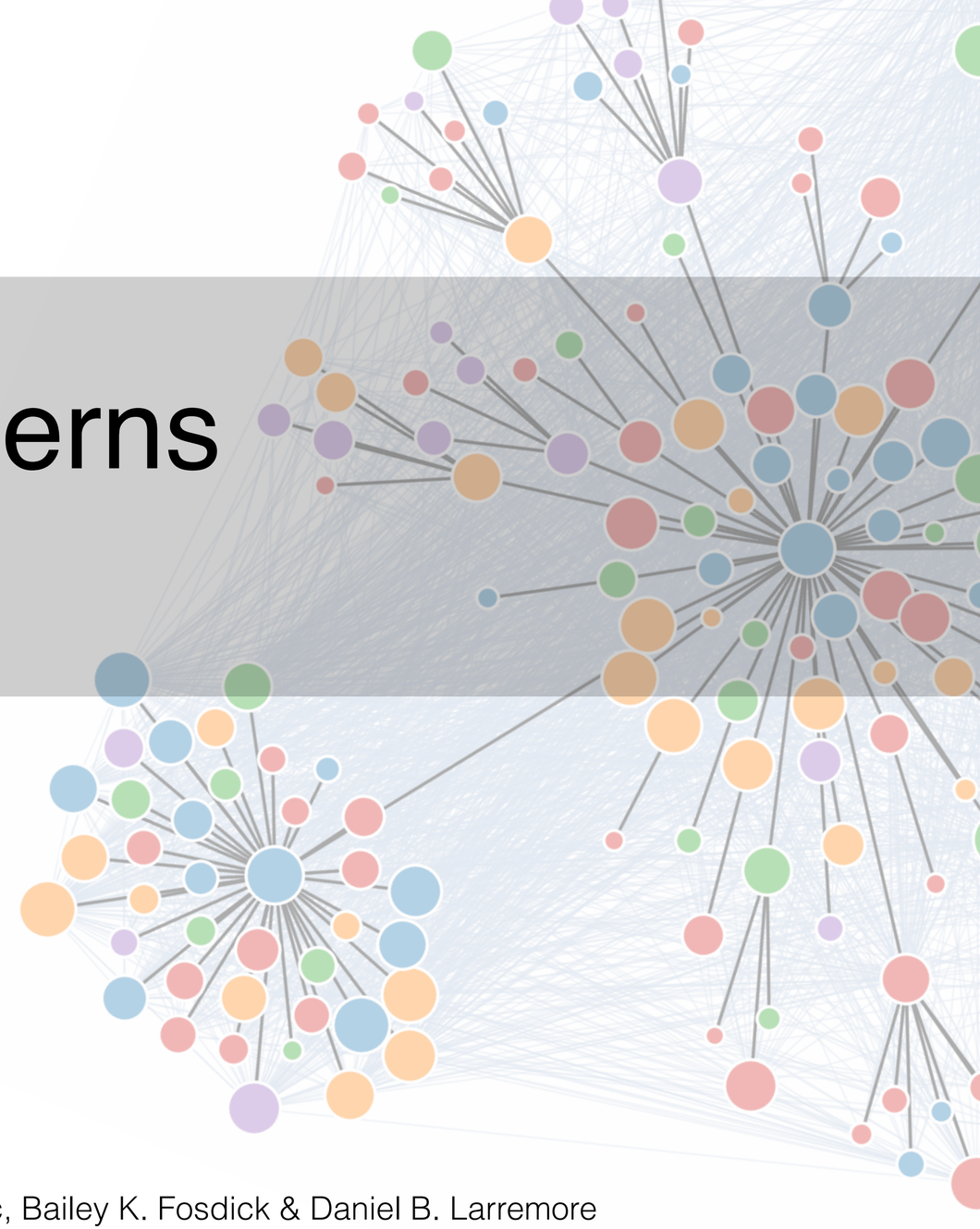
Gender and retention patterns among U.S. faculty



Katie Spoon and Aaron Clauset
@thekatiespoon @aaronclauset

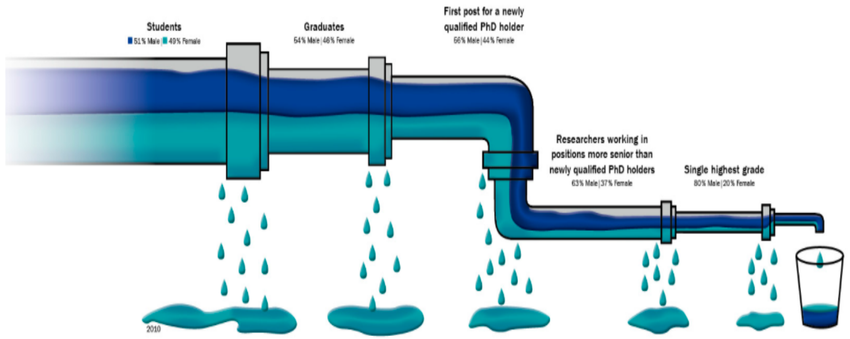
Computer Science Dept. & BioFrontiers Institute
University of Colorado, Boulder

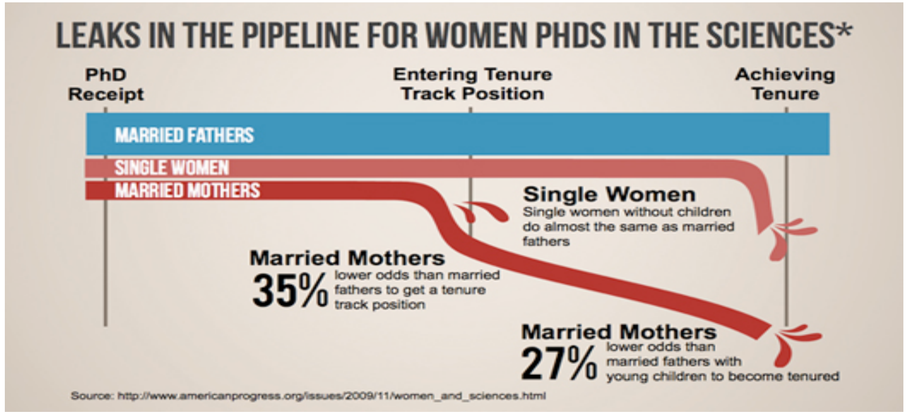
with Nicholas LaBerge, K. Hunter Wapman, Sam Zhang, Allison C. Morgan, Mirta Galesic, Bailey K. Fosdick & Daniel B. Larremore

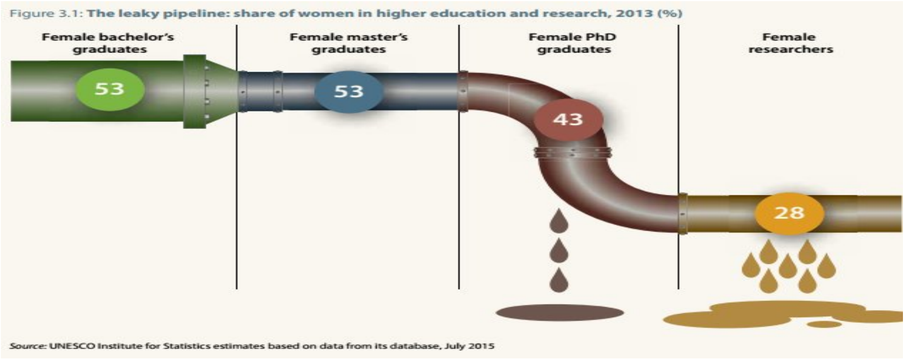
1 February 2024

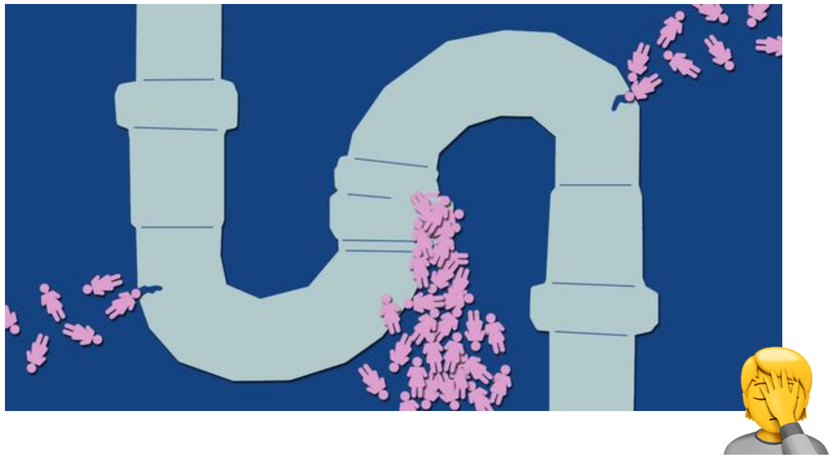
gender in higher education

- **40 years of leaky pipelines…**









these any many more easily findable online — all variations on the same idea

gender in higher education

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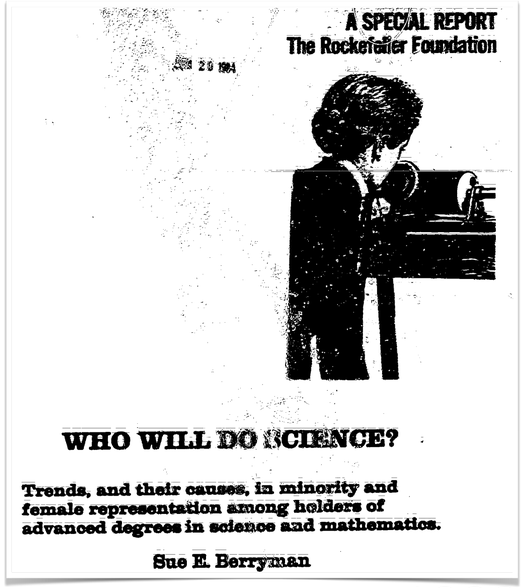
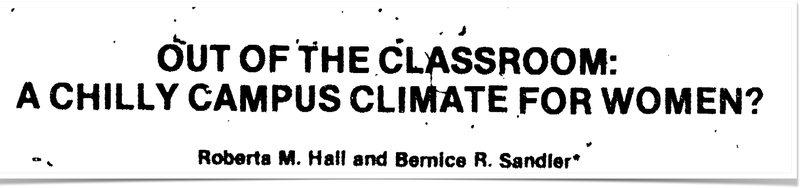


1983



1984

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- 1984: higher ed *climate* is gendered

pipeline analyses: Vetter et al. (1975, 1978) & Berryman (1983) & Widnall (1988)
gendered climate: Hall & Sandler (1984)

gender in higher education

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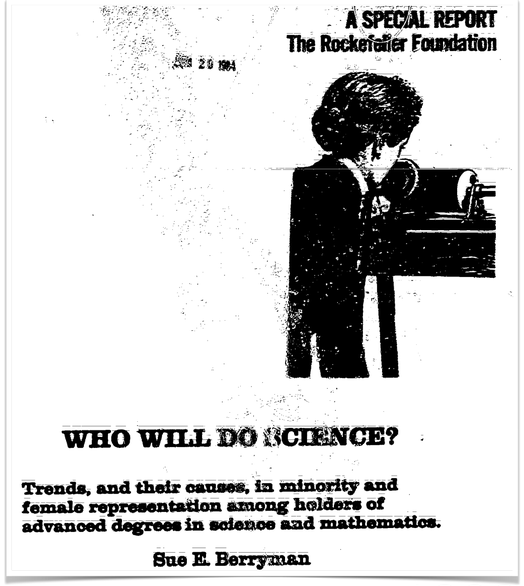

