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Supplemental Digital Appendix 1

Content and Timing of BRIM Breaking the Bias Habit Workshop[a,b]

INTRODUCTION (28 MINUTES)

• Brief introduction of presenters emphasizing credentials, title, or experience to establish their credibility.
• Overview of workshop goals and format noting that there are breaks (one for the in-person version and two for virtual version).
• Presentation of science and medicine workforce diversity data showing:[1-10]
  o Percentages for ethnic/racial groups underrepresented in medicine at all career stages, highlighting underrepresentation relative to U.S. population,
  o Gender parity at early pipeline stages since the passage of Title IX making quotas illegal, but loss at subsequent career stages toward leadership and sex segregation within subspecialties of internal medicine,
  o Well representation at early pipeline career stages of individuals from the multiple subgroups categorized as Asian with loss of talent with advancement toward leadership.
• Paired 3-minute discussion on the benefits of increasing representation of groups that are currently underrepresented in one's division or field. (To avoid instances of a single participant finding themselves in a virtual breakout room, trios rather than pairs used for the virtual workshop version.)
• Large group report out followed by a brief summary of a large body of research supporting participants' observations of the value of diversity in the multiple domains of science, medicine, teaching, and health care[11-21] going into a bit of detail on two studies[22, 23] to increase engagement of participants and enhance credibility of presenters.
• Acknowledgment that explicit prejudice certainly exists followed by a statement derived from statements by AAMC, NIH, National Academy of Sciences, and others that unintentional bias arising from cultural stereotypes operates in personal interactions, institutional cultures, and evaluations processes to perpetuate inequities in science and medicine.

MODULE 1. IMPLICIT BIAS AS A HABIT (32 MINUTES)
• Noting that changing any habit is a multistep process and using smoking cessation as a metaphor of how change in the behaviors of individuals is fundamental to changes in policy and practices which collectively change culture.[24-30] • Difference between implicit and explicit bias clarified. • Group exercise using Shepard's optical illusion of identical tables[31] that appear to be of different sizes. These are shown on a slide with copies of transparencies passed around to let participants demonstrate to themselves that the tables are the same size. (This exercise was eliminated in the virtual workshop version.) • Stroop Color Naming Task[32] as a group exercise to illustrate how implicit cognitive processes such as reading English can lead to behavioral errors when, for example, the word "red" is written in blue. • List of some of the research that has examined implicit bias in various workplace and academic settings, calling attention to the multiple different identity groups involved in these studies.[33-50] • An example of a study illustrating perceptual distortion occurring from implicit stereotype-based assumptions: Students heard more accented English when they thought a pre-recorded lecture in Standard American English was delivered by an Asian instructor vs. a White instructor.[51] • Interactive discussion of participants' experience taking Implicit Association Tests (IAT)[52] to which they were sent a link 2-3 days before the workshop. • Distributions of IAT population data for the race IAT[52] and gender and leadership IAT[53, 54] shown, emphasizing that the goal of the workshop is *not* to change the score on an IAT but to change behavior. • Brief review of research on physician decision-making and IAT scores (generally little impact for decisions based on objective data, more impact for subjective decisions like pain or suicidal ideation, most impact on physician-patient communication). [55-67] • Summary of module points and questions taken; 5-minute break.

(continued)

MODULE 2: BECOMING BIAS LITERATE (82 MINUTES)

- Introduced by noting that research on organizational change emphasizes the importance of having a common language in solving complex problems.
- Five bias concepts labeled, defined, and illustrated with studies.
  - Expectancy bias (and competency bias as a type of expectancy bias) – expecting individuals to possess or exhibit characteristics or abilities stereotypically associated with the social group to which they belong. Expecting the workshop presenters who are from Wisconsin to like cheese, beer and the Green Bay Packers used as an illustrative example. To demonstrate that stereotypes are widely known even if not personally endorsed:
    - After acknowledging that gender does not exist as a binary but along a more nuanced continuum, participants asked to call out (or write on whiteboard in virtual version) stereotypes about men (followed by a list from research which always matches those generated by participants); repeat for women.[68-71]
    - Review of a study demonstrating that people living in the U.S. are also aware of stereotypes about different ethnic and racial groups and listing the stereotypes identified (acknowledging that these may make participants uncomfortable or even be triggering, but emphasizing that awareness of these stereotypes is pervasive).
    - Competency bias – a form of expectancy bias in which members of historically lower status groups are expected to be less competent than members of groups that have typically held positions of high-status or authority. Noting that in our culture, men and individuals with white skin are imbued with higher social status than women and individuals with darker skin. Patients expecting a brand new physician to know more than the nurse working in the clinic/ward for 10 years used as an example.
    - Pause for questions.
    - It is noted that stereotypes persist in the face of disconfirming data; are activated by trivial amounts of information (e.g., skin color, age, accent, dress); distort objective data even when they are not consciously endorsed; create stereotype-advantaged and stereotype-disadvantaged groups.
    - Posited that expectancy bias and competency bias may help explain the findings of gender or race differences in word descriptors in Medical Student Performance Evaluations,[72] multiple studies showing salary differences by gender,[73-75] physicians' assumptions about education attainment of Black and White patients,[76] or physicians' assumptions about adherence to antihypertensive medications by body mass index.[77]
  - Role congruity/incongruity – the "fit" or lack of "fit" between group stereotypes and stereotypes about workplace roles.
    - Concept illustrated by showing that stereotypes about leaders are incongruent with stereotypes about women and Asian people and reflecting back to initial workforce data slides.[43, 71, 78, 79]
    - Point about stereotypes being resistant to disconfirming data illustrated by contrasting stereotypes about leaders with actual research findings on leadership effectiveness.[69, 70, 80-83]
    - Posited that role (in)congruity might contribute to research showing Asian and Black medical students are less likely than White students to be selected to AOA,[84, 85] Black applicants less likely to have their R01s funded than White applicants,[33, 86] female faculty receive lower teaching evaluations than their male counterparts,[87, 88] and employment penalties for men who request family leave.[89]
    - Group exercise in which participants provide examples of role congruity/incongruity in their own workplace experiences (e.g., women physicians being mistaken for nurses; Black physicians being mistaken for housekeeping staff).
  - Reconstructing credentials - Unintentionally adjusting the value of specific credentials to favor an applicant from a stereotype congruent group.
    - From a list of studies demonstrating this concept,[82, 90-94] a pair of experimental hiring studies in one paper are reviewed in more detail.[94]
  - Stereotype priming – exposure to pictures, words, or names that serve as reminders of group stereotypes can activate the entire set of stereotypes about a group and distort subsequent information processing.
    - From a list of studies demonstrating this concept,[95-100] a more detailed presentation of the potential impact of multiple male gendered semantic primes on the outcome of the first NIH Director's Pioneer Award and their subsequent removal.[95, 96]
- Questions taken.

