Reducing Implicit Gender Leadership Bias in Academic Medicine With an Educational Intervention

Sabine Girod, MD, DDS, PhD, Magali Fassiotto, PhD, Daisy Grewal, PhD, Manwai Candy Ku, PhD, Natarajan Sriram, PhD, Brian A. Nosek, PhD, and Hannah Valantine, MD

Abstract

Purpose
One challenge academic health centers face is to advance female faculty to leadership positions and retain them there in numbers equal to men, especially given the equal representation of women and men among graduates of medicine and biological sciences over the last 10 years. The purpose of this study is to investigate the explicit and implicit biases favoring men as leaders, among both men and women faculty, and to assess whether these attitudes change following an educational intervention.

Method
The authors used a standardized, 20-minute educational intervention to educate faculty about implicit biases and strategies for overcoming them. Next, they assessed the effect of this intervention. From March 2012 through April 2013, 281 faculty members participated in the intervention across 13 of 18 clinical departments.

Results
The study assessed faculty members' perceptions of bias as well as their explicit and implicit attitudes toward gender and leadership. Results indicated that the intervention significantly changed all faculty members' perceptions of bias ($P < .05$ across all eight measures). Although, as expected, explicit biases did not change following the intervention, the intervention did have a small but significant positive effect on the implicit biases surrounding women and leadership of all participants regardless of age or gender ($P = .008$).

Conclusions
These results suggest that providing education on bias and strategies for reducing it can serve as an important step toward reducing gender bias in academic medicine and, ultimately, promoting institutional change, specifically the promoting of women to higher ranks.

According to data published in 2014 by the Association of American Medical Colleges (AAMC), women represented 47% of students at accredited U.S. MD-granting medical schools, 46% of participants in residency programs, and 38% of full-time medical school faculty.[1] Despite these impressive numbers, women remain underrepresented in the upper echelons of academic medicine. Only 34% of associate professors and 21% of full professors are women.[1] Further, among the leadership in academic health centers (AHCs), only 16% of deans and 15% of department chairs are women.[1] Given these numbers, investigators have estimated that gender parity at the full professor level will not be achieved for at least 40 years.[2]

Please see the end of this article for information about the authors.

Correspondence should be addressed to Hannah Valantine, Office of the Director, National Institutes of Health, 300 Rockville Pike, Rockville, MD 20850; telephone: (650) 724-0239; e-mail: Hannah.valantine@nih.gov.

Acad Med. 2016;91:1143–1150.
First published online January 27, 2016
doi: 10.1097/ACM.0000000000001099

Supplemental digital content for this article is available at http://links.lww.com/ACADMED/A329.

Prior researchers have attributed the lack of advancement and the attrition of women faculty to unsupportive work environments, active discrimination, personal choices, institutional barriers, and a leaky pipeline.[3–11] Consequently, medical schools have established mentoring, networking, leadership, and coaching resources to recruit, advance, and retain women faculty. Even though women avail themselves of these resources in large numbers,[12] their presence among higher-ranked faculty and leaders is growing very slowly, suggesting that additional mechanisms may interfere with advancement.[13]

Gender biases that favor men over women may influence the hiring, promotion, and retention of women faculty in science, technology, engineering, math, and medicine.[6,14] Importantly, such biases need not arise from explicitly avowed beliefs.[15,16] Both men and women implicitly associate science with men more than they do with women.[17,18]

Implicit biases may play a role in decision-making processes relevant to the engagement of women in academic leadership.[19] For example, studies on hiring suggest that men and women show a stronger preference for male candidates (e.g., for fathers over mothers)—even when all application materials are identical.[20] Similarly, an analysis of 61 studies comparing male and female leaders suggests that a bias favors male leaders.[21] Curiously, when women enact a "masculine style" of leadership (e.g., if the female leaders are autocratic and directive), they receive the lowest ratings among men and women leaders, presumably because their agentic behavior violates the social norms and expectations for women.[22] These findings suggest that subtle gender biases are pervasive, and we believe that, in turn, the pervasiveness of these biases calls for the design of interventions to increase women in academic leadership roles.

Evidence indicates that implicit bias can be alleviated by education that both increases awareness and provides bias reduction strategies.[23–26] Prior studies, notably those that have evaluated the Women in Science & Engineering Leadership Institute (WISELI) and the Science and Technology Recruiting to Improve Diversity and Excellence

(STRIDE) program, have reported the increased hiring of women faculty following the education of search committee members on the issue of implicit bias.[27–31] The intervention presented here is based on many of the successful strategies described in these studies, but is less time intensive and serves to measure implicit biases of study participants using a Web-based design.

We designed a study that consisted of a pre- and postassessment to examine the explicit and implicit biases of participants before and after a 20-minute standardized presentation titled "Recruitment to Expand Diversity and Excellence" (REDE) that provides current information on implicit biases as well as strategies for overcoming them. Our primary goal was to determine whether raising awareness of implicit bias among faculty in one medical school, using this standardized educational instrument, would affect implicit and explicit biases regarding women and leadership. To understand how educational interventions on explicit and implicit biases might operate, we addressed the following research questions:

1. Is there a measurable *explicit* bias in favor of men as leaders, and if so, does it differ between men and women faculty?
2. Is there a measurable *implicit* bias in favor of men as leaders, and if so, does it differ between men and women faculty?
3. (Regardless of whether there is a measurable bias in favor of men) do explicit biases of leadership being associated with men more than women change following the REDE intervention? and,
4. (Regardless of whether there is a measurable bias in favor of men) do implicit biases of leadership being associated with men more than women change following the REDE intervention?