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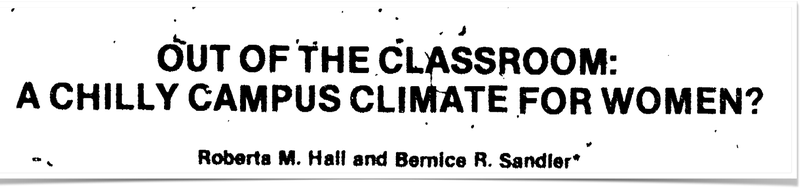
1988



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gender in higher education

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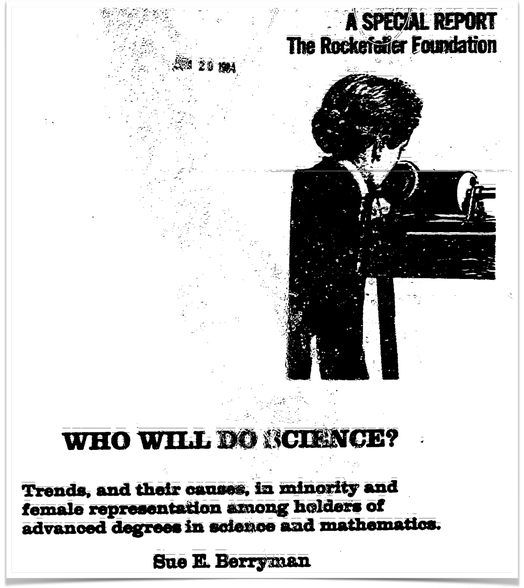

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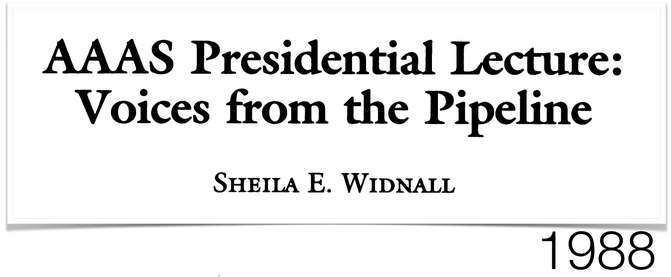

1988

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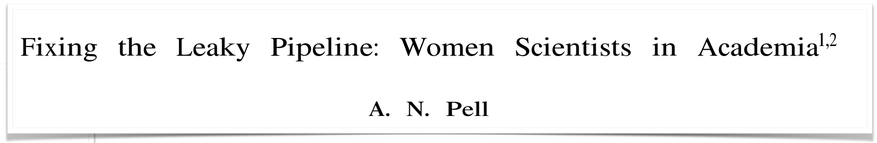
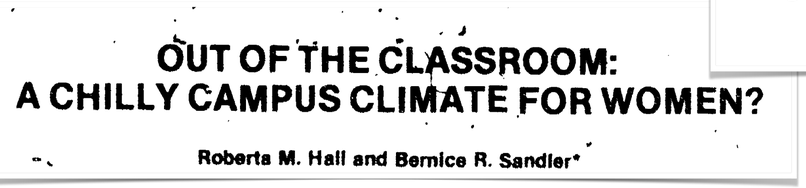


1996



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- 1993: "leaky pipeline" for women
- 1996: gendered *faculty* retention

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gendered climate: Hall & Sandler (1984)
"leaky pipeline" of Black students: Astin (1982)
"leaky pipeline" of women: Rosser in Alper (1993)
women faculty retention: Pell (1996)

gendered faculty attrition

- **faculty literature is deep and messy = 100s of papers**

no / few gendered differences

CULTURE, CLIMATE, AND CONTRIBUTION: Career Satisfaction Among Female Faculty

Louise August*,** and Jean Waltman*

Research in Higher Education (2004)

Women in Academic Science: A Changing Landscape

Stephen J Ceci [1], Donna K Ginther [2], Shulamit Kahn [3], Wendy M Williams [4]

Psych. Science in the Public Interest (2014)

Exploring Gender Bias in Six Key Domains of Academic Science: An Adversarial Collaboration

Stephen J. Ceci[1], Shulamit Kahn[2], and Wendy M. Williams[1]

Psych. Science in the Public Interest (2023)

it's complicated

Survival Analysis of Faculty Retention in Science and Engineering by Gender

DEBORAH KAMINSKI AND CHERYL GEISLER

Science (2012)

Retention and promotion of women and underrepresented minority faculty in science and engineering at four large land grant institutions

Marcia Gumpertz, Raifu Durodoye, Emily Griffith, Alyson Wilson

PLOS One (2012)

Women in Academic Economics: Have We Made Progress?

Donna K. Ginther

Shulamit Kahn

American Economic Association (2021)

real gendered differences

Trends in the Representation of Women Among US Geoscience Faculty From 1999 to 2020: The Long Road Toward Gender Parity

Meghana Ranganathan, Ellen Lalk, Lyssa M. Freese, Mara A. Freilich, Julia Wilcots, Margaret L. Duffy

American Geophysical Union (2021)

Competing Risks Analysis of Promotion and Attrition in Academic Medicine: A National Study of U.S. Medical School Graduates

Donna B Jeffe [1], Yan Yan, Dorothy A Andriole

Academic Medicine (2019)

Gender Differences in Academic Medicine: Retention, Rank, and Leadership Comparisons From the National Faculty Survey

Phyllis L Carr [1], Anita Raj, Samantha E Kaplan, Norma Terrin, Janis L Breeze, Karen M Freund

Academic Medicine (2018)

gendered faculty attrition

faculty literature is deep and messy = why?

no / few gendered differences | **it's complicated** | **real gendered differences**

real limitations

- faculty attrition is hard to study (small numbers & confounding factors)
- study either rates (admin data) *or* reasons (qual & small)
- most studies are (1) single/few institutions or (2) single point in time or (3) single/few academic fields
- typically (1) Assistant Professors, (2) elite institutions, (3) STEM fields → (only 15% of all tenure-track U.S. faculty!)

evident consensus

- *work-life balance* is dominant cause (eg parenthood)
- *pre-tenure years* most important

for instance, see Morgan et al. "The unequal impact of parenthood in academia" (2021)

study design

To investigate whether this consensus holds at scale…

- combine **broad faculty employment data** with **social survey of faculty**

attrition rates & *attrition reasons*

census
- 245,270 tenured / tenure-track faculty
- 391 U.S. PhD-granting institutions
- 111 academic fields, in 9 broad domains
- 10 years, 2011-2020

from Academic Analytics Research Center AARC

- 10,071 respondents (14.1% response rate)
- 325 U.S. institutions
- 29 academic fields
- Fall 2021

*Current & former faculty

questions about stress & reasons for leaving
self-reported gender, race, parenthood

- all institutions, cross-disciplinary, longitudinal, all faculty ranks

AARC data provided via a data use agreement, cleaned extensively, used in Wapman et al. Nature (2022)
social survey sent to 71,449 faculty from 29 diverse fields within the AARC frame; Colorado IRB protocol 21-0293

do women and men leave *at different rates?*

To investigate whether this consensus holds at scale…

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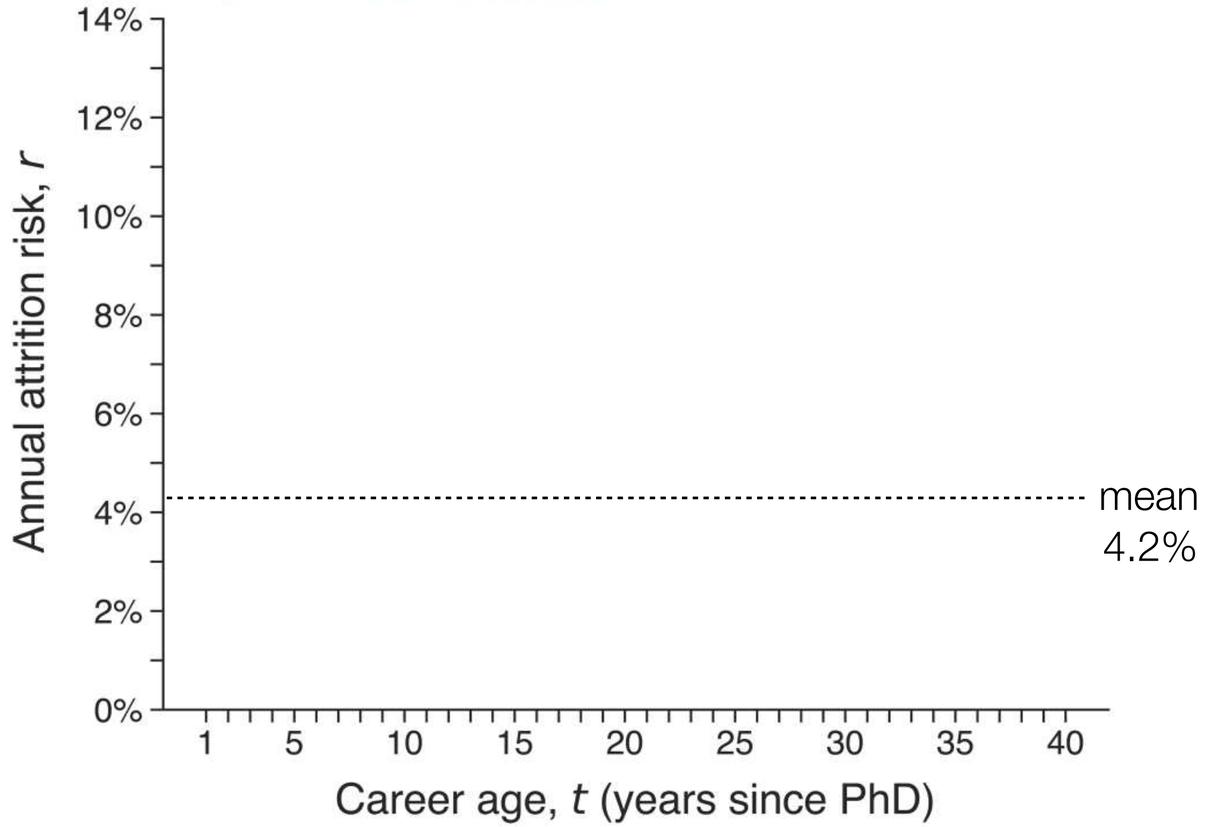
attrition over a career