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MODULE 2: BECOMING BIAS LITERATE CONTINUED (82 MINUTES)

- Case study – conducted as a reader's theater with volunteers asked to read various parts of a conversation among faculty colleagues about a new chair of a large department. The conversation contains examples of the 5 bias concepts. Participants discuss the case and identify concepts in pairs or trios for 5 minutes and report back to the group for a facilitated discussion.
- 5-minute break (moved to the end of Module 2 in virtual workshop).
  - Microaggressions (last bias concept in Module 2)– subtle but frequent or persistent comments, behaviors, or environmental cues that communicate hostile and unwelcoming messages towards members of underrepresented groups, even if unintentional.[101-103]
    - Characteristics described as being experienced frequently and persistently, not generally ill-intended but impact the target negatively, often informed by stereotypes and biases.
    - Examples from Sue[102] given with emphasis on the message received (rather than intent).
    - Examples of microaggressions that might be experienced within academic medicine with instruction to imagine what message the target received (2-minute paired discussion for in person and as a whiteboard exercise in virtual workshop). After group report out of discussion, label and definition of the microaggression given: status leveling, failure to differentiate, attribution error, and invalidation.
    - Some recommendations on how to act in the moment or later for those who commit a microaggression, those who witness a microaggression, and those who experience a microaggression.[104-108]
    - Concluding emphasis that it is better to engage than avoid interacting with someone different from you out of fear of committing a microaggression.

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MODULE 3. EVIDENCE-BASED STRATEGIES TO BREAK THE BIAS HABIT (34 MINUTES)

- Introduced by noting that the recommended strategies to practice were selected from a review of a large body of research, are supported by at least one randomized controlled study, and prioritized to have behavioral outcomes.
- Three strategies that do not work reviewed first; participant interaction encouraged before the first two by asking why they would not work before describing research indicating its ineffectiveness.
  - Accepting that everyone has bias – doing so normalizes bias and can lead to increased reliance on stereotyping.[109]
  - Believing oneself to be objective, nonracist, and/or nonsexist – those with such beliefs exhibit greater racial and gender bias than those who recognize the possible influence of bias.[110, 111]
  - Stereotype suppression – while potentially effective during brief moments when significant cognitive resources are devoted to the task, over the long term, when tight mental control is released or interrupted, stereotypes can rebound and exert stronger influence than if they had not been suppressed.[112]
- Four strategies recommended for participants to practice:
  - Recognize, label, and challenge stereotypes – Become intentional in recognizing when you see or hear a stereotype at play, or when you make a stereotyped assumption; label this as a stereotype or as an example of one of the bias concepts discussed; and challenge the stereotype with data and accurate information.
    - Examples include those from the case study and also reference clinical decision-making with advice to avoiding generalizing from a social category rather than examining an individual patient's clinical information.
    - Advice to tune one's ear to listen for whenever someone says "members of some group are…" because the next word will be a stereotype.
  - Recite growth mindset (believing that with hard work and perseverance new behaviors can be learned) and internal motivation (believing that engaging in any behavior is a personal choice) messages – Remind yourself that most people who accept their potential to be influenced by bias and stereotypes commit to working hard to overcome this influence and that with hard work and conscious effort it is possible to overcome unconscious bias in your judgments and decision-making. Focus on your own internal motivation for engaging in this work.
    - Acknowledgement that many participants may have heard of growth mindset from the decades of elegant experimental research from Carol Dweck at Stanford and its relevance to medical education.
    - Brief review of research demonstrating the effectiveness of these strategies in reducing bias and how socially coercive messages increased bias.[109, 113, 114]
    - Example of message to practice drawn from studies provided:
      1) Growth mindset = *The vast majority of people are working hard to overcome the influence of stereotypes and it can be achieved!*
      2) Internal motivation = *I want to practice bias-reducing strategies because working in an environment without bias is enjoyable and good for everyone!*
  - Individuate and perceive variability – Practice seeing each person as a unique individual and focus on the existence of multiple subgroups within any social category.
    - Perceiving variability studies are reviewed in some detail because of the simplicity and effectiveness of the interventions.[115]
      1) Recalling the instruction to tune one's ear, when one hears someone say "[members of some group] are…] they can practice perceiving variability by responding with "some [members of that group] are…others are…and still others are…."
      2) Example of hearing "women physicians want to work part-time" and responding with "some women physicians want to work part-time, some want to work full-time, some want to work 24/7" and perhaps adding "some men would like to work part-time but may be prevented from doing so by social stigma."
  - Practice perspective-taking − Imagining in detail what it is like to walk in the shoes of another person and experience the world as they do.
    - Noted that a large body of experimental research supports the value of this cognitive exercise.
    - Participants reminded that the microaggression exercise focusing on what message is received by the target was an exercise in perspective-taking.