Method

Materials

The pre- and postassessments consisted of the following: (1) a survey measuring general perceptions of bias, (2) an assessment of measures of explicit attitudes related to gender and leadership, and (3) a version of the Implicit Association Test (IAT) measuring the association between gender and leadership.

The survey on general perceptions of bias provides statements about gender bias and stereotypes, and it asks faculty either to agree or disagree with the statements. Because the statements are contrary to the information presented through REDE, higher scores, indicating disagreement, are "right" (insofar as any answers are right). Higher scores thus show more alignment with the content of the presentation.

The assessment of explicit attitudes related to gender and leadership asked respondents to explicitly rate the effectiveness of men and women as leaders (see also Results).

We assessed implicit attitudes using the IAT, which assesses the relative strengths of associations between two pairs of concepts (e.g., male/female and leader/follower).[32–37] Importantly, the IAT can predict behaviors even when explicit, consciously reported thoughts or feelings do not. We used the Brief IAT (a shortened version of the IAT) to measure how closely respondents associated *Gender* (male, female) with *Leadership* (leader, follower).[38–40] (See Supplemental Digital Appendix [SDA] 1 for a description of keywords used in the Gender–Leadership IAT, http://links.lww.com/ACADMED/A329.) Instructions ask participants to complete the IAT as quickly as possible. It is subsequently scored with the *D* algorithm, a scoring procedure that considers the difference in mean response times (or response latencies) of the two sorting conditions, divided by the standard deviation (SD) of all latencies.[41,42] IAT *D* scores can range from −2 to +2, and zero indicates no difference between the contrasting conditions. A positive value indicates a stronger association of leader with male than with female.

In addition to the survey on faculty's perceptions of biases, explicit attitudes toward women in leadership, and the IAT, we collected basic demographic data (age, race, gender) for each participating faculty member.

Intervention design

The first step in developing the intervention was the recruitment and training of senior Stanford School of Medicine faculty "champions" to deliver the presentations on implicit bias from March of 2012 through April 2013. We sent e-mails to department chairs and senior leaders informing them of the study and gauging their availability to participate. We selected champions on the basis of their seniority, credibility with other faculty, and sustained demonstration of an interest in and ability to lead diversity initiatives in their own departments or institutes. The 13 selected champions—9 male and 4 female faculty members in leadership positions—represented the relative gender distribution of the faculty.

We trained champions to deliver a 20-minute presentation that summarizes the research literature on implicit bias. The presentation, similar in format and content to the materials used in the STRIDE and WISELI studies,[27–31] focuses particularly on gender and leadership. It provides data that depict the existence and effects of unconscious gender bias in academic science as well as tips for overcoming bias in hiring processes. For example, to illustrate the real existence of unconscious bias, the presentation includes a study that used a nationwide sample of biology, chemistry, and physics professors to evaluate application materials of an undergraduate science student (female or male) for a lab manager position. In the study, *both* male and female faculty participants rated the identically qualified female student as less competent and less hirable, and both male and female participants offered the female student a lower salary and less mentoring.[6] To describe how to overcome bias (and to emphasize the importance of promoting awareness of bias in the self and others), the REDE presentation includes a study showing that at one medical school, departments that participated in workshops on unconscious bias had significantly higher odds ($P < .05$) of increasing the percentage of women faculty hires.[29] (See SDA 2 for a bibliography of articles used in the REDE presentation, http://links.lww.com/ACADMED/A329.) Medical faculty champions were very receptive to the presentation of *published* data on the effects of bias and ways to overcome it. During the two-hour training meeting, the champions received a toolkit that included, among other items, the following: (1) a letter from the REDE program directors outlining the importance of the training program, (2) an overview of the program, (3) a list of frequently asked questions on implicit bias, (4) a directory of other champions, and (5) a bibliography of further reading. During the training, champions experienced an in-depth version of the presentation they would, in turn, present to departments.

Procedure

Stanford University's Research Compliance Office deemed the study, a departmental developmental program, exempt. Champions were matched to their own departments or divisions (or, if necessary, to departments/divisions that were deemed most similar to their own) and delivered the REDE implicit bias presentation during regularly scheduled faculty meetings.

During these meetings, faculty participants completed an Internet-based preassessment, comprising the survey of their perceptions of bias, the assessment of their explicit attitudes about gender and leadership, and the IAT to measure implicit attitudes about gender and leadership. Each participant created a specific password at log-in using a standardized procedure based on their date of birth and name. We used these unique, anonymous passwords to match each participant's pre- and postassessment. Next, the champion gave the 20-minute REDE presentation, during which faculty could comment, share stories, and ask questions. Immediately after the presentation, participants completed the postassessment (identical to the preassessment). The assessments presented the items on explicit and implicit attitudes in a randomized order for each participant. Participants received $25 Amazon gift cards for completing the study. To protect participants' anonymity, a third-party provider collected all data.