- "all-cause" attrition risk $r = (\#\ \text{who left})/(\#\ \text{who could have left})$ over all faculty in all fields

non-academic job
retirements
didn't get tenure
moved abroad
etc…



mean 4.2% is for career age t ≤ 40 years
N = 245,270 faculty

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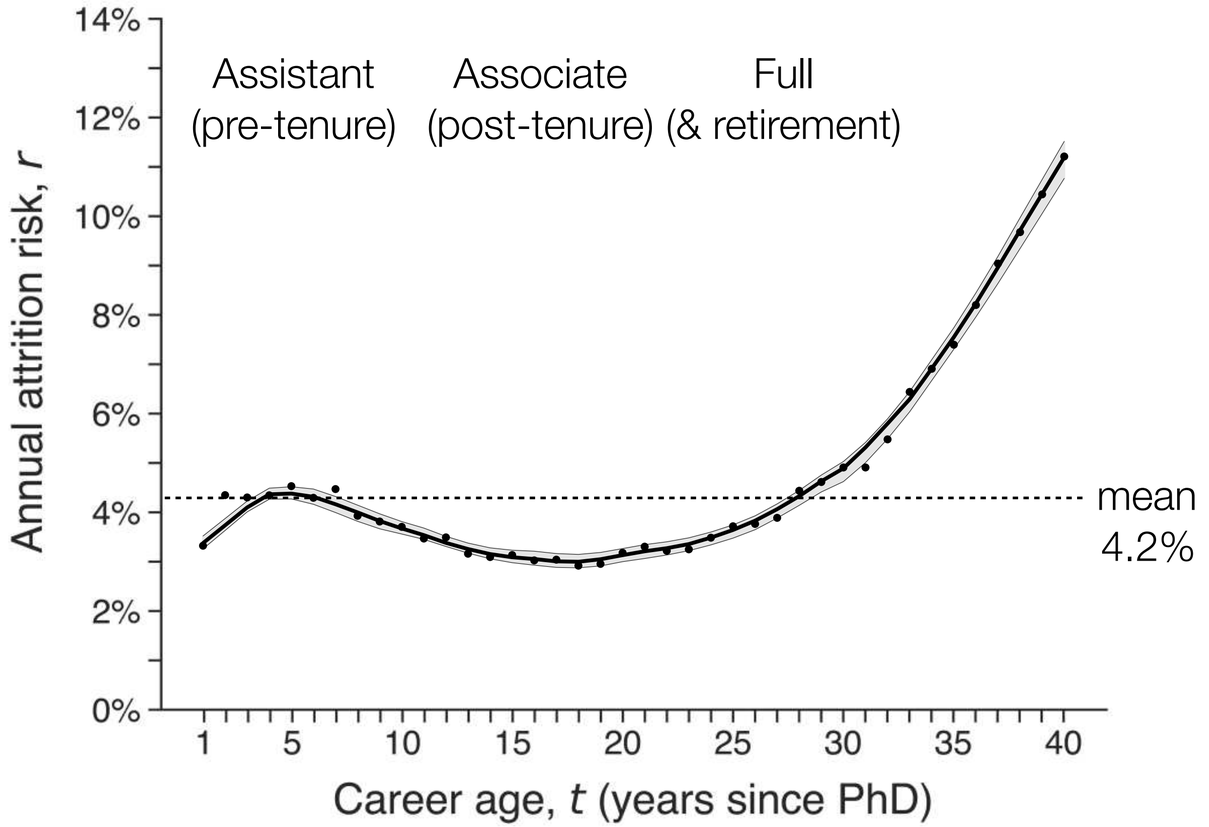

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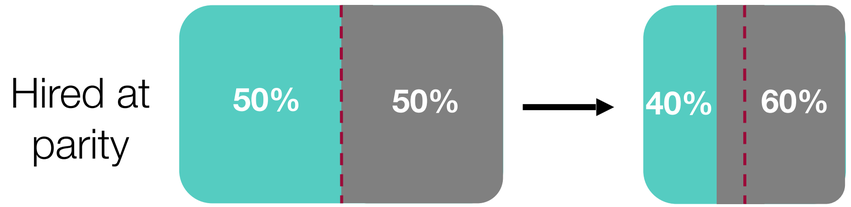
attrition over a career

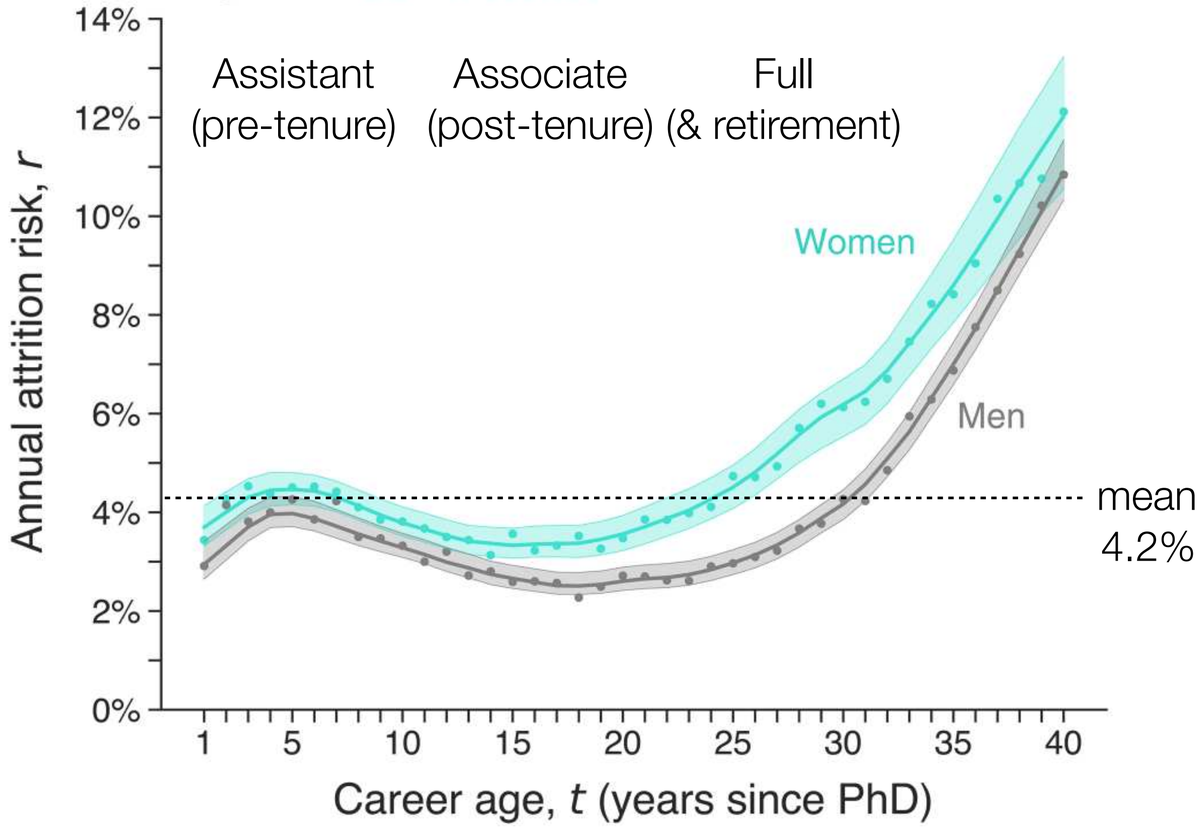
- "all-cause" attrition risk $r = (\#\ \text{who left})/(\#\ \text{who could have left})$ over all faculty in all fields

at every career age, women are more likely to leave than men



- but! these rates aggregate over many factors: different fields, ranks, prestige, etc.

  let's disaggregate…



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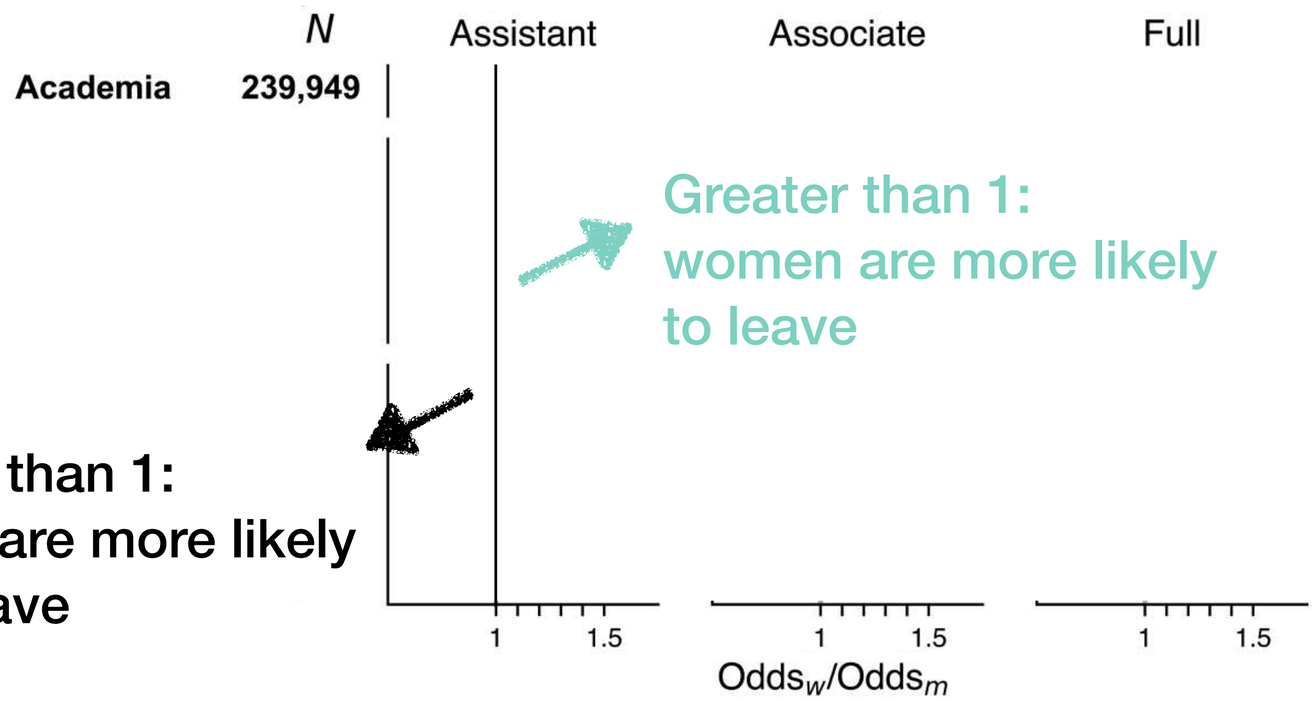
how heterogeneous is attrition?