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MODULE 3. EVIDENCE-BASED STRATEGIES TO BREAK THE BIAS HABIT CONTINUED (34 MINUTES)

- Review of a study showing that medical students engaging in a perspective-taking exercise before interacting with a standardized patient were rated significantly better than controls.[116]

- The value of implementation intention (i.e., personal if-then scenarios) in helping individuals change behavior acknowledged.[117-119]
  - Participants engage in a "Commitment to action" in which they write about a specific setting in which they would use some of the bias-reducing strategies and specifically what strategies they would use. A summary of these Commitments to action is sent to all members of the division within a week of the division's workshop.
  - For each division, these strategies were compiled and sent to all members of the division within one week of the workshop.
- Group re-convenes for final words reminding them that breaking any habit requires hard work, but can be achieved and the tools provided should help participants be successful (collectively encouraging a growth mindset).
- Evaluation of workshop requested (evaluation form in folder or via link).

[a] For in person workshops participants received a folder with the consent form; the case study; a bibliography; a lexicon with definitions of the bias concepts; a resource list for microaggressions; an evaluation form; a pocket card with a list of bias concepts on one side and bias-reducing strategies on the other side; a BRIM pen; and a pad of sticky notes that repeated a growth mindset message, an internal motivation message, and reminders to engage in perspective taking and look for and remove stereotype primes in one's work place. For virtual workshops participants were given links to the handouts from the agenda and in the chat window at the appropriate time during the workshop; pocket cards and sticky notes were sent to each site for distribution to participants.

[b] Average module times combine timing for both in-person and virtual workshops, and include breaks that fall within a module. Four minutes are lost due to starting late/ending early.

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Supplemental Digital Appendix 2

Bias Awareness and Intentional Behavioral Change Outcome Variables

Category	Outcome variable	Description	Items in survey[a]
Bias Awareness	Personal bias vulnerability	Perceived vulnerability to personally engage in biased thoughts or actions	1. I could unintentionally behave in biased ways towards URM[b] 2. I could unintentionally behave in biased ways towards women 3. I could unintentionally behave in biased ways towards any minority[c]
	Bias rejection	Disbelief in concepts or effects of implicit bias on others	1. URM[b] are overly sensitive about unintended offenses 2. Women are overly sensitive about unintended offenses 3. Any minority[c] are overly sensitive about unintended offenses
	Denial of bias in personal decision-making	Belief in one's personal objectivity	1. Stereotypes rarely affect my clinical decision-making in patient care 2. Stereotypes rarely impact hiring decisions I make in my division
	Witnessing bias in others	Awareness of implicit bias in others	1. I notice when others exhibit bias towards URM[b] 2. I notice when others exhibit bias towards women 3. I notice when others exhibit bias towards any minority[c]
	Societal benefit	Perceived benefit to society for promoting bias reduction actions	1. I consider discrimination against URM[b] to be a serious social problem 2. I consider discrimination against women to be a serious social problem 3. I consider discrimination against any minority[c] to be a serious social problem
	Disciplinary bias	Awareness of implicit bias in one's field, division, or discipline	1. Discrimination is a serious problem in my division 2. Unintentional bias is a serious problem in my division

(continued)			
Category	**Outcome variable**	**Description**	1. **Items in survey**[a]
Intentional Bias-Reducing Behavioral Change	General motivation	Desire to engage in bias reduction activities	2. I want to recognize when bias is occurring during an interpersonal interaction 3. I want to speak about equity and diversity in my workplace to my colleagues 4. I want to challenge a personnel decision if I think it has been influenced by stereotypes 5. I want to challenge a clinical decision if I think it has been influenced by stereotypes 6. I want to intervene if I witness a student, resident, fellow, or colleague being treated in a biased way 7. I want to assess my office décor, clinic décor, division website, and/or teaching materials for language or images the reinforce negative stereotypes 8. I want to adopt the perspective of a student/resident/colleague who is a minority group member 9. I want to become better acquainted with a person whose background is different from my own
	Internal motivation	Motivation to promote bias reduction based on one's internal beliefs	1. When I promote equity in my division, I do so because of my personal values
	External motivation	Motivation to promote bias reduction based on concerns of appearing biased to others	1. I only go along with my division's diversity goals because everybody else is