Statistical analysis

We conducted all statistical analyses using Stata 13 (StataCorp, College Station, Texas). We used multiple regression to measure the impact of demographic characteristics on our surveyed items, and we conducted both paired *t* tests and linear mixed models to measure changes in surveyed items pre and post test. To account for the department-level administration of the intervention and the possibility of group effects, all of the regression models incorporated a random effect for department. We also ran models incorporating fixed effects for departments to analyze whether systematic differences occurred by department (and, by association, by presenting champion). Because joint significant tests of department variables showed no differences after accounting for our demographic variables, we have not presented these results below; rather, we have presented only the random effect adjustment.

Results

Participants

Two hundred eighty-one current faculty members from 13 of 18 clinical departments (nearly 20% of all clinical faculty at Stanford) participated from March 2012 through April 2013. (See SDA 3 for a list of participating departments, http://links.lww.com/ACADMED/A329). The percentage of department members attending the sessions ranged from 7% in anesthesiology and neurosurgery to 85% in neurology. Because attendance at faculty meetings is random, based on availability, we do not suspect that these differences are associated with implicit biases.

Of the 281 participants, 163 (58%) were male, 99 (35%) were 50 or older, and 90 (32%) were nonwhite. We collected age in five-year intervals (i.e., 25–29, 30–34, 35–39, 40–44, 45–49, 50–54, 55–59, 60+) and treated age as an interval–scale variable in the analyses. Because only 2 respondents were in the 25–29 age group, we included these 2 in the 30–34 age group in analyses. Of the 90 nonwhite participants, 82 (91%) were Asian/Pacific Islander, 6 (7%) were Hispanic/Latino, and the remaining 2 nonwhite participants identified as African American and Native American/Alaska Native. We examined the white versus nonwhite categories, as further group divisions were too small to analyze meaningfully.

Changing perceptions of bias

To ensure that participants absorbed the content of the educational intervention, we asked them about their perceptions of bias as part of the pre- and postintervention assessments (see Table 1).

Table 1

Results From Pre- and Postintervention Surveys Measuring Understanding of Bias Among Faculty Respondents, March 2012 to April 2013[a]

Survey items	Preintervention survey, mean (SD)	Postintervention survey, mean (SD)
Personal bias		
In most situations, I am objective in my decision making.	1.74 (0.75)	2.10 (0.90)
Biases do not usually influence my decision making.	2.90 (1.24)	3.10 (1.28)
Societal bias		
Men and women vary in the types of biases they have against other people.	2.34 (1.05)	2.52 (1.16)
People in today's society tend to treat people of different social groups (e.g., race, gender, class) equally.	4.16 (1.31)	4.34 (1.40)
Society has reached a point where all people, regardless of background, have equal opportunities for achievement.	4.42 (1.39)	4.71 (1.25)
Biases in academic medicine		
In academic medicine, bias against others is no longer a problem in the area of *hiring*.	4.12 (1.27)	4.52 (1.21)
In academic medicine, bias against others is no longer a problem in the area of *promotion*.	3.91 (1.33)	4.59 (1.25)
In academic medicine, bias against others is no longer a problem in the area of *leadership*.	4.15 (1.33)	4.78 (1.13)

Abbreviation: SD indicates standard deviation.
[a]Respondents are faculty from 13 of 18 clinical departments at Stanford University School of Medicine. The faculty responding to both the pre- and postsurvey (n = 281) represent nearly 20% of Stanford's clinical faculty. The faculty responded to the questions on a Likert-type scale where 1 = strongly agree, 2 = moderately agree, 3 = slightly agree, 4 = slightly disagree, 5 = moderately disagree, and 6 = strongly disagree.

The results of our paired *t* tests for each of the eight items on the perceptions of bias survey showed that after the presentation, faculty experienced significant increases in their perceptions of personal bias (Cohen's d = 0.50 and 0.17; $P < .01$ for both questions), perceptions of societal bias (Cohen's d = 0.14, 0.12, and 0.25; $P < .05$ for all three questions), and perceptions of bias in academic medicine (Cohen's d = 0.38, 0.57, and 0.58; $P < .001$ for all three questions). These findings suggest that respondents listened to and absorbed the presented materials.

Explicit and implicit attitudes about gender and leadership at baseline

We next examined the findings related to our first two research questions regarding whether there are measurable *explicit* and *implicit* biases in favor of men as leaders, and if so, whether they differ between men and women faculty.

Explicit attitudes. First, to examine explicit bias, we asked respondents to rate (1) the effectiveness of men as leaders and (2) the effectiveness of women as leaders. As expected, we detected no significant difference between explicit stereotyping of male and female leader effectiveness at baseline ($P > .76$). The ratings remained the same when we accounted for respondents' demographic characteristics (i.e., gender, age, and race) using multiple regression models that incorporated effectiveness scores as the dependent variable. A joint significance test showed that none of these demographic characteristics had any effect on the difference in effectiveness scores ($P > .34$).

As a second measure of explicit bias, we asked respondents to directly compare men and women as leaders, using a scale of 1 (strong preference for men as leaders) through 7 (strong preference for women as leaders). The mean response was 4.12 (SD = 0.59), with a 4 representing perfect equality between men and women leaders. Multiple regression analysis showed no difference in scores based on any of the respondents' demographic characteristics ($P > .52$).