- logistic regression to estimate annual attrition odds-ratio* by (1) career stage, (2) STEM / non-STEM, and (3) domain



OR >1: women more likely to leave vs. OR < 1: men more likely to leave
* regression covariates: career age, doctoral degree year, employer prestige (which accounts for mean productivity), US/non-US PhD
N = 239,949 faculty; adding field-level fixed effects eliminates gendered attrition for assistant professors, but not for other ranks; ~5k faculty lacking all covariates omitted

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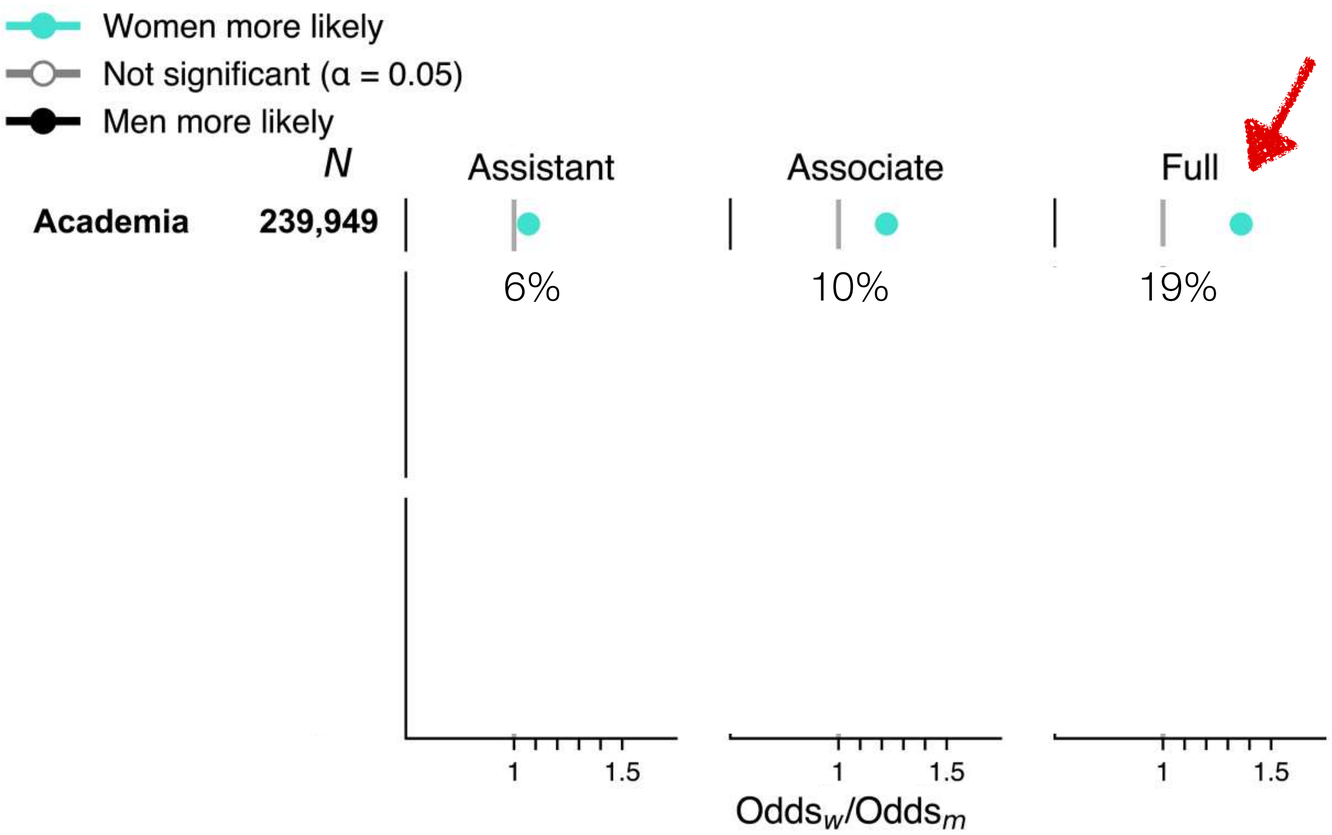
! *gendered attrition largest among full professors*



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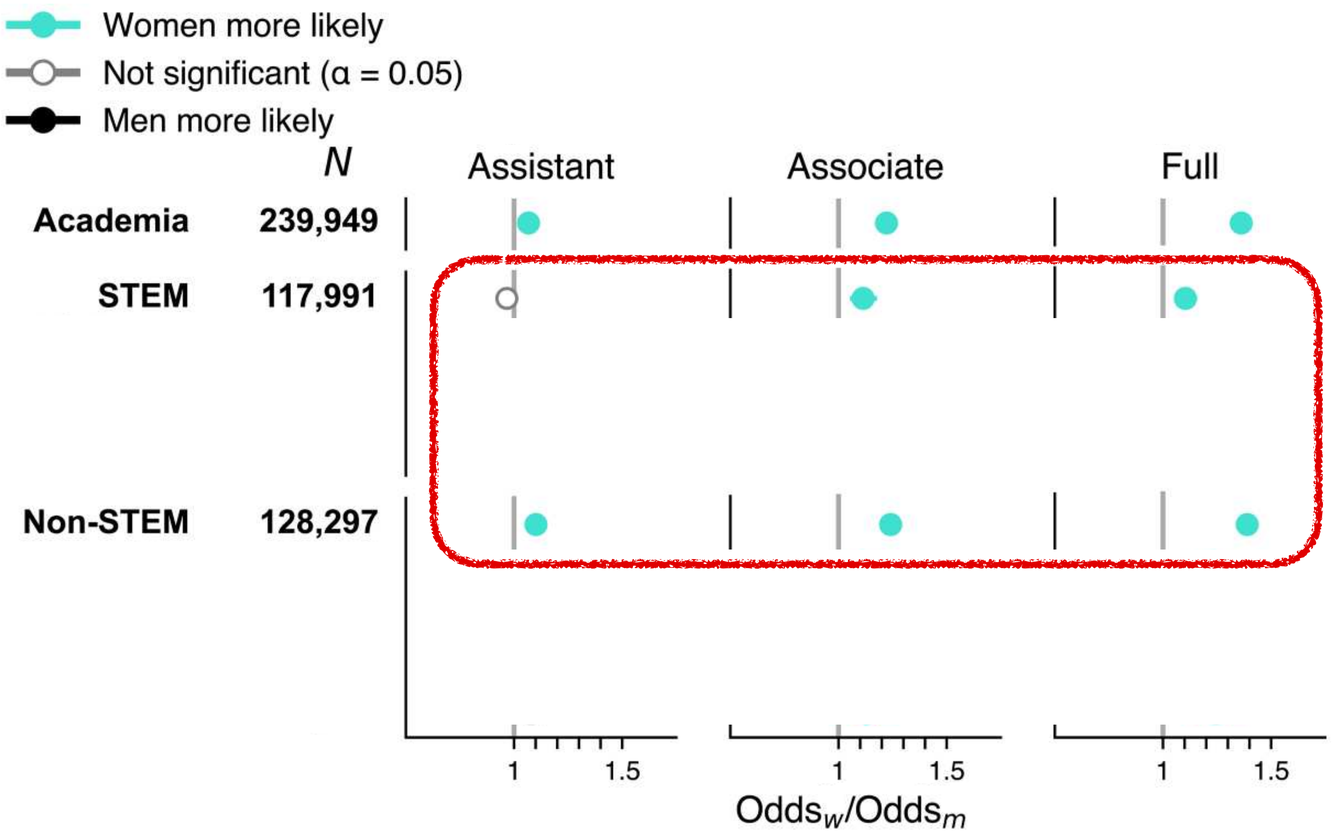

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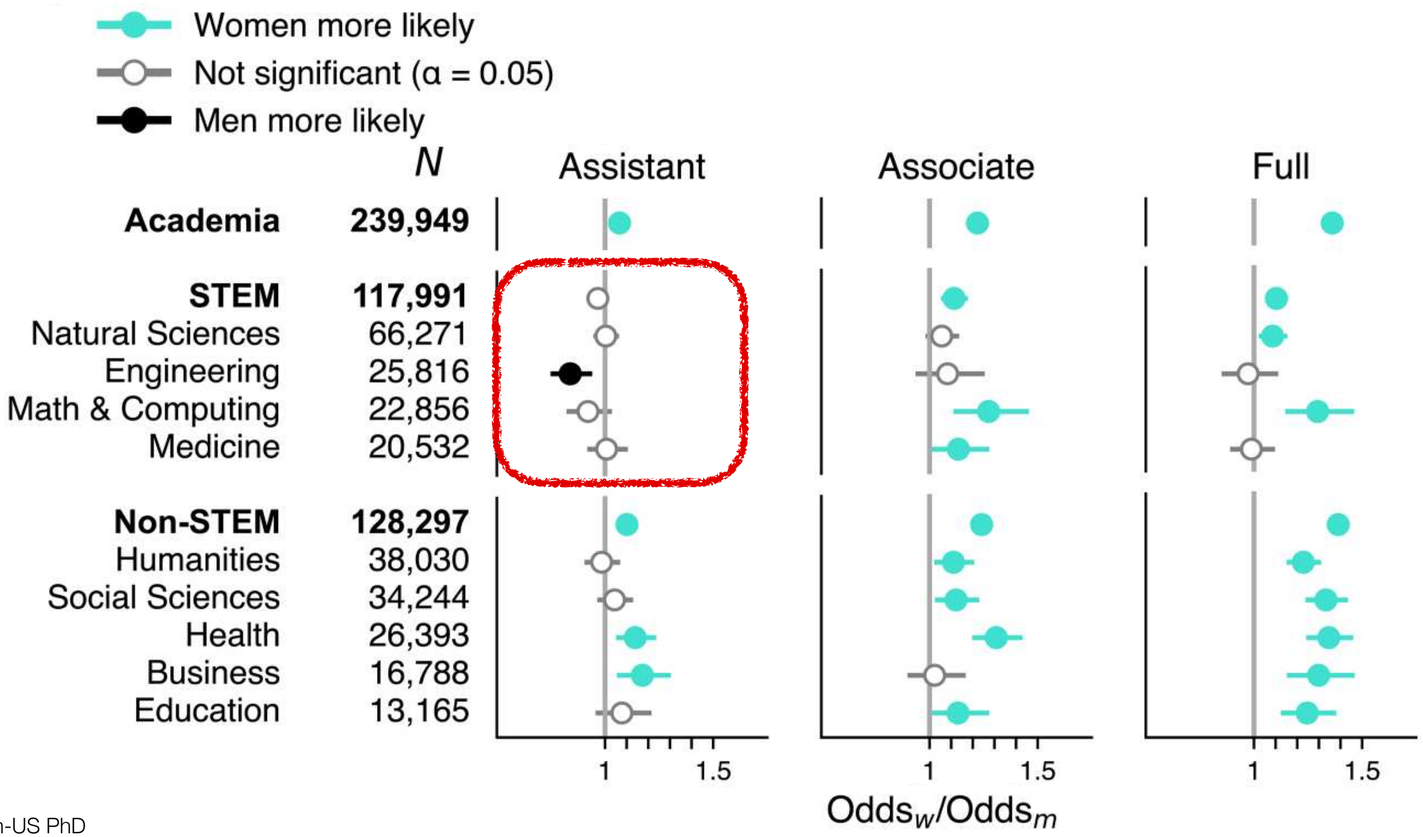
! *gendered attrition largest among*
full professors
non-STEM faculty

There are ***no*** STEM domains where women assistant profs are more likely to leave than men



