clinical care and outcomes. In a Canadian study, a standardized male patient and a standardized female patient with moderate knee osteoarthritis each sought evaluation with thirty-eight family physicians and thirty-three orthopaedic surgeons[60]. Total knee arthroplasty was recommended to the male but not the female patient by 42% of physicians and to the female but not the male patient by 8% of physicians. The odds of a family practice physician recommending arthroplasty to the male patient was twice that of recommending it to the female patient, and the odds of an orthopaedic surgeon recommending arthroplasty to the male patient was twenty-two times that of recommending it to the female patient. In a subsequent study, the authors found that the same physician's treatment and referral decisions for "paper patients" were not influenced by the patient's sex, raising concern that paper patients are not a sensitive method of assessing physician bias[61].

Strategies to minimize unconscious bias include self-awareness and evaluation processes. With the adoption by symphony orchestras of "blind" auditions with a "screen" to conceal the candidate's identity, the probability that a woman musician would be hired and advanced was increased[62]. While such a scenario is not easily applied to orthopaedics, evaluation committees for residency or faculty applicants should use sex-neutral language and commit to predefined evaluation criteria before actually meeting candidates to minimize a focus on male applicants. Interviews should be structured with standard questions asked of each candidate. Moreover, those on evaluation committees and in leadership roles should acknowledge that they may have hidden biases. It is important to know that, despite conscious commitment to equality, most people have some degree of unconscious bias that conflicts with their values. The reader is encouraged to take the Implicit Association Test to understand personal hidden biases (https://implicit.harvard.edu/implicit)[6].

Conclusion

The reason why orthopaedic residency programs do not attract a diverse applicant pool, and woman specifically, is a complex issue. There are several strategies to improve the "pipeline." These include early "upstream" involvement in medical student education, such as continuing to champion core musculoskeletal medicine education, facilitating small-group learning and preceptoring individuals in the first and second years of medical school, and participating in outreach to college students and even high-school students. The AAOS, through efforts of the Diversity Advisory Board, has initiated an awareness campaign to debunk the persistent myths and misperceptions related to a career in orthopaedic surgery for the purpose of

encouraging medical students to pursue a career in that field. This campaign includes outreach events at several national medical school association conferences, which has provided medical students, early in their careers, personal contact with practicing orthopaedic surgeons. This personal contact with students not only helps to dispel the misperceptions regarding our profession and lifestyle but also provides an introduction to the early mentoring programs offered by the AAOS, the J. Robert Gladden Society, and the Ruth Jackson Orthopaedic Society.

Unconscious sex bias is pervasive and negatively impacts women in medicine and women as leaders. Everyone has unconscious bias, and it is important that each individual acknowledge his or her bias. As stated earlier, taking the Implicit Association Test can help identify our own biases and perhaps the areas in which we can improve. Diversifying one's team is an essential step to minimizing the unconscious bias of the group. This will not only cause the entire group to excel, but it will serve to reduce health-care disparities and improve the quality of care for everyone.

Although progress has been made, many other changes still need to be undertaken so that orthopaedic surgery can capitalize on the growing female talent within our medical schools. Hariri et al. identified several efforts that may allow orthopaedics to capitalize on the changing demographics of medical students[13]. We, as orthopaedic surgeons, need to take the time to address what Zhuge et al. called the "most important 'talent management' opportunity surgery has ever faced."[30] In a time when a decrease in the orthopaedic workforce is projected yet the demand for our services continues to rise[63], orthopaedics should reach out to embrace all excellent qualified candidates.

Appendix: Actual Forum Responses to Query: "What Is Ortho Like for a Female Resident?"*

"So, generally every specialty has a personality stereotype. The orthopods are typically athletic, outgoing or outspoken, and playful. They have an interaction style thats lockerroom-esque. So, odds are if you're also an athlete, and/or are laid back, confident, and are the type of gal who works hard and can hang with the guys then you'll fit in and be treated fairly." (sic)

"They dont believe we will work hard enough. They think we will quit when we have babies." (sic)

"Ive been told that 'You're setting your self up for a disappointing career and homelife by going into surgery, because you'll be a bad doctor and a bad mother . . . You will be forced to split time between the two and as a result will do neither well.'" (sic)

"Ive been told that 'the kind of women who go into surgery doesnt want to be around about her families or kids, so there is a selection bias for bitchy females in surgery.'" (sic) ■

*(Source: http.studentdoctor.net)

Valerae Olive Lewis, MD
Section of Orthopaedic Oncology,
The University of Texas,
MD Anderson Cancer Center,
1515 Holcombe Boulevard,
Houston, TX 77030.
E-mail address for V.O. Lewis: volewis@mdanderson.org

Susan A. Scherl, MD
Children's Hospital Omaha, 8200 Dodge Street,
Pavilion 4, Omaha, NE 68114

Mary I. O'Connor, MD
Department of Orthopedic Surgery, Mayo Clinic,
4500 San Pablo Road, Jacksonville, FL 32224.
E-mail address: oconnor.mary@mayo.edu)

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