Implicit attitudes. Next, we analyzed implicit associations between gender and leadership. The mean IAT *D* score among respondents was 0.16 (SD = 0.42), indicating a slight implicit preference for men in leadership positions over women. We regressed individual IAT *D* scores on respondents' gender, age, and race to understand how these demographic variables, when taken into account at the same time, might be associated with attitudes toward gender and leadership. The effects of both gender and age were significant and positive ($\beta_{MALE} = 0.18$, $P = .001$; $\beta_{AGE} = 0.04$, $P = .004$), whereas race (i.e., white or nonwhite) had no discernible effect ($\beta_{NONWHITE} = 0.02$, $P > .72$). These findings suggest that both male faculty and older faculty have stronger implicit associations of leadership with men than women compared with, respectively, female and younger faculty.

Changing explicit and implicit attitudes about gender and leadership

We next examined the postassessment data to answer our third and fourth research questions regarding whether explicit and implicit biases of leadership being associated with men more than women changed following the REDE intervention.

Explicit biases. We detected no significant differences between pre- and postsurvey answers related to explicit views of male and female leader effectiveness (pre–post male leader effectiveness: $P > .40$; pre–post female leader effectiveness: $P > .99$; see Figure 1). Differences between pre- and postsurvey answers for our second measure of explicit bias, directly comparing male and female leaders, were also not significant ($P > .18$; see Figure 2).

Implicit biases. The main effect of an implicit bias associating leadership with male more than female (i.e., the *D* score), however, decreased significantly among all participants following the REDE intervention ($P = .002$). We next examined the effect of our intervention while controlling for respondents' demographic characteristics. We analyzed linear mixed models with participants' *D* scores as the dependent variable; we included gender, age, race, and the postintervention time period as covariates and nested random effects for participants' repeated observations within their departments. We have reported main effects from a model including all of the demographic covariates. The intervention continued to have a significant effect on *D* scores, even when including demographic covariates ($\beta_{POSTINTERVENTION} = -0.08$, $P = .008$), which suggests that the intervention was effective for all participants regardless of gender, age, and race. As before, both the main effect for gender ($\beta_{MALE} = 0.16$, $P < .001$) and age ($\beta_{AGE} = 0.03$, $P = .003$) were significant, while race was not ($\beta_{NONWHITE} = 0.01$, $P > .78$). This finding suggests that both male participants and older participants experienced implicit bias favoring male leaders (see Figures 3 and 4). We noted that gender and age among participants were related ($r_{pb} = 0.71$, $P < .001$), which led us to consider the possibility that the effect of age could be attributed to the fact that men are overrepresented in older age groups. However, in additional analyses, the inclusion of an interaction term between gender and age is not significant.

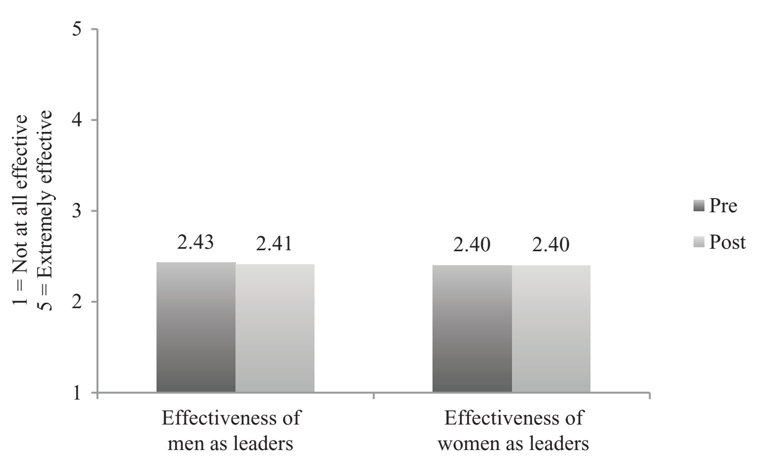

Figure 1 Pre- and postintervention results of the assessment of *explicit* attitudes about the effectiveness of men and women as leaders among clinical faculty at Stanford University School of Medicine, March 2012 to April 2013. Respondents are faculty from 13 of 18 clinical departments at Stanford University School of Medicine. The faculty responding to both the pre- and postsurvey (n = 281) represent nearly 20% of Stanford's clinical faculty.

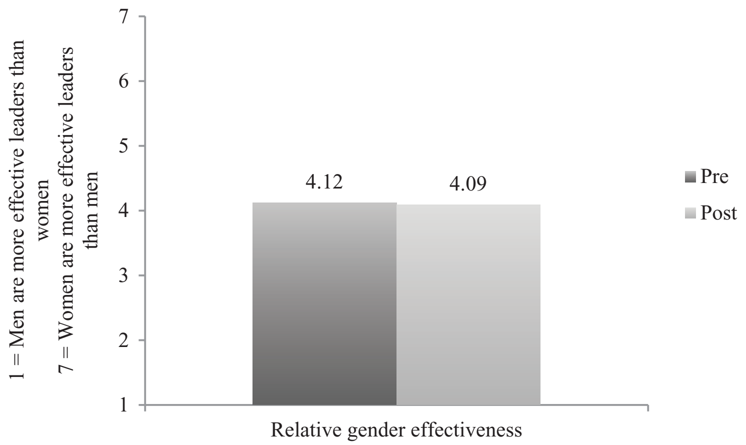

Figure 2 Pre- and postintervention results of the assessment of *explicit* attitudes about relative gender effectiveness in leadership among clinical faculty at Stanford University School of Medicine, March 2012 to April 2013. Respondents are faculty from 13 of 18 clinical departments at Stanford University School of Medicine. The faculty responding to both the pre- and postsurvey (n = 281) represent nearly 20% of Stanford's clinical faculty.