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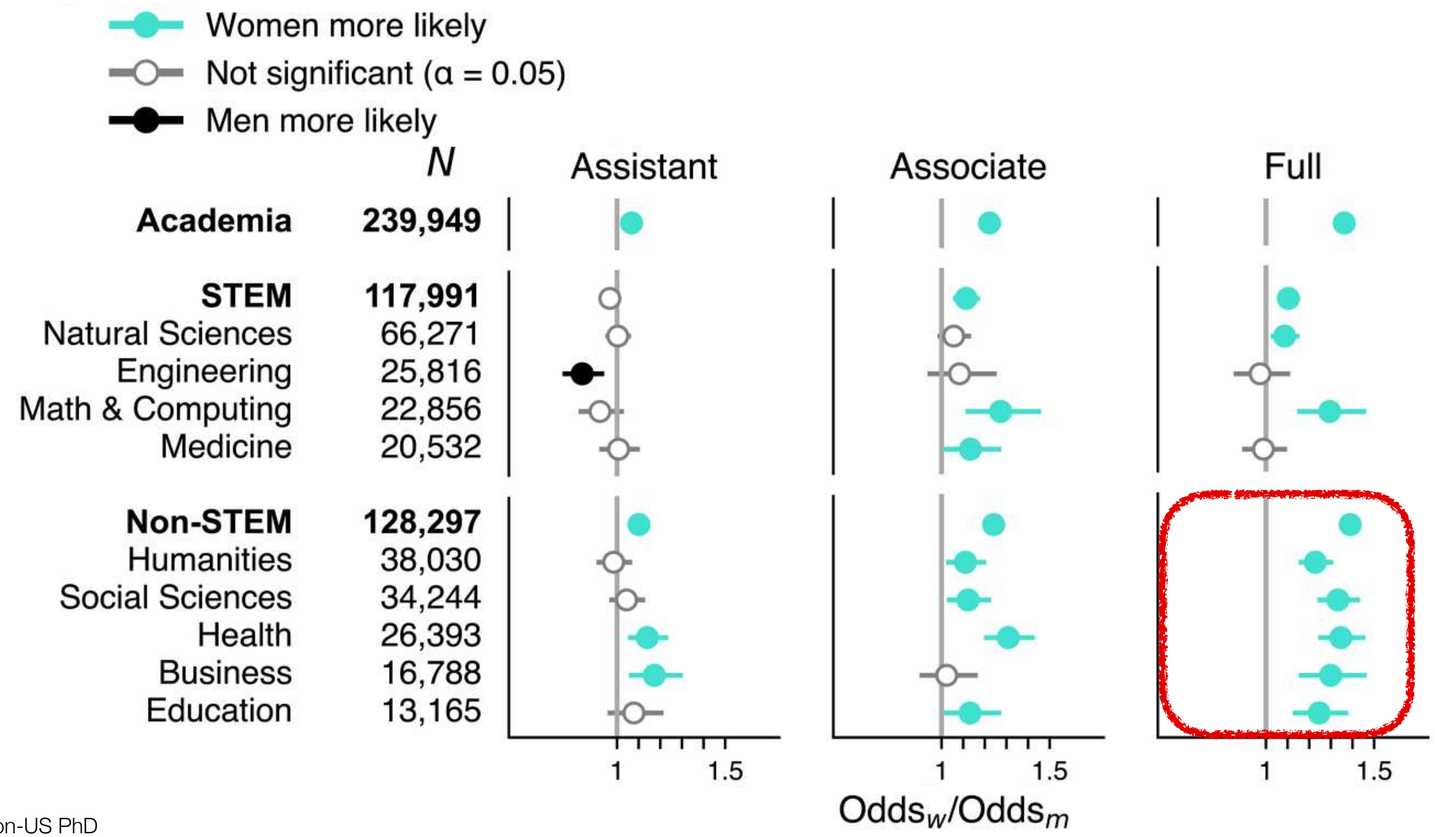
! *gendered attrition largest among*
full professors
non-STEM faculty

In contrast, women full profs in ***every*** non-STEM domain are more likely to leave than men



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! *gendered attrition largest among*
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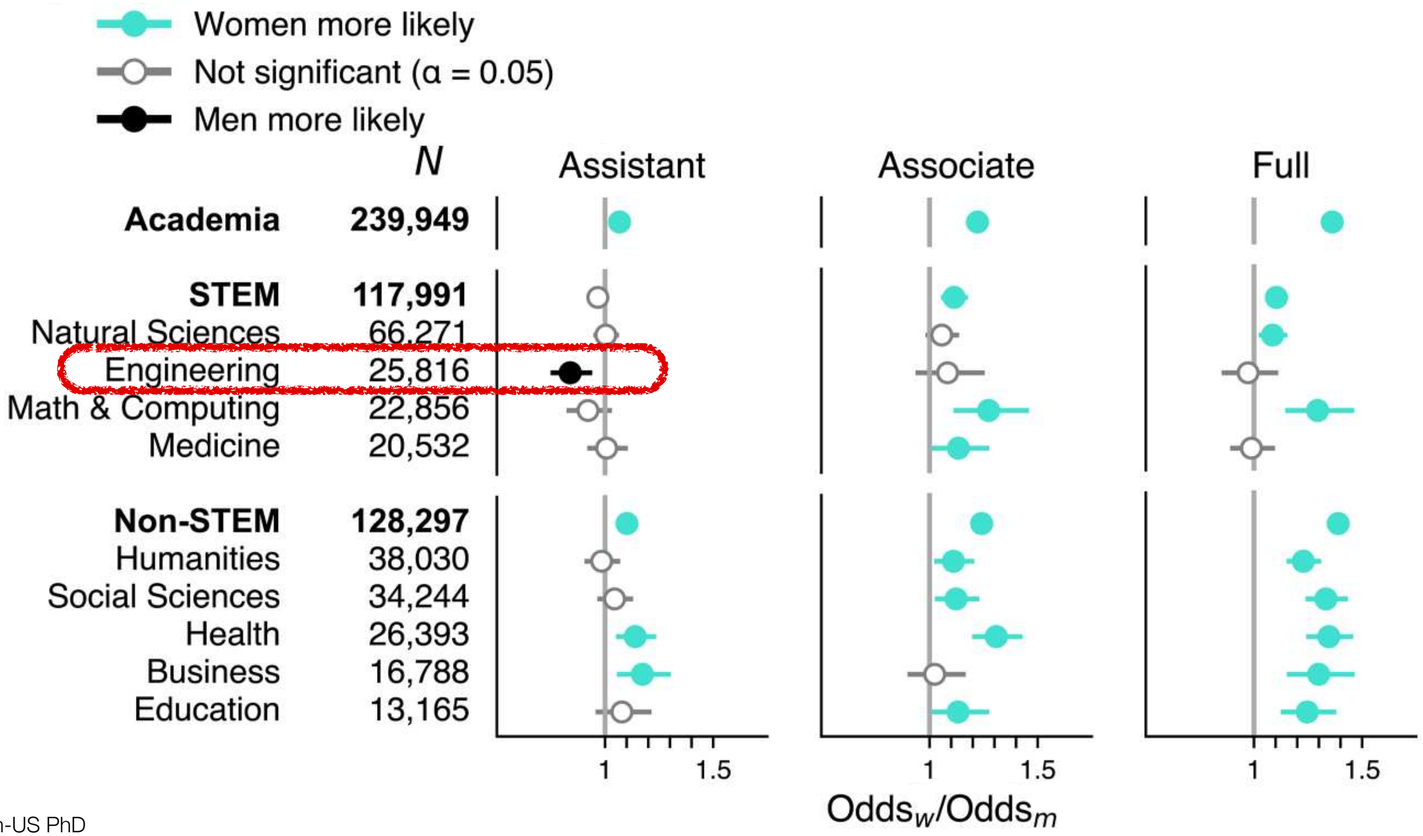
remember this ⭐ note : untenured men in Engineering

- *all domains* show some evidence of gendered attrition, but varies by rank & field
- this variability may explain some contradictory results in literature



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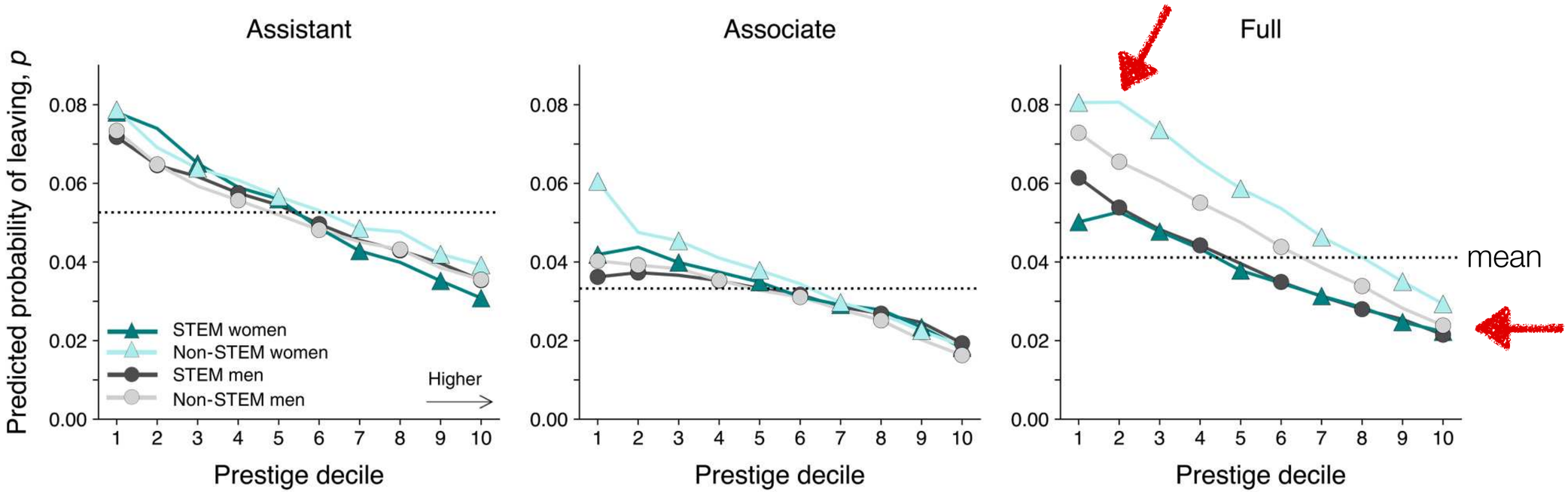
how heterogeneous is attrition?