(continued)			
Category	**Outcome variable**	**Description**	**Items in survey[a]**
(Intentional Bias-Reducing Behavioral Change)	Bias reduction self-efficacy	Confidence in being able to enact bias-reducing behaviors	1. I am confident I can recognize when bias is occurring during an interpersonal interaction 2. I am confident I can speak about equity and diversity in my workplace to my colleagues 3. I am confident I can challenge a personnel decision if I think it has been influenced by stereotypes 4. I am confident I can challenge a clinical decision if I think it has been influenced by stereotypes 5. I am confident I can intervene if I witness a student, resident, fellow, or colleague being treated in a biased way 6. I am confident I can assess my office décor, clinic décor, division website, and/or teaching materials for language or images the reinforce negative stereotypes 7. I am confident I can adopt the perspective of a student/resident/colleague who is a minority group member I am confident I can become better acquainted with a person whose background is different from my own
	Negative outcome expectations (risks of acting)	Feeling it would be personally risky to engage in bias reduction activities in one's division	1. It would be risky for me to recognize when bias is occurring during an interpersonal interaction 2. It would be risky for me to speak about equity and diversity in my workplace to my colleagues 3. It would be risky for me to challenge a personnel decision if I think it has been influenced by stereotypes 4. It would be risky for me to challenge a clinical decision if I think it has been influenced by stereotypes 5. It would be risky for me to intervene if I witness a student, resident, fellow, or colleague being treated in a biased way 6. It would be risky for me to assess my office décor, clinic décor, division website, and/or teaching materials for language or images the reinforce negative stereotypes 7. It would be risky for me to adopt the perspective of a student/resident/colleague who is a minority group member 8. It would be risky for me to become better acquainted with a person whose background is different from my own

(continued)			
Category	**Outcome variable**	**Description**	**Items in survey[a]**
(Intentional Bias-Reducing Behavioral Change)	Positive outcome expectations (benefits of acting)	Feeling it would be personally beneficial to engage in bias reduction activities in one's division	1. It would benefit me to recognize when bias is occurring during an interpersonal interaction 2. It would benefit me to speak about equity and diversity in my workplace to my colleagues 3. It would benefit me to challenge a personnel decision if I think it has been influenced by stereotypes 4. It would benefit me to challenge a clinical decision if I think it has been influenced by stereotypes 5. It would benefit me to intervene if I witness a student, resident, fellow, or colleague being treated in a biased way 6. It would benefit me to assess my office décor, clinic décor, division website, and/or teaching materials for language or images the reinforce negative stereotypes 7. It would benefit me to adopt the perspective of a student/resident/colleague who is a minority group member 8. It would benefit me to become better acquainted with a person whose background is different from my own
	Taking action to reduce bias	Acting on a regular basis to promote bias reduction activities in one's division	1. I recognize when bias is occurring during an interpersonal interaction on a regular basis 2. I speak about equity and diversity in my workplace to my colleagues on a regular basis 3. I challenge a personnel decision if I think it has been influenced by stereotypes on a regular basis 4. I challenge a clinical decision if I think it has been influenced by stereotypes on a regular basis 5. I intervene if I witness a student, resident, fellow, or colleague being treated in a biased way on a regular basis 6. I assess my office décor, clinic décor, division website, and/or teaching materials for language or images the reinforce negative stereotypes on a regular basis 7. I adopt the perspective of a student/resident/colleague who is a minority group member on a regular basis 8. I become better acquainted with a person whose background is different from my own on a regular basis

[a]Response Options 1-7: Strongly Disagree, Disagree, Slightly Disagree, Neither Disagree nor Agree, Slightly Agree, Agree, Strongly Agree

[b]Actual survey used the phrase "individuals from racial/ethnic minority groups" (abbreviated that as "URM" in this table.)

[c]Actual survey used the phrase "individuals from any minority group as described above" (abbreviated that as "any minority" in this table.)

