



## Promising Practices for Addressing the Underrepresentation of Women in Science, Engineering, and Medicine: Opening Doors

Despite decades of research, funding, and programs dedicated to increasing the representation of women in science, engineering, technology, mathematics and medicine (STEMM), the numbers, particularly in leadership roles have remained low or stagnant in many fields, particularly among women of color. Without diverse voices and perspectives in these fields, the scientific enterprise is limiting its potential for innovation—vital to contributing to the continued prosperity, health, and well-being of the United States. The evidence indicates that underrepresentation of women in STEMM is driven by a wide range of structural, cultural, and institutional patterns of bias, discrimination, and inequity that do not affect men of comparable ability and training.

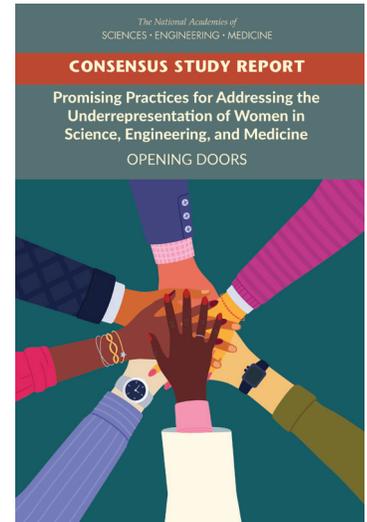
*Promising Practices for Addressing the Underrepresentation of Women in Science, Engineering, and Medicine: Opening Doors* addresses this critical topic by synthesizing the current research on the factors that drive gender disparities in recruitment, retention, and advancement across a range of disciplines and throughout the educational and career life course; examining research on effective evidence-based strategies and practices; and exploring why these interventions have not been scaled up or adopted by more institutions. The recommendations described below offer guidance to leaders from multiple sectors on how to move forward with intentional, evidence-based strategies and policies to improve recruitment, retention, and advancement of women in STEMM.

### WHAT DO WE KNOW ABOUT THE UNDERREPRESENTATION OF WOMEN IN STEMM?

There is an abundance of research, including decades of National Academies' reports, that describe barriers women face in STEMM. The current report builds on this knowledge and provides six major conclusions related to what we know about the recruitment, retention, and advancement of women in STEMM fields.

**Conclusion 1:** Although the absolute number of women earning degrees across science, engineering, and medical fields has increased in recent years, women—especially women of color—are underrepresented relative to their presence in the workforce and the U.S. population. National patterns of underrepresentation vary by career stage, race and ethnicity, and discipline.

**Conclusion 2:** Bias, discrimination, and harassment are major drivers of the underrepresentation of women in science, engineering, and medicine; they are often experienced more overtly and intensely by women of intersecting identities (e.g., women of color, women with disabilities, LGBTQIA women).



**Conclusion 3:** While some institutions have seen improvements in the representation of women in science, engineering, and medical education and careers, national patterns of underrepresentation are still prevalent at most institutions, especially for women of color.

**Conclusion 4:** There are numerous effective, evidence-based strategies and practices that institutions can adopt to improve the recruitment, retention, and advancement of White women across a broad range of scientific, engineering, and medical disciplines and multiple stages of the educational and career pathway. However, additional investigation is needed specifically to understand how to support more effectively the participation of women of color and women of other intersecting identities, in science, engineering, and medicine.

**Conclusion 5:** Improving recruitment and retention of women in STEMM throughout their education and training is important, particularly in mathematics-intensive fields such as computer science and engineering. Educational strategies that challenge stereotypes about the essential attributes of a successful STEMM professional and about the nature of work in STEMM can increase interest, improve performance, and instill a sense of belonging in these fields among White women, women of color, and other underrepresented groups (e.g., first-generation college students and men of color).

**Conclusion 6:** Both research literature and the findings of focus groups that were carried out by the independent non-profit research institute RTI International on behalf of this study point to a common set of conditions that support institutional adoption of practices to improve the recruitment, retention, and advancement of women, including:

- Committed leadership at all levels, especially from those in positions of authority (such as policy makers, college and university presidents and deans, and individual faculty that manage training programs and large laboratories) who can implement, allocate resources toward, and monitor progress on new policies and strategies that close the gender gap.
- Dedicated financial and human resources—including new or re-directed funds and appropriately compensated individuals in positions of power and authority whose work is dedicated toward opening doors to opportunity and success for women.
- Accountability and data collection—especially when used as a tool to inform and incentivize progress.
- Adoption of an intersectional approach that explicitly and concretely addresses the challenges faced by women of color and other groups who encounter multiple, cumulative forms of bias and discrimination.