- does prestige matter? — very much

! *gendered attrition largest among*
full professors
non-STEM faculty
low-prestige institutions

- faculty at least prestigious = 2.5x, 3.0x, 3.3x more likely to leave than faculty at most prestigious



nothing makes sense in academia except in the light of prestige…

study design

- combine **broad faculty employment data** with **social survey of faculty**

🤔

rates ≠ reasons

men and women could leave at different rates for same reasons

or

same rates for different reasons

attrition reasons

- 10,071 respondents (14.1% response rate)
- 325 U.S. institutions
- 29 academic fields
- Fall 2021

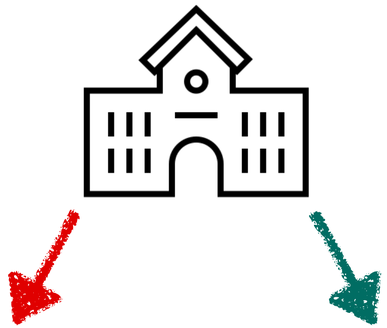
*Current & former faculty

questions about stress & reasons for leaving

self-reported gender, race, parenthood

social survey sent to 71,449 faculty from 29 diverse fields within the AARC frame; Colorado IRB protocol 21-0293

push & pull



Push

“I am unhappy, stressed, or otherwise less than satisfied with my current position”

Pull

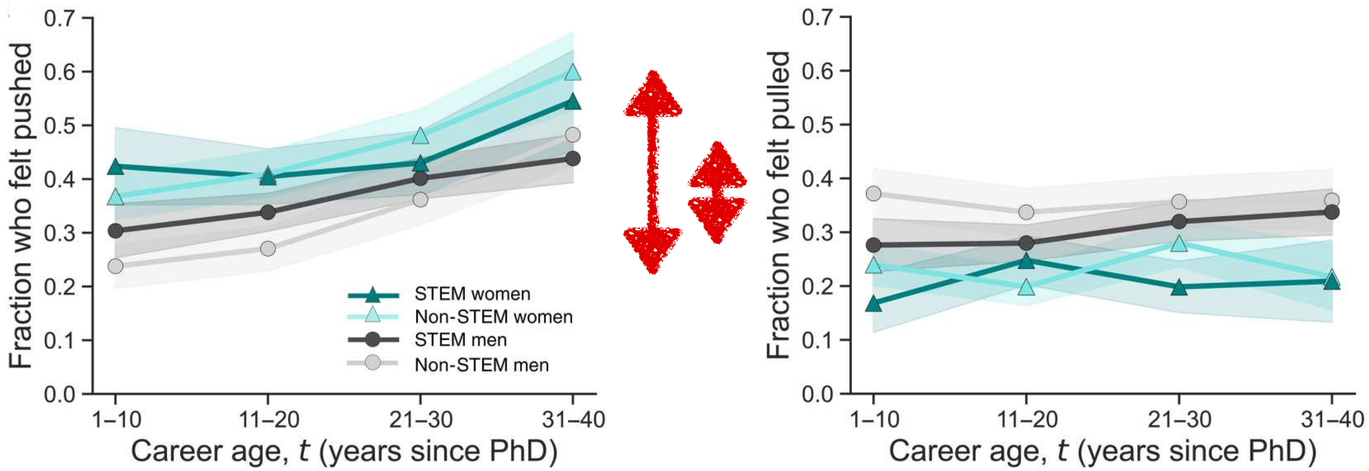
“I am drawn to, excited by, or otherwise attracted to a different position”

push/pull: could select both or neither; neither: wanted to retire (former), would not leave (current)
social survey sent to 71,449 faculty from 29 diverse fields within the AARC frame; Colorado IRB protocol 21-0293

push & pull

- who feels pushed out vs. pulled to better opportunities?

  pushes > pulls, but women feel pushed at greater rates than men



N = 4,919 faculty respondents

push & pull

What types of pushes?

- who feels pushed out vs. pulled to better opportunities?

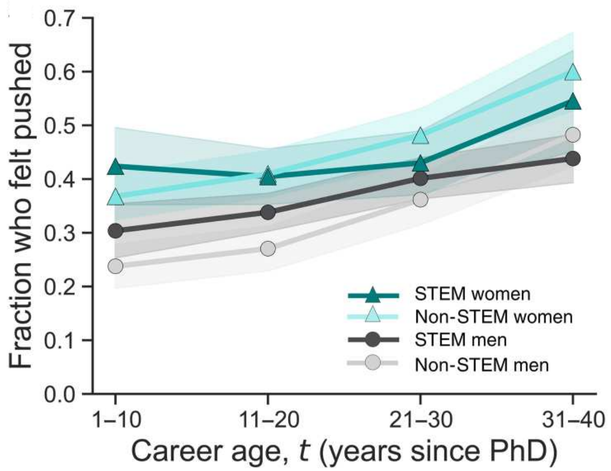
pushes > pulls, but women feel pushed at greater rates than men

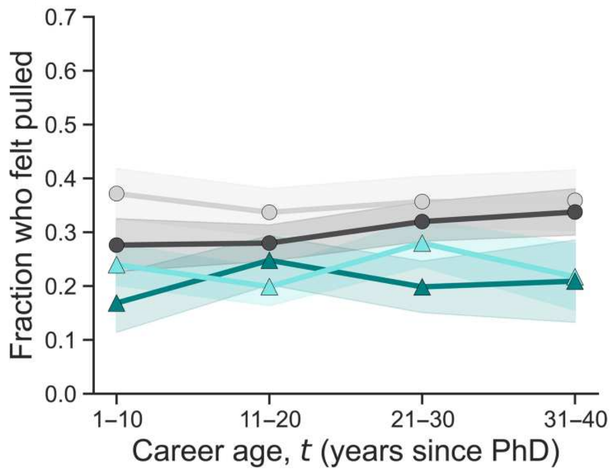
! women's odds of feeling pushed:
44% higher than men

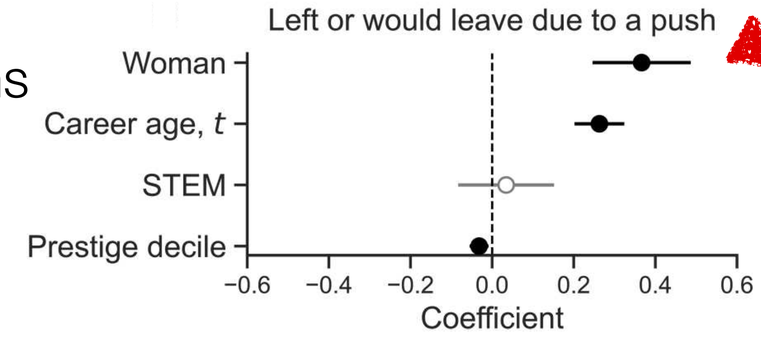
women's odds of feeling pulled:
39% lower than men

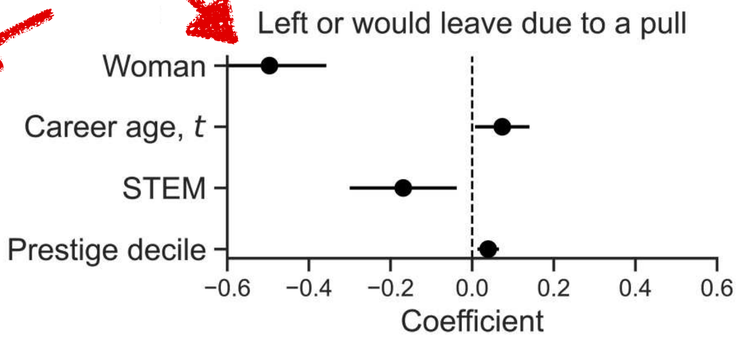
gender *predicts** push vs. pull

very few differences across domains









* multiple regression, adjusting for career age, STEM/non-STEM, employment prestige
self-reported race was not a significant predictor of push vs. pull (but, small samples)
self-identified parents with in-home children were 45% more likely to feel pulled
N = 4,919 faculty respondents

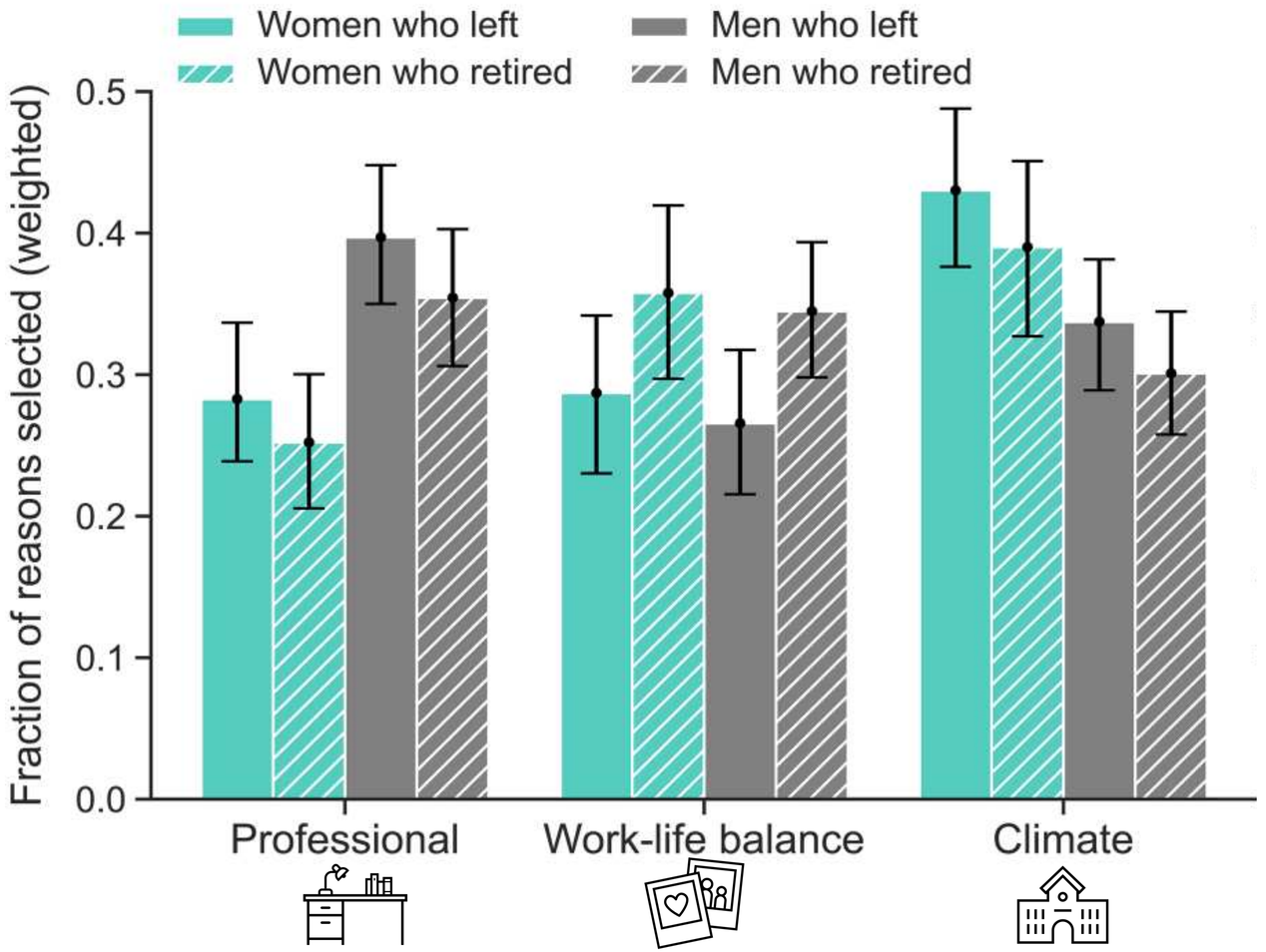
reasons for leaving

Professional
Productivity, funding, salary, admin. support, etc.