Supplemental Digital Appendix 3
Division Climate Outcome Variables

Outcome Variable	Description	Items in survey
Satisfaction with climate in division[a]	Satisfaction with division leadership's management of climate and being a member of the division	1. How often are you treated with respect by your division chief? 2. How satisfied are you with your division head's efforts to create a collegial and supportive environment? 3. How satisfied are you with being a member of your division?
Climate for underrepresented persons[b]	How do members of specific underrepresented groups experience climate in the division	1. In my division, the climate for women is … 2. In my division, the climate for racial/ethnic minority group members is … 3. In my division, the climate for lesbian, gay, bisexual, and/or transgender (LGBT) individuals is … 4. In my division, the climate for persons with disabilities is very …
Feeling work is valued in the division[c]	Colleagues and others value my work in different areas	1. How much do your colleagues value your research? 2. How much do your colleagues value your clinical work? 3. How much do your colleagues value your teaching?
Feeling respected in the division[a]	Colleagues and others in the workplace respect me	1. How often are you treated with respect by colleagues? 2. How often are you treated with respect by patients? 3. How often are you treated with respect by others in the workplace?
Priming for implicit bias in the workplace[a]	The presence of images and language that reinforce stereotypes in the environment	1. How often do you hear jokes or sarcastic comments about diversity and inclusion from your colleagues? 2. How much do the images or words used in the common areas in your division, including clinical spaces, reinforce stereotypes?
Burnout[a]	Exhaustion related to work stress or environment	1. How often do you feel overwhelmed by your job?
Respectful division meetings[a]	Respectful interactions in division meetings	1. How often are interactions in your division meetings respectful?
Discussion of bias[a]	Division openly discusses issues of bias within its practices and procedures	1. How often has your division engaged in explicit discussion of potential biases in division processes, such as admissions, hiring, promotion, award nominations?
Ideas valued in division meetings[a]	Feeling of ideas being valued when speaking in meetings	1. How often are your ideas valued when you talk in meetings?
Work/life balance[c]	Comfort raising personal issues in work-related contexts	1. How comfortable are you in raising personal and family responsibilities when scheduling division obligations?
Feeling of "fit"[c]	Feeling that one "fits" in one's division	1. How well do you fit into your division?
Overall climate[b]	General sense of climate in the division	1. In my division, the overall climate is …

[a]Response Options 1-6: Never, Rarely, Sometimes, Often, Very often, Not applicable
[b]Response Options 1-5: Very negative, Negative, Neutral, Positive, Very positive
[c]Response Options 1-6: Not at all, A little, Somewhat, Very, Extremely, Not applicable

Supplemental Digital Appendix 4
Demographic Variables

Variable	Description	Items in survey
Female	Female or woman-identified gender identity	What gender do you identify with? *Male/Female/Prefer to self-describe*
Any Minority	Member of a "minority group" defined as: "… a group that historically has not been well-represented in your division such as racial/ethnic underrepresented groups, LGBT persons, persons with disabilities, women or men in specific clinical areas or division roles, etc."	If you consider yourself to be a member of a "minority group" as defined earlier in this survey, please check all identity groups that apply: *racial minority / ethnic minority / person with a disability / Non-U.S. citizen / LGBT / woman in male-dominated workgroup / man in female-dominated workgroup / religious minority / U.S. Veteran / prefer to self-identify*
MD	Has an MD or DO credential	Your credentials (check all that apply): *MD or DO / PhD / MD-PhD / Other, Write-in*

Supplemental Digital Appendix 5

Intracluster Correlations Coefficients

Dependent Variables	Intracluster correlation coefficient (SE) [95% Confidence Interval]
Bias Awareness	
Personal bias vulnerability	0.054 (0.009) [0.040 to 0.074]
Witnessing bias in others	0.011 (0.005) [0.005 to 0.025]
Societal benefit	0.024 (0.006) [0.015 to 0.038]
Bias rejection	0.034 (0.007) [0.023 to 0.050]
Denial of bias in decision-making	0.026 (0.006) [0.017 to 0.040]
Disciplinary bias	0.069 (0.011) [0.051 to 0.092]
Motivation	
General motivation	0.035 (0.007) [0.024 to 0.051]
Internal motivation	0.004 (0.004) [0.001 to 0.024]
External motivation	0.016 (0.005) [0.008 to 0.029]
Bias reduction self-efficacy	0.016 (0.005) [0.008 to 0.031]
Negative outcome expectation	0.021 (0.006) [0.012 to 0.036]
Positive outcome expectation	0.030 (0.006) [0.017 to 0.042]
Taking action to reduce bias	0.020 (0.006) [0.012 to 0.036]
Climate	
Respectful division meetings	0.067 (0.010) [0.049 to 0.091]

Supplemental Digital Appendix 6

Divisions Within Departments of Medicine Eligible for Randomization

The labels in capital letters are the acronyms we used for randomization. The local name of the division varied (e.g., CAR may have been called Cardiology or Cardiovascular Medicine, ENDO may have been called Endocrinology or Endocrinology and Metabolism, and GASTRO may have been called Gastroenterology or Gastroenterology and Hepatology). The divisions represent the clinical subspecialties of internal medicine, but divisions also generally contained PhD scientists on their faculty and some included advanced practice providers on their faculty. All individuals designated by a division as faculty were surveyed and invited to the workshop. Some departments had divisions not uniformly found within departments of medicine such as Epidemiology, Medical Genetics, or Dermatology. In these cases, the divisions were not randomized. Their faculty were surveyed but their data were not included in the study. These divisions were offered workshops with divisions randomized to the waitlist control group after the experimental study was concluded (i.e., following the 3-month follow-up survey). Workshops to these divisions and the waitlist control divisions were presented by individuals at the local site as part of the faculty development curriculum to prepare them to deliver the BRIM workshop.