We also examined interactions between the demographic covariates and the postintervention indicator to understand if our intervention had a greater effect on some demographic groups than on others. Because we were concerned with oversaturating the model, we have reported interaction effects from three separate models that include all of the covariates with a single demographic–intervention interaction at a time. We detected no significant interactions between gender and the postintervention time period ($\beta_{\text{MALE-INTERACTION}} = -0.06$, $P > .29$), between age and the postintervention time period ($\beta_{\text{AGE-INTERACTION}} = -0.02$, $P > .26$), or between race and the postintervention time period ($\beta_{\text{NONWHITE-INTERACTION}} = 0.004$, $P > .94$). These results indicate that the effect of our intervention did not differ significantly between male and female faculty, younger and older faculty, or white and nonwhite faculty, such that all groups yielded similar decreases in their IAT *D* scores post intervention.

IAT effects can decline with experience.[41] Although using the *D* score (as opposed to merely measuring mean latencies) can lessen the impact of such a practice effect, the possibility of a practice effect should still be taken into consideration as we examine our results. Because we conducted the pre-IATs during the department meetings, the 3 to 10 people per department who arrived late did not take the pre-IAT; however, these individuals did complete the post-IATs. To examine the possibility of a practice effect, we compared the results of the post-IAT study participants with those who had not taken the pre-IAT (n = 82), using an independent two-sample *t* test. We conducted two-sample *t* tests both with and without a Satterthwaite correction. Despite the discrepancy in sample size between the matched pre–post sample and the simple post sample, results were equivalent, and a variance ratio test showed no significant difference in sample variances, so we report results from the pooled standard error method. Possibly, those who arrived late could differ in other unmeasured ways that this test may not capture, yet we found no significant differences between the IAT results of those "experienced" (M = 0.10, SD = 0.38) and "nonexperienced" (M = 0.07, SD = 0.38) with the IAT ($P > .56$). This finding supports that the longitudinal effect is due to the intervention rather than a practice effect.

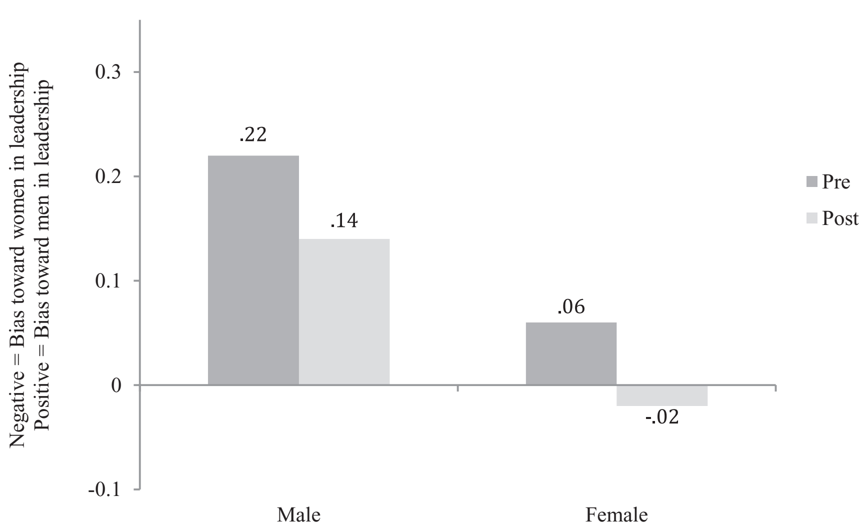

Figure 3 Predicted values from regression models of implicit attitudes toward gender and leadership pre and post intervention, by faculty gender controlling for age and race. The Implicit Association Test (IAT) was used to measure implicit attitudes among faculty before and after a presentation on implicit bias, March 2012 to April 2013. Scores from the IAT can range from −2 to +2. Respondents are faculty from 13 of 18 clinical departments at Stanford University School of Medicine. The faculty responding to both the pre- and postsurvey (n = 281) represent nearly 20% of Stanford's clinical faculty.

Discussion

The present intervention study is unique in that it measures changes of explicit and implicit bias toward gender and leadership at baseline and after an educational intervention, and it identifies demographic characteristics that may be associated with bias. We report three major findings in this study:

1. A 20-minute standardized presentation highlighting the current research on implicit bias and providing strategies for overcoming such biases significantly changed the perception of implicit bias in male and female faculty;
2. Male gender and age were significantly associated with greater implicit bias associating leadership with men more than women; and
3. The intervention had a small, but significant effect on the implicit biases surrounding women and leadership of all participants regardless of age and gender.