## SELECT RECOMMENDATIONS

The following recommendations are grouped into four categories, which are targeted at incentivizing and informing the broad adoption of evidence-based promising practices for improving the recruitment, retention, and advancement of women in science, engineering, and medicine: (I) Driving transparency and accountability to drive behavior change; (II) Adopting data-driven approaches to address underrepresentation of women in STEMM (III) Rewarding, recognizing, and resourcing equity, diversity, and inclusion efforts; (IV) Filling critical knowledge gaps. Importantly, the recommendations are not aimed at “fixing the women,” but instead focus on changing the culture through systemic actions. Described in the report are a series of implementation actions aligned with each high-level recommendations.

It is important to acknowledge that these four broad categories, in fact, distinct, but are fundamentally interconnected components of a complex system of actors, incentives, and information (see Figure 1). The recommendations are intended to support such systemic change through an interconnected process with three main components:

**Drivers:** Transparency and accountability; rewards, resources, and recognition; and committed leadership, can provide positive and negative incentives that increase the likelihood that institutions will take action and adopt a change process.

**Change Process:** Addressing the underrepresentation of women in STEMM in academia requires a four step change process consisting of four stages: (1) an institution, school, or department collects, analyzes and monitors quantitative and qualitative data to first diagnose the particular issues they are having with recruitment, retention, and advancement of white women and women of color; (2) institutional leaders take action to address their shortcomings at the program, school, or department level by drawing upon the existing research and practice to adopt or adapt targeted, evidence-based approaches; (3) the institution, school, or department repeats the data collection and monitoring to determine whether the treatment has been effective or whether it is time to try a new approach; and (4) leaders formally institutionalize effective practices through policy changes so they can sustain transitions in leadership, budget fluctuations, and other potential disruptors.

**Iteration over Time:** The goal of the change process is to move from the status quo to a more diverse, equitable, and inclusive STEMM enterprise. To achieve this, institutions must invest in an iterative cycle of action and evaluation that supports the development and, ultimately, institutionalization of effective strategies and practices.

The interconnected and mutually reinforcing recommendations from  
*Promising Practices for Addressing the Underrepresentation of Women in Science, Engineering, and Medicine*

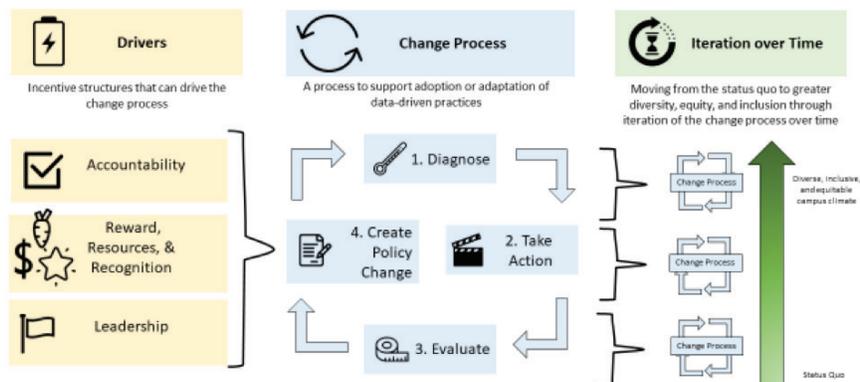


FIGURE 1 Improving the recruitment, retention, and advancement of women in STEM will require systemic change driven through the actions of a range of stakeholders.

In addition to high-level recommendations, the report includes a series of implementation actions for each recommendation that are designed to provide stakeholders with specific, practical advice.

## I. DRIVING TRANSPARENCY AND ACCOUNTABILITY

Increasing public transparency and accountability in federal agencies and universities will be critical to driving change around the representation of women in STEM and in moving toward a more equitable, diverse, and inclusive scientific, engineering, and medical workforce. Recommendations around improving transparency and accountability include:

### RECOMMENDATION 1

The legislative and executive branches of the U.S. government should work together to increase transparency and accountability among federal agencies by requiring data collection, analysis, and reporting on the nature, impact, and degree of investment in efforts to improve the recruitment, retention, and advancement of women in STEM, with an emphasis on existing efforts that take an intersectional approach.