Work-life balance
Caring responsibilities, long hours, partner's career, etc.

Workplace climate
Dysfunctional leadership, lack of fit or belonging, harassment, etc.

reasons are *highly* gendered:
e.g., professional vs climate
work-life balance *not* strongly gendered
→ contrasts past literature



all reasons derived from literature on faculty leaving academia (see paper supplement for details)
social survey sent to 71,449 faculty from 29 diverse fields within the AARC frame; Colorado IRB protocol 21-0293

survey design: all participants were asked questions about how often they experienced the above stressors from 3 categories
former faculty were also asked to check boxes for specific stressors contributed to decision to leave
then, current faculty were asked how much each of 3 categories would influence a hypothetical decision to leave

reasons for leaving, hypothetical

Professional
Productivity, funding, salary, admin. support, etc.

Work-life balance
Caring responsibilities, long hours, partner's career, etc.

Workplace climate
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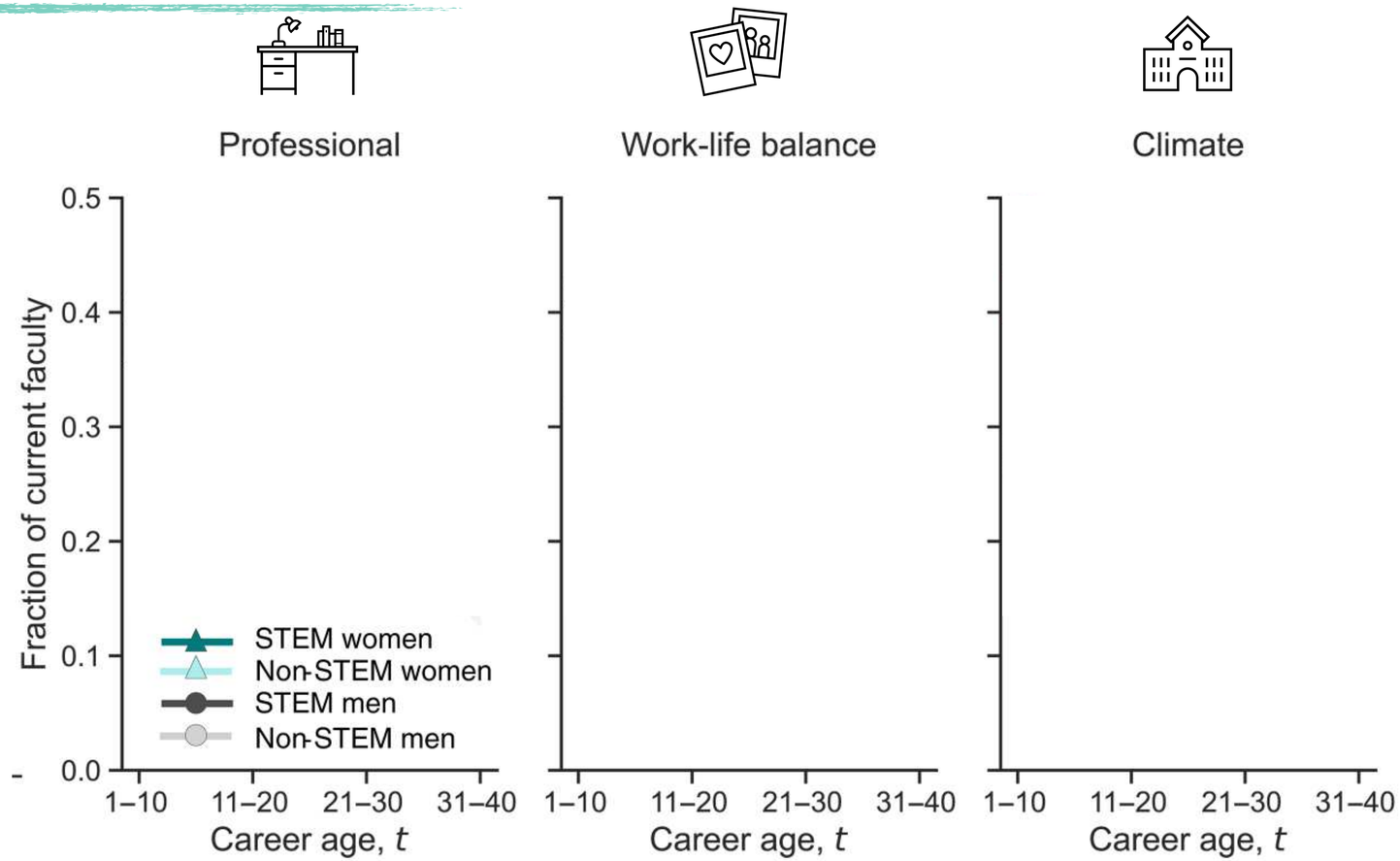

N = 7,195 current faculty
all reasons derived from literature on faculty leaving academia (see paper supplement for details)
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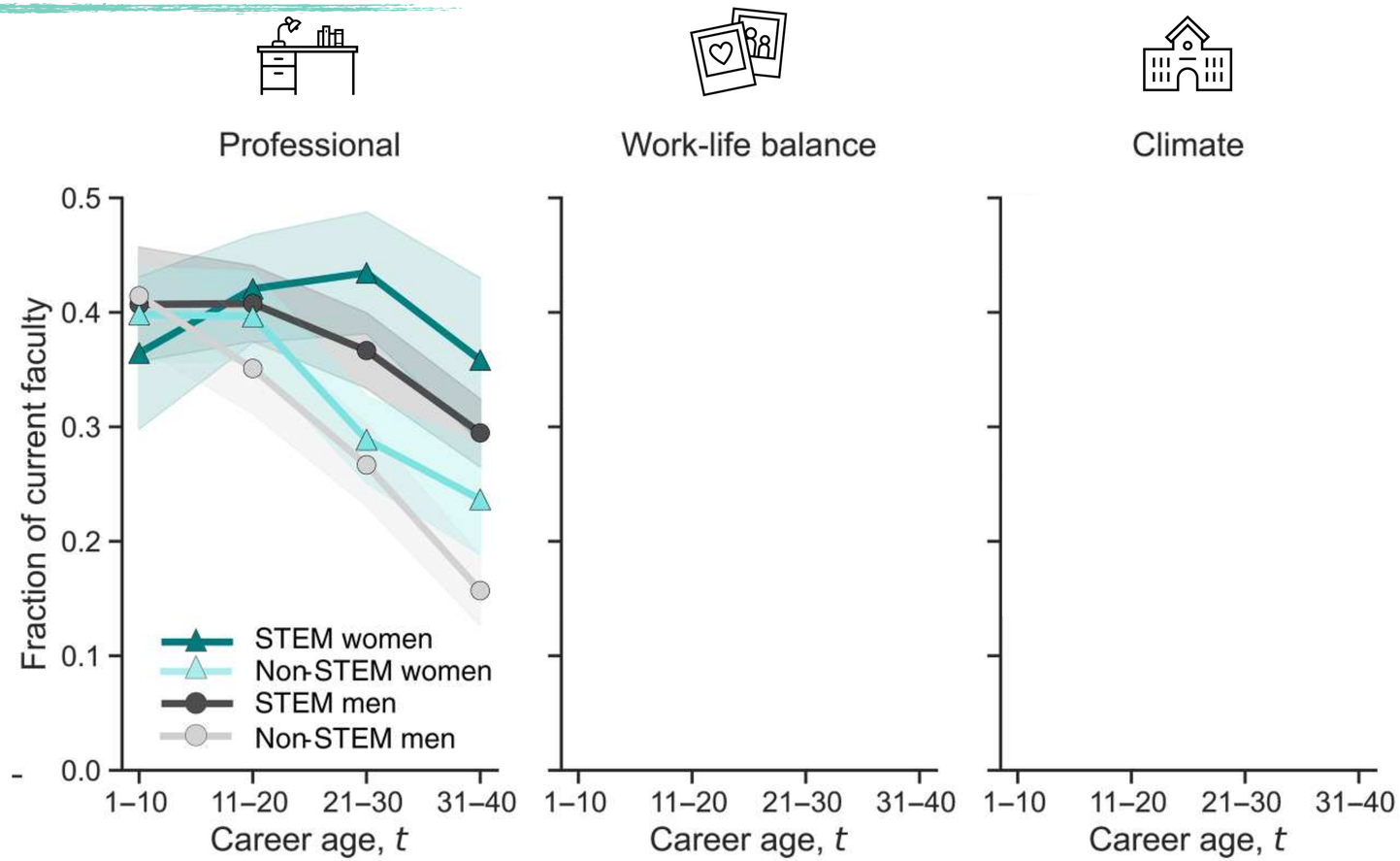


Professional: higher for all early-career faculty and late-career STEM faculty

N = 7,195 current faculty
all reasons derived from literature on faculty leaving academia (see paper supplement for details)
social survey sent to 71,449 faculty from 29 diverse fields within the AARC frame; Colorado IRB protocol 21-0293