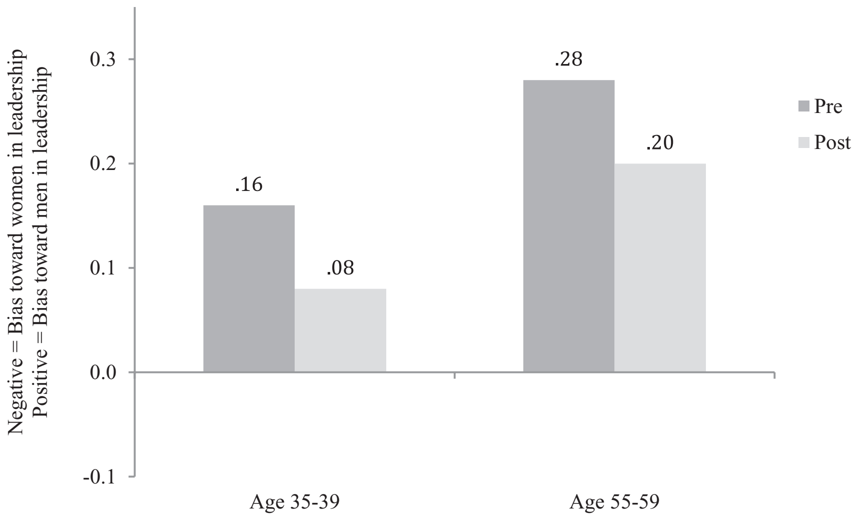

Figure 4 Predicted values from regression models of implicit attitudes toward gender and leadership pre and post intervention, by age (i.e., a "junior" faculty member aged 35–39 compared with a "senior" faculty member aged 55–59) controlling for gender and race. The Implicit Association Test (IAT) was used to measure implicit attitudes among faculty before and after a presentation on implicit bias, March 2012 to April 2013. Scores from the IAT can range from −2 to +2. Respondents are faculty from 13 of 18 clinical departments at Stanford University School of Medicine. The faculty responding to both the pre- and postsurvey (n = 281) represent nearly 20% of Stanford's clinical faculty.

Our study is limited by the lack of a control group and the absence of random assignment. Further, we did not collect behavioral outcomes or measures of bias distal from the immediate exercise. Some research suggests that effects of interventions are fleeting, and others show some evidence of a longer-term impact.[38] Finally, we acknowledge the possibility that observed changes on the perceptions of bias survey do not reflect a genuine improvement in individual perceptions of biases but, rather, that the presentation was effective in conveying the information we had compiled. Nevertheless, this study is an important first step in examining and mitigating gender biases in academic medicine, and further research should test for evidence of long-term changes in implicit attitudes and behaviors.

Despite the study's limitations, our results show that a brief intervention can change participants' perceptions of implicit bias, which was the major goal of our project. Both male and female faculty showed similar and significant improvements in their perceptions and awareness of bias. We did not see, nor did we expect to see, gender differences regarding explicit biases or an effect of the intervention on explicit biases because expressing balanced views toward women in academic medicine is socially desirable—independent of consciously or unconsciously held beliefs. However, we observed differences in implicit bias between men and women faculty and between older and younger faculty; both older age and male gender were significantly associated with IAT scores favoring male leadership. After the REDE intervention, implicit bias against women leadership decreased in all groups in our study.

The implications of these findings are important to consider as institutions examine not only how women's promotion packages, grants, and manuscripts are evaluated but also the process through which women obtain career-advancing opportunities. Extrapolating from the experimental work of Logel and colleagues,[43] implicit bias among senior male faculty may subtly contribute to the relative paucity of women among the higher-ranking faculty and leaders of academic medicine. Implicit bias may also contribute to stereotype threat or the feeling of not belonging among women leaders in academic medicine. In fact, implicitly activated gender stereotypes may be more damaging to women than explicitly activated gender stereotypes because the latter may at least inspire or contribute to discussions and change.[44] Hoyt and colleagues[45–47] have found that even women with high leadership self-efficacy can suffer adverse effects of stereotype threat. Given the growing evidence that physicians' implicit biases may impact their clinical decision making with patients,[48] the greater implicit bias in men and older physicians may also influence their interactions with female patients.

Although our study does not address long-term outcomes of an intervention related to bias, we have observed promising signs of success following our REDE intervention. For example—though we cannot assess if any of the longer-term outcomes reported here are directly attributable to our intervention—we note that in departments receiving the REDE training, the increase in the percentage of women faculty in the next academic year (2013–2014) was 1.5% compared with an increase of 0.7% for those not experiencing the intervention. In addition, in the 2014 administration of the AAMC Faculty Forward Satisfaction and Engagement Survey, Stanford departments that received the REDE intervention averaged 8 percentage points higher for the statement "My department is successful in recruiting female faculty members" than did the departments whose faculty did not experience the REDE training.

Although this study took place at only one AHC, we believe that Stanford University School of Medicine's faculty members do not differ from those at other AHCs with regard to the susceptibility to and consequences of implicit gender biases, so the question remains, how can members of the academic medicine community effectively influence the apparent implicit individual and institutional biases against women leaders in AHCs? In general, interventions aimed at reducing bias have proven particularly effective if (1) participants experience counterstereotypical examples (e.g., strong female leaders), (2) the interventions use evaluative conditioning methods (e.g., participants are presented with positive or negative stimuli associated with a specific concept or object to stimulate a change in attitude, as in pairing positive words with women leaders), and (3) the presenters provide specific recommendations for overriding biases such as those included in our presentation.[30,49,50] The evidence to date, including the findings of this study, indicates that implicit biases are malleable; they are influenced by self- and social motives, specific strategies, the perceiver's focus of attention, and the configuration of stimulus cues.[24] This research suggests that when faculty participants are made aware of biases, including their own personal biases, and when they learn about strategies to overcome these biases, they are able to self-correct.

Acknowledgments: The authors would like to thank the leadership of the Stanford School of Medicine and the champions who led the Recruitment to Expand Diversity and Excellence education for their time, support, and advice on this project.

Funding/Support: This work was supported by National Institutes of Health Clinical and Translational Science Award 1UL1 RR025744-01 and the National Institutes of Health Director's Pathfinder Award (1DP4GM096849-01).