### RECOMMENDATION 2

Federal agencies should hold grantee institutions accountable for adopting effective practices to address gender disparities in recruitment, retention, and advancement and carry out regular data collection to monitor progress.

## II. TARGETED, DATA-DRIVEN INTERVENTIONS BY COLLEGES AND UNIVERSITIES

Addressing the underrepresentation of women in STEM in academia requires a change process as described above (see Figure 1), rather than a single blueprint for action. Given that institutions vary widely, a particular strategy may work well at one institution and be ineffective at another. Institutions may adopt or adapt the strategies and practice outlined here and iterate over time to develop an approach that will work well for their particular institution and the people it serves.

### RECOMMENDATION 3

College and university deans and department chairs should annually collect, examine, and publish data on the number of students, trainees, faculty, and staff, disaggregated by gender and race/ethnicity, to understand the nature of their unit's particular challenges with the recruitment, retention, and advancement of women and then use this information to take action.

### RECOMMENDATION 4

College and university administrators should dedicate resources to carry out qualitative research on the climate in the school or department and the experiences of underrepresented groups and use this information to shape policies and practices aimed at promoting an inclusive climate and supporting underrepresented groups enrolled or employed at the institution.

### RECOMMENDATION 5

Taking into account the institutional context, college and university presidents, deans, department chairs, and other administrators should adopt or adapt actionable, evidence-based strategies and practices that directly address particular gender gaps in

recruitment, retention, and advancement of women in science, engineering, and medicine within their institution, as observed by quantitative and qualitative data analysis and monitoring.

#### **RECOMMENDATION 6**

Federal agencies should support efforts and research targeted at addressing different profiles of underrepresentation in particular scientific, engineering, and medical disciplines throughout the educational and career life course.

### **III. PRIORITIZE, RECOGNIZE, REWARD, AND RESOURCE**

A culture change is needed in academia and governmental institutions around diversity and an inclusive scientific, engineering, and medical enterprise. Described below are recommendations that address the need to sustainably allocate resources and authority to the leaders of equity, diversity, and inclusion efforts, while providing positive incentives for faculty.

#### **RECOMMENDATION 7**

Leaders in academia and scientific societies should put policies and practices in place to prioritize, reward, recognize, and resource equity, diversity, and inclusion efforts appropriately.

#### **RECOMMENDATION 8**

Federal agencies and private foundations should work collaboratively to recognize and celebrate colleges and universities that are working to improve gender equity.

### **IV. FILLING KNOWLEDGE GAPS**

Despite a wealth of research on this topic, there continues to be critical knowledge gaps that must be filled to support most effectively the improved recruitment, retention, and advancement of all women in science, engineering, and medicine, including those described below.

#### **RECOMMENDATION 9**

Although scholarly research on gender disparities in science, engineering, and medicine has yielded an abundance of information that can be applied toward reaching gender equity, critical knowledge gaps remain and require very close attention. For example, there are gaps related to the intersectional experiences of women of color, women with disabilities, LGBTQIA women, and women of other intersecting identities (e.g., age). This also includes strategies and practices that can support improved recruitment, retention, and advancement of women of color and women of other intersecting identities. Other specific priority research gaps are described in the report.

The recommendations above, if implemented, offer a well-defined path forward to improve the recruitment, retention, and advancement of women in STEMM fields.

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**For More Information...** This Consensus Study Report Highlights was prepared by the Committee on Women in Science, Engineering, and Medicine based on the Consensus Study Report *Promising Practices for Addressing the Underrepresentation of Women in Science, Engineering, and Medicine: Opening Doors* (2020). The study was sponsored by the National Institutes of Health, the National Science Foundation, and L’Oreal USA. Any opinions, findings, conclusions, or recommendations expressed in this publication do not necessarily reflect the views of any organization or agency that provided support for the project. Copies of the Consensus Study Report are available from the National Academies Press, (800) 624-6242; <http://www.nap.edu>.

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## **Policy and Global Affairs Committee on Women in Science, Engineering, and Medicine**

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