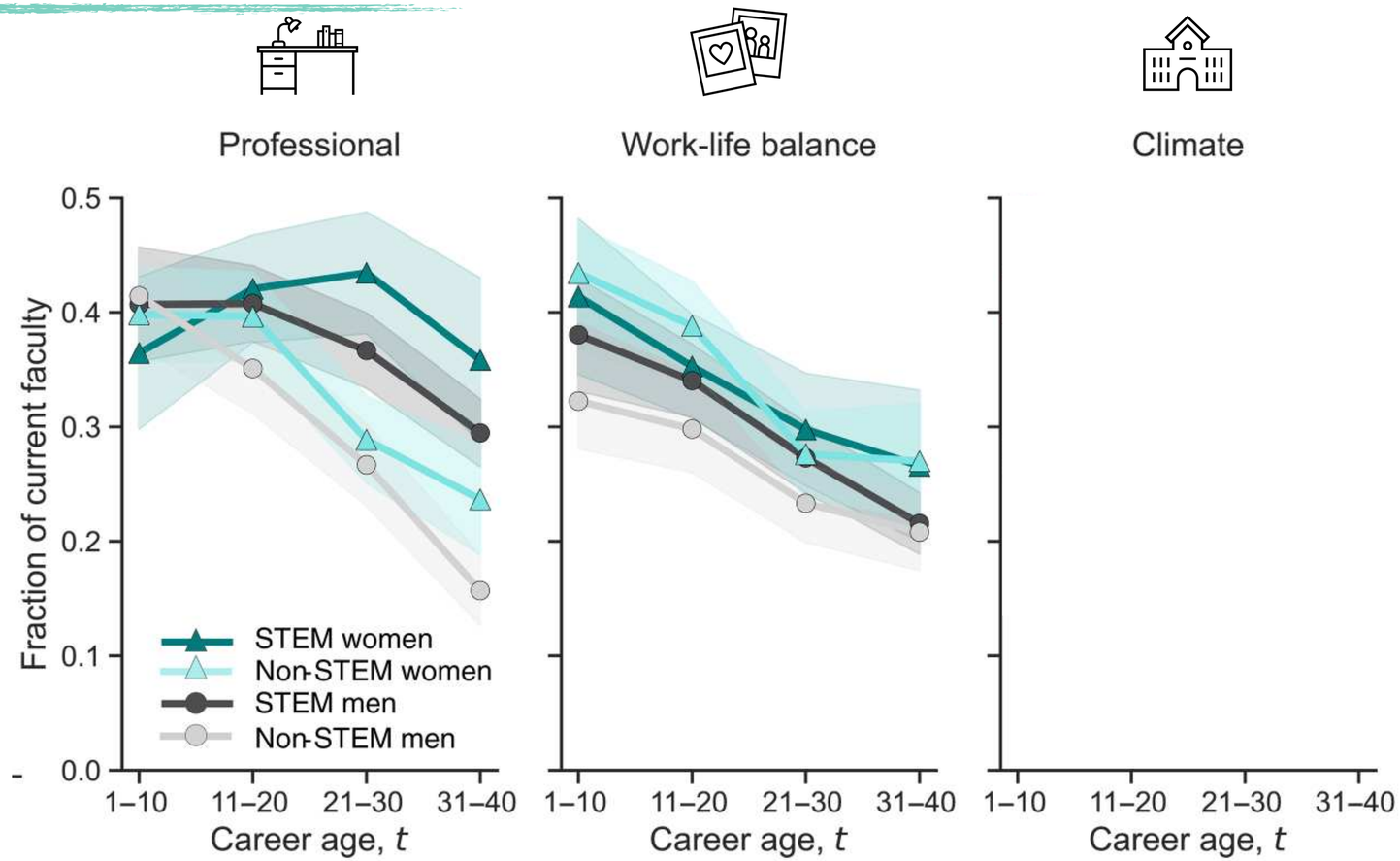
survey design: all participants were asked questions about how often they experienced the above stressors from 3 categories
former faculty were also asked to check boxes for specific stressors contributed to decision to leave
then, current faculty were asked how much each of 3 categories would influence a hypothetical decision to leave

reasons for leaving, hypothetical

Professional
Productivity, funding, salary, admin. support, etc.

Work-life balance
Caring responsibilities, long hours, partner's career, etc.

Workplace climate
Dysfunctional leadership, lack of fit or belonging, harassment, etc.



Work-life balance: higher for all early-career faculty (especially women), falls sharply over time

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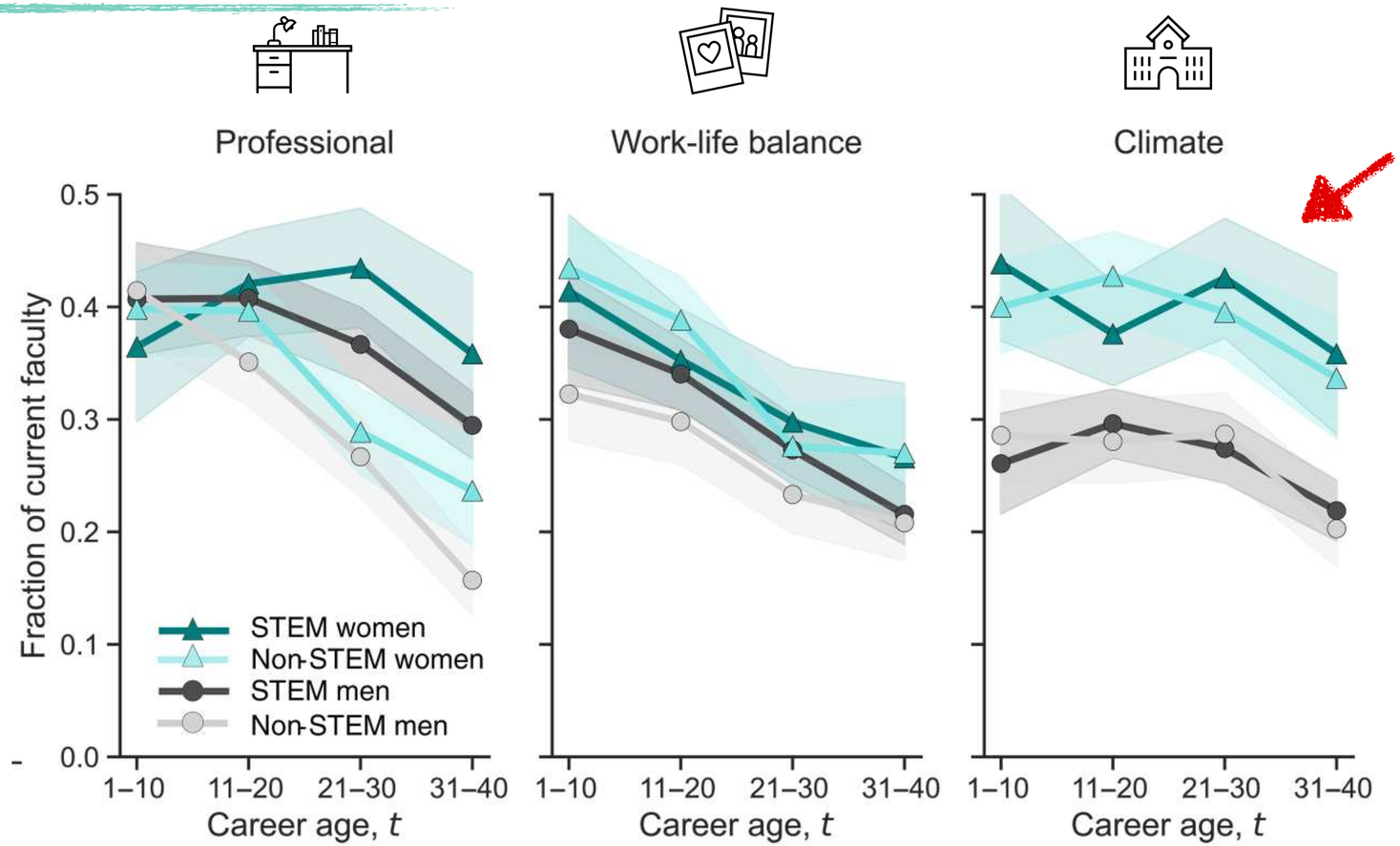

Climate: consistently higher for women, *regardless of career age*

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survey design: all participants were asked questions about how often they experienced the above stressors from 3 categories
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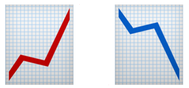
conclusions

- **women faculty leave academia at higher rates than men** 
  - rates vary by domain & career stage — in 37% of domains/stages, women's rates = men's rates

    effect is largest among (1) tenured women in (2) non-STEM at (3) lower-prestige schools

understanding *causes* of this variability & whether it persists over time is crucial open question

tenured women represent 61% of all women faculty

conclusions

- **women faculty leave academia at higher rates than men** 📈 📉
  - rates vary by domain & career stage — in 37% of domains/stages, women's rates = men's rates

    effect is largest among (1) tenured women in (2) non-STEM at (3) lower-prestige schools
  - regardless of *rates*, women leave for different *reasons* than men → pre-tenure men in *Engineering* leave at higher rates than pre-tenure women

    they feel pushed out, esp. by their workplace climates ☔

    but pre-tenure women report feeling pushed out

> Under the person-environment fit theoretical framework (*53*–*59*), our findings indicate that gender incongruences are real, substantial, and universal in academia, even in disciplines with larger proportions of women, such as health and education. The dominant incongruences for women arise from workplace climate, including dysfunctional leadership, feelings of not belonging to the department or university, harassment and discrimination. As a result, workplace climate is a major reason that women faculty leave academia, at every career age, but especially for tenured women (Fig. 4 and fig. S7). Such incongruences highlight the way departmental and institutional policies and norms tend to reflect, accommodate, and reinforce the traditional overrepresentation of white men from more privileged backgrounds, thereby driving gendered attrition over a career and inducing a substantial, asymmetric loss of overall talent and scholarship (*5*).

efforts to address gendered attrition must focus on gendered reasons for leaving rather than gendered rates

this will require new measurement instruments for climate

paragraph from Spoon et al. "Gender and retention patterns among U.S. faculty" (2023)
tenured women represent 61% of all women faculty

conclusions

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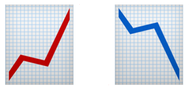
- **contrast with past work**
  - *work-life balance* is **not** dominant cause (eg parenthood) →
    - strong effect in early career, but falls off with age
    - only marginally gendered (shifting gender norms? policy progress?) — BUT *discrimination* around motherhood remains an issue (classified as "climate" in our study)
  - *pre-tenure years* **not** most important

study limitations (many) :
the employment data span 2011-2020, which excludes the disproportionate effects of COVID on women, while the survey was in 2021, which may include them
all data is for tenured and tenure-track faculty only, and omits all non-TT faculty
the employment data does not include self-identified race/ethnicity labels, which precludes any intersectional analysis there
the survey data does include those labels, but the same size is too small to support well-powered statistical analyses
the survey also relied on retrospective assessments from former faculty, and prospective assessments of current faculty
survey respondents: full professors slightly over-represented, assistant professors slightly under-, higher-prestige slightly over. cannot assess other characteristics, eg, parenthood status, SES, etc.

conclusions

- **women faculty leave academia at higher rates than men** 
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- **contrast with past work**
  - *work-life balance* is **not** dominant cause (eg parenthood)
  - *pre-tenure years* **not** most important → • pre-tenure gendered attrition only in specific fields
    • things *get worse* after tenure

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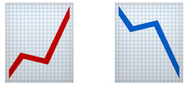
- **women faculty leave academia at higher rates than men** 
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social biases (eg gendered attrition) shape the *composition* of the scientific workforce

that composition shapes the *rate and type of scientific discoveries*

things have improved in 40 years, but we have WORK to do yet

what interventions can mitigate climate-induced incongruences?

Big thanks to AARC for the data!

Code, aggregated data & survey pdf are available on zenodo

references & collaborators

SCIENCE ADVANCES | RESEARCH ARTICLE

SOCIAL SCIENCES

Gender and retention patterns among U.S. faculty

Katie Spoon[1]*, Nicholas LaBerge[1], K. Hunter Wapman[1], Sam Zhang[2], Allison C. Morgan[1], Mirta Galesic[3], Bailey K. Fosdick[4], Daniel B. Larremore[1,5], Aaron Clauset[1,3,5]*

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thank you to all of our survey participants for their time and contributions

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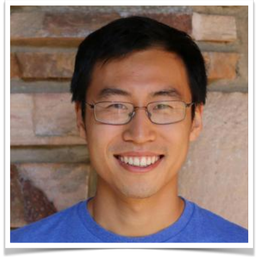
K. Hunter Wapman (Colorado)



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Prof. Mirta Galesic (Santa Fe)

Prof. Bailey Fosdick (CU Anschutz)

Prof. Daniel Larremore (Colorado)

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