Other disclosures: None reported.

Ethical approval: Reported as not applicable.

Previous presentations: M. Fassiotto presented findings from Recruitment to Expand Diversity and Excellence at the Association of American Medical Colleges Group on Faculty Affairs Professional Development Conference, July 19, 2014, Boston, Massachusetts.

S. Girod is associate professor, Department of Surgery and, by courtesy, Department of Otolaryngology, Stanford University School of Medicine, Stanford, California.

M. Fassiotto is director of programs and research, Office of Faculty Development and Diversity, Stanford University School of Medicine, Stanford, California.

D. Grewal is assessment and program evaluation analyst, Office of the Vice Provost for Undergraduate Education, Stanford University, Stanford, California.

M.C. Ku is research program manager, Apple Inc., Cupertino, California.

N. Sriram is founder of Implisci, Charlottesville, Virginia.

B.A. Nosek is professor, Department of Psychology, University of Virginia, and executive director, Center for Open Science, Charlottesville, Virginia.

H. Valantine is chief officer for scientific workforce diversity, National Institutes of Health, Bethesda, Maryland. This work was conducted while H. Valantine was at Stanford University, Stanford, California.

References

1 Association of American Medical Colleges. The state of women in academic medicine: The pipeline and pathways to leadership 2013–2014. 2014. https://members.aamc.org/eweb/upload/The%20State%20of%20Women%20in%20Academic%20Medicine%202013–2014%20FINAL.pdf. Accessed December 10, 2015.
2 Valantine H, Sandborg CI. Changing the culture of academic medicine to eliminate the gender leadership gap: 50/50 by 2020. Acad Med. 2013;88:1411–1413.
3 Committee on Maximizing the Potential of Women in Academic Science and Engineering; Committee on Science, Engineering, and Public Policy; Institute of Medicine; Policy and Global Affairs; National Academy of Sciences; National Academy of Engineering. Beyond Bias and Barriers: Fulfilling the Potential of Women in Academic Science and Engineering. Washington, DC: National Academies Press; 2007.
4 Sandler BR. The Chilly Classroom Climate: A Guide to Improve the Education of Women. Washington, DC: National Association for Women in Education; 1996.
5 Massachusetts Institute of Technology. A study on the status of women faculty in science at MIT. 1999. http://web.mit.edu/fnl/women/women.html#The%20Study. Accessed December 10, 2015.
6 Moss-Racusin CA, Dovidio JF, Brescoll VL, Graham MJ, Handelsman J. Science faculty's subtle gender biases favor male students. Proc Natl Acad Sci U S A. 2012;109:16474–16479.
7 Ceci SJ, Williams WM. Understanding current causes of women's underrepresentation in science. Proc Natl Acad Sci U S A. 2011;108:3157–3162.
8 Mayer AP, Blair JE, Ko MG, et al. Gender distribution of U.S. medical school faculty by academic track type. Acad Med. 2014;89:312–317.
9 Pololi LH, Civian JT, Brennan RT, Dottolo AL, Krupat E. Experiencing the culture of academic medicine: Gender matters, a national study. J Gen Intern Med. 2013;28:201–207.
10 White FS, McDade S, Yamagata H, Morahan PS. Gender-related differences in the pathway to and characteristics of U.S. medical school deanships. Acad Med. 2012;87:1015–1023.
11 Stewart A, LaVaque-Manty D. Advancing women in science and engineering: An effort in institutional transformation. In: Watt HMG, Eccles JS, eds. Gender and Occupational Outcomes: Longitudinal Assessments of Individual, Social, and Cultural Influences. Washington, DC: American Psychological Association; 2008:299–322.
12 Carter NM, Silva C. Mentoring: Necessary but Insufficient for Advancement. New York, NY: Catalyst; 2010.
13 Valantine HA, Grewal D, Ku MC, et al. The gender gap in academic medicine: Comparing results from a multifaceted intervention for Stanford faculty to peer and national cohorts. Acad Med. 2014;89:904–911.
14 Trix F, Psenka C. Exploring the color of glass: Letters of recommendation for female and male medical faculty. Discourse Soc. 2003;14:191–220.
15 Greenwald AG, Poehlman TA, Uhlmann EL, Banaji MR. Understanding and using the implicit association test: III. Meta-analysis of predictive validity. J Pers Soc Psychol. 2009;97:17–41.
16 Nosek BA, Smyth FL, Hansen JJ, et al. Pervasiveness and correlates of implicit attitudes and stereotypes. Eur Rev Soc Psychol. 2007;18:36–88.
17 Nosek BA, Smyth FL. Implicit social cognitions predict sex differences in math engagement and achievement. Am Educ Res J. 2011;48:1125–1156.
18 Nosek BA, Smyth FL, Sriram N, et al. National differences in gender-science stereotypes predict national sex differences in science and math achievement. Proc Natl Acad Sci U S A. 2009;106:10593–10597.
19 Macrae CN, Bodenhausen GV. Social cognition: Categorical person perception. Br J Psychol. 2001;92(part 1):239–255.
20 Correll SJ, Bernard S, Paik I. Getting a job: Is there a motherhood penalty? Am J Soc. 2007;112:1297–1339.
21 Eagly AH, Karau SJ, Makhijani MG. Gender and the effectiveness of leaders: A meta-analysis. Psychol Bull. 1995;117:125–145.
22 Eagly AH, Karau SJ. Role congruity theory of prejudice toward female leaders. Psychol Rev. 2002;109:573–598.
23 Devine PG, Forscher PS, Austin AJ, Cox WT. Long-term reduction in implicit race bias: A prejudice habit-breaking intervention. J Exp Soc Psychol. 2012;48:1267–1278.
24 Rudman LA, Ashmore RD, Gary ML. "Unlearning" automatic biases: The malleability of implicit prejudice and stereotypes. J Pers Soc Psychol. 2001;81:856–868.
25 Blair IV. The malleability of automatic stereotypes and prejudice. Pers Soc Psychol Rev. 2002;6:242–261.
26 Mitchell JP, Nosek BA, Banaji MR. Contextual variations in implicit evaluation. J Exp Psychol Gen. 2003;132:455–469.
27 Carnes M, Bland C. Viewpoint: A challenge to academic health centers and the National Institutes of Health to prevent unintended gender bias in the selection of clinical and translational science award leaders. Acad Med. 2007;82:202–206.
28 Carnes M, Devine PG, Isaac C, et al. Promoting institutional change through bias literacy. J Divers High Educ. 2012;5:63–77.
29 Sheridan JT, Fine E, Pribbenow CM, Handelsman J, Carnes M. Searching for excellence & diversity: Increasing the hiring of women faculty at one academic medical center. Acad Med. 2010;85:999–1007.
30 Stewart AJ, LaVaque-Manty D, Malley JE. Recruiting female faculty in science and engineering: Preliminary evaluation of one intervention model. J Women Min Sci Eng. 2004;10:361–375.
31 Isaac C, Lee B, Carnes M. Interventions that affect gender bias in hiring: A systematic review. Acad Med. 2009;84:1440–1446.
32 Carnes M, Devine PG, Baier Manwell L, et al. The effect of an intervention to break the gender bias habit for faculty at one institution: A cluster randomized, controlled trial. Acad Med. 2015;90:221–230.
33 Nosek BA, Greenwald AG, Banaji MR. Understanding and using the Implicit Association Test: II. Method variables and construct validity. Pers Soc Psychol Bull. 2005;31:166–180.
34 Amodio DM, Devine PG. Stereotyping and evaluation in implicit race bias: Evidence for independent constructs and unique effects on behavior. J Pers Soc Psychol. 2006;91:652–661.
35 Rudman LA, Heppen JB. Implicit romantic fantasies and women's interest in personal power: A glass slipper effect? Pers Soc Psychol Bull. 2003;29:1357–1370.
36 Ostafin BD, Palfai TP. Compelled to consume: The Implicit Association Test and automatic alcohol motivation. Psychol Addict Behav. 2006;20:322–327.
37 Andrews JA, Hampson SE, Greenwald AG, Gordon J, Widdop C. Using the Implicit Association Test to assess children's implicit