1. ALLERGY – Designation for a distinct division of Allergy. If Allergy was combined with another division, it was included with the larger division. For example, if Allergy was combined with Pulmonary Medicine, we labeled the division PULM.
2. CAR – Division in which cardiologists were located.
3. ENDO – Division in which endocrinologists were located.
4. GASTRO – Division in which gastroenterologists were located.
5. GERI – Designation for a distinct division of Geriatrics; if Geriatrics was combined with General Internal Medicine, it was included with GIM.
6. GIM – Division of General Internal Medicine. If GIM also included Hospital Medicine, Geriatrics, and/or Palliative Care; the whole division was randomized as GIM.
7. HEME – Used for sites that had a separate division of Hematology in which hematologists were located.
8. HOSP – Division in which hospitalists were located.
9. ID – Division in which infectious disease physicians were located.
10. NEPH – Division in which nephrologists were located.
11. ONC – Division in which oncologists were located; usually combined with Hematology and sometimes with Palliative Care.
12. PULM – Division in which pulmonologists and critical care physicians were located.
13. RHEUM – Division in which rheumatologists were located.

Supplemental Digital Appendix 7

Sites Participating in the Bias Reduction in Internal Medicine (BRIM) Study (Alphabetical)

1. Beth Israel Deaconess Medical Center
2. Boston University
3. Brown University
4. Indiana University
5. Johns Hopkins University
6. Northwestern University
7. Tufts University
8. University of Colorado-Denver
9. University of Florida
10. University of Illinois-Chicago
11. University of Minnesota
12. University of Pittsburgh
13. University of Rochester
14. University of Texas Southwestern
15. University of Utah
16. University of Virginia
17. University of Washington
18. University of Wisconsin-Madison
19. Washington University in St. Louis

Supplemental Digital Appendix 8

Additional Information on How Demographic Information Was Collected

Collection of demographic information for randomization of clusters into intervention and control groups.
Demographic characteristics of divisions were provided by the departments, who used their internal human resources systems to calculate the percentages of women, white people, MDs, non-tenure-track faculty, and junior faculty for each division. Because different departments of medicine coded race/ethnicity, employment track, and rank differently, we used definitions that were most likely to be tracked by all departments (e.g., "white" would always be a racial/ethnic category, whereas a category such as "Hispanic" might be defined differently at different institutions.)

Collection of demographic information for survey respondents.
We ascertained self-reported respondent demographic characteristics with three items. Using the terms gender and sex interchangeably in our survey, female sex was assigned if a respondent selected "female" gender identity or indicated a self-reported identity that was feminine/female/woman (e.g., trans woman.) "Any minority" status was assigned if a respondent identified in any of nine categories, including but not limited to racial/ethnic minority groups, that are typically underrepresented in academic medicine. We did not ask respondents to report any specific racial/ethnic category in order to reduce the chances that respondents could be identified and therefore provide a sense of safety when filling out the surveys. Our concern was underscored when we were repeatedly contacted by members of divisions who wanted to be assured of their inability to be identified before they competed the survey. MD status was noted if a respondent selected "MD or DO" as their credential. See Supplemental Digital Appendix 5 for detailed items.

Supplemental Digital Appendix 9

Methods for Analysis of Primary Outcomes and Exploratory Analyses

Model specifications

To estimate the effect of workshop, we considered a general model specification (multilevel model or linear mixed-effect model) as follows:

$$Y_{tiju} = \beta_1 + \beta_2 Intervention_{ju} + \beta_3 Time_{tiju} + \beta_4 Intervention_j * Time_{tiju} + \beta_5 Division_{ju} + \beta_6 Individual_{iju} + \sigma_{ju} + \omega_u + \epsilon_{tiju} \quad (1)$$

where Y_{tiju} is a faculty member i ($i = 1, \dots, n$)'s, in the j ($j = 1, \dots, 204$) division of the u ($u = 1, \dots, 19$) department, outcome measure at the pre- or post-survey ($t = 1, 2$). $Intervention_{ju}$ indicates the intervention status of division (cluster; intervention group vs. control group). $Time_{tiju}$ indicates the time point of outcome measurement (pre- or post-) that a faculty member responded. $Intervention_j * Time_{tiju}$ is an interaction term of intervention status with time point, which indicates the workshop effect. $Division_{ju}$ is a list of division-level (cluster) characteristics including the number of faculty, % female, % white, % MD, % non-tenure track faculty, and % Junior faculty. $Individual_{iju}$ is a list of individual-level characteristics including gender (male vs. female), race/ethnicity (majority vs. any minority), and credential (MD vs. non-MD). σ_{ju} represents a division (cluster) random effect; ω_u represents a department (university) random effect; ϵ_{tiju} represents the residual error term.

In this specification, β_2 and β_3 are main effects for the intervention status and time. β_4 indicates the point estimate of workshop effect, that is the outcome's mean difference of division between intervention and control groups over time (pre- and post-), which were reported in Table 3. β_5 and β_6 are a list of estimated coefficients for covariates.

Three-way interactions models

To test if the workshop effect differs by the type of workshop (in-person vs. virtual), we specified three-way interaction models by including a three-way interaction term – treatment status * time (pre- vs. post-) * type of workshop (in-person vs. virtual) – with relevant main effect and two-way interaction terms: main and interaction terms in model (1) above were replaced with main effect, two-way, and three-way interaction terms in model (2) as follows:

$$Y_{tiju} = \cdots + \beta_2 Intervention_{ju} + \beta_3 Time_{tiju} + \beta_4 Workshop\_Type_u + \beta_5 Intervention_j * Time_{tiju} + \beta_6 Time_{tiju} * Workshop\_Type_u + \beta_7 Intervention_j * Workshop_{Type_u} + \beta_8 Intervention_j * Time_{tiju} * Workshop\_Type_u + \dots \quad (2)$$

where $Workshop\_Type_u$ indicates the type of workshop (in-person vs. virtual). β_2, β_3, and β_4 are the coefficients of main effects for intervention status, time, and the type of workshop, respectively. β_5, β_6, and β_7 are the coefficients of two-way interaction terms among main effects. β_8 represents a point estimate that tests if the workshop effect differs by the type of workshop (in-person vs. virtual).