attitudes toward smoking. J Appl Soc Psychol. 2010;40:2387–2406.
38 Dasgupta N, Asgari S. Seeing is believing: Exposure to counterstereotypic women leaders and its effect on the malleability of automatic gender stereotyping. J Exp Soc Psychol. 2004;40:642–658.
39 Lai CK, Hoffman KM, Nosek BA. Reducing implicit prejudice. Soc Pers Psychol Compass. 2013;7:315–330.
40 Sriram N, Greenwald AG. The Brief Implicit Association Test. Exp Psychol. 2009;56:283–294.
41 Greenwald AG, Nosek BA, Banaji MR. Understanding and using the implicit association test: I. An improved scoring algorithm. J Pers Soc Psychol. 2003;85:197–216.
42 Nosek BA, Greenwald AG, Banaji MR. The Implicit Association Test at age 7: A methodological and conceptual review. In: Bargh JA, ed. Automatic Processes in Social Thinking and Behavior. New York, NY: Psychology Press; 2007.
43 Logel C, Walton GM, Spencer SJ, Iserman EC, von Hippel W, Bell AE. Interacting with sexist men triggers social identity threat among female engineers. J Pers Soc Psychol. 2009;96:1089–1103.
44 Kray LJ, Thompson L, Galinsky A. Battle of the sexes: Gender stereotype confirmation and reactance in negotiations. J Pers Soc Psychol. 2001;80:942–958.
45 Hoyt CL, Blascovich J. The role of leadership self-efficacy and stereotype activation on cardiovascular, behavioral and self-report responses in the leadership domain. Leadersh Q. 2010;21:89–103.
46 Hoyt CL, Blascovich J. Leadership efficacy and women leaders responses to stereotype activation. Group Process Intergroup Relat. 2007;10:595–616.
47 Hoyt CL, Johnson SK, Murphy SE, Skinnell KH. The impact of blatant stereotype activation and group sex-composition on female leaders. Leadersh Q. 2010;21:716–732.
48 Sabin JA, Greenwald AG. The influence of implicit bias on treatment recommendations for 4 common pediatric conditions: Pain, urinary tract infection, attention deficit hyperactivity disorder, and asthma. Am J Public Health. 2012;102:988–995.
49 Lai CK, Hoffman KM, Nosek BA. Reducing implicit prejudice. Soc Pers Psychol Comp. 2013;7:315–330.
50 Lai CK, Marini M, Lehr SA, et al. Reducing implicit racial preferences: I. A comparative investigation of 17 interventions. J Exp Psychol Gen. 2014;143:1765–1785.