Subgroup Analyses

As exploratory analyses, we conducted a series of subgroup analyses to test differences in workshop effects between intervention and control groups by faculty gender (male vs. female), race/ethnicity (majority vs. any minority), credential (MD vs. non-MD), and the sector of institution (private vs. public).

Model (1) was estimated in each sample of subgroups and the workshop effect for each subgroup was compared. Model (2) was utilized to test whether the workshop effect between intervention and control groups differ by each subgroup by replacing interaction terms in the model (2) with relevant interaction terms (e.g. Intervention * Time * Gender instead of Intervention * Time * Workshop_Type, etc).

Intracluster correlations

We used 20 imputed datasets created from a multiple imputation technique to estimate the workshop effect in models (1) and (2). There is not a clear consensus to calculate the intracluster correlation using multiply imputed datasets. Thus, here, we provide the intracluster correlation with SE and 95% confidence intervals calculated from the final dataset (20^{th} dataset in the 20 datasets), rather than averaging it over imputed datasets.

Missingness

Most major outcomes' missingness ranged from 4% to 9%, which is not unusual in any longitudinal survey. Internal motivation and a few divisions' climate-related items had relatively larger number of missing cases (around 12–13%). This could be an item order effect on missingness with later items more likely to be skipped due to medical faculty's time constraints. To test the robustness of our findings for variation in the missing responses across outcomes, we did supplementary analyses in which we repeated our major analyses with a sample of non-missing cases to the largest missing item (e.g., internal motivation; that is, we excluded non-respondents to internal motivation item from analyses on other outcome measures). We found no substantial change of our findings across analyses on our major outcomes. Thus, we believe that some variation in the number of missing responses across outcomes did not affect our major findings.

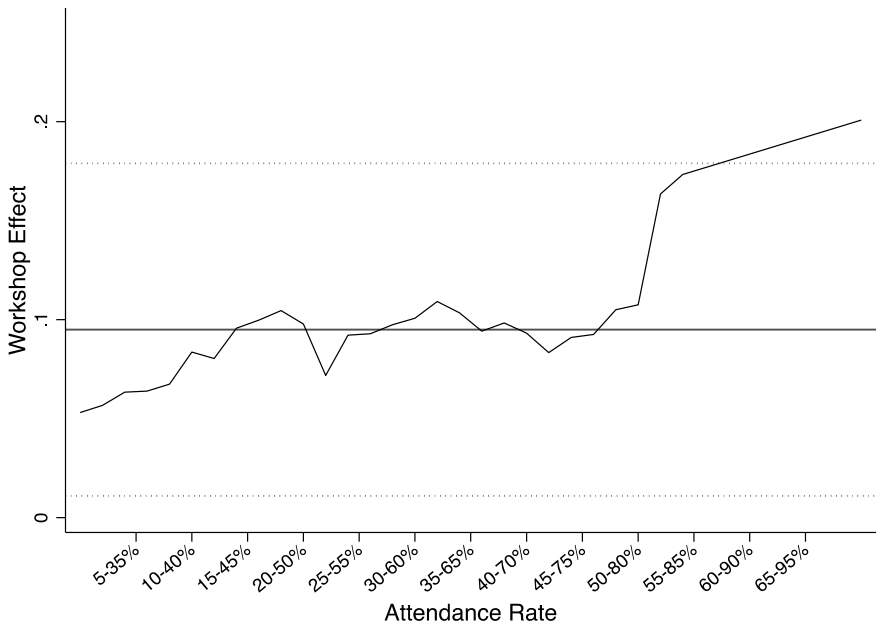
For composite variables, we followed the 'rowmean' approach in which we calculated the (row) means of the items in the list, ignoring missing values. That is, if one item was missing in the list (e.g. 8 items), the (row) means were calculated from the remaining items (e.g. 7 items). Our supplementary analyses on the listwise deletion (excluding respondents with any missing item) found no substantial difference in our findings from the 'rowmean'. While we included dependent variables in our multiple imputation (MI) models to create 20 complete datasets, imputed values (cases) for dependent variables were excluded in the analysis (von Hippel, Regression with Missing Ys: An Improved Strategy for Analyzing Multiply Imputed Data. 2007, *Sociological Methodology*, 37: 83–117. doi:10.1111/j.1467-9531.2007.00180.x)

Supplemental Digital Appendix 10

Exploratory Dose-Response Analyses on Workshop Attendance Rate

Our intervention was defined as a 3-hour workshop. Due to the nature of our experimental design, resources, and cost; it was not feasible to define a length of workshop (e.g., 1hr vs. 3hrs vs. 6hrs workshops) or the frequency of workshops as a dosage to our outcomes. Instead, we defined the workshop attendance rate as a dosage; that is, what proportion of faculty members within a division were directly exposed to the workshop, and examined the relationship between the workshop attendance rate and the outcome. However, there are major limitations for this approach due to the small number of divisions (clusters) in our study. Only 102 divisions in our intervention group were distributed across a continuous scale of workshop attendance rate (ranged from 3% to 86%), which would, inevitably, result in excessive extrapolation, large standard errors, and computational problems in some linear mixed regression models (i.e., subgroup analyses).

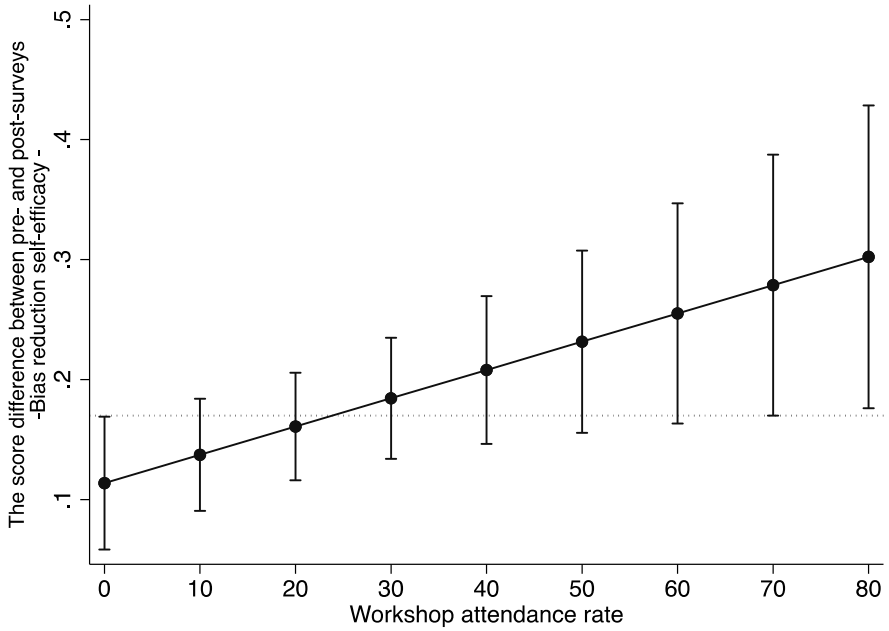
Thus, rather than testing the significant dosage level by relying on inaccurate estimation, we descriptively explored the reasonable range of attendance rate that could lead to desirable workshop outcomes through two exploratory approaches. First, we illustrated the workshop effect by attendance rate – a consecutive range (eFigure 10.1). To do this illustration, we estimated each workshop effect from a series of subgroups (e.g., control group vs. intervention groups with attendance rate of 5-35%, 10-45%, …). For stable and smoothing effects, we set a range of workshop attendance rate by 30% for each subgroup (e.g. divisions with attendance rate of 5-35%) and did a series of subgroup analyses by 2% (e.g. 5-35%, 7-37%, 9-39%, 11-41%, …, 65-90%) using our major model specifications. Then, we visualized a series of workshop effects by these subgroups.



eFigure 10.1. Workshop effects on bias reduction self-efficacy by a range of attendance rate

In eFigure 10.1, we present the predicted workshop effect on bias reduction self-efficacy by subgroups with a consecutive range of attendance rate. The horizontal line x indicates the average point-estimate of workshop effect (b = 0.097) and dotted lines indicate the lower and upper bounds of the 95% confidence interval [0.010 to 0.184] (see Table 3 Bias reduction self-efficacy). While the workshop effect fluctuated a bit across the attendance rate, it generally increased as more faculty members within a division attended the workshop. In particular, the workshop effects for divisions whose attendance rate was higher than 20-30% were very close to the average workshop effect in this study. In addition, there was a big leap for divisions in which more than 50% of faculty members attended our workshop.

Second, we also estimated the predicted difference in pre- and post-survey outcomes across divisions' workshop attendance rates (eFigure 10.2). In this approach, we estimated a linear mixed regression of outcomes on the interaction of attendance rate with time (pre, post) and relevant covariates - we found a linear relationship between attendance rate and time was significant while a quadratic relationship was not significant.



eFigure 10.2. The contrast of predictive margins of pre- and post-surveys on bias reduction self-efficacy by workshop attendance rate

Y-axis indicates the score difference in outcome (bias reduction self-efficacy) between pre- and post-survey. The score difference (the contrast of predictive margins) and 95% confidence intervals at the attendance rate = 0 indicate the difference between pre- and post-survey for divisions in the control group (no workshop), which are the reference difference and confidence intervals to compare with divisions in the intervention group (attendance rate > 0). Similar to eFigure 10.1, score differences increased as the attendance rate was increasing. In particular, the score difference and 95% confidence intervals overlapped less with those of control groups when divisions' attendance rate reached at 30 - 40%.

Results of personal bias vulnerability and taking action to reduce bias were similar to bias reduction self-efficacy, while respectful division meetings (climate) showed no clear pattern. Even though we could not implement a rigorous dose-response analysis due to the limitations of research design and data in our study, these exploratory analyses suggest that an attendance rate of approximately 30% or more is recommended for an effective workshop and more than 50% would be ideal for the best outcome of the workshop.