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Affirmative Action Bans and Enrollment of Students From Underrepresented Racial and Ethnic Groups in U.S. Public Medical Schools

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Background: The percentage of U.S. physicians who identify as being from an underrepresented racial or ethnic group remains low relative to their proportion in the U.S. population. How this percentage may have been affected by state bans on affirmative action in public postsecondary institutions has received relatively little attention.

Objective: To examine the association between state affirmative action bans and percentage of enrollment in U.S. public medical schools from underrepresented racial and ethnic groups.

Design: Event study comparing public medical schools in states that implemented affirmative action bans with those in states without bans.

Setting: U.S. public medical schools.

Participants: 21 public medical schools in 8 states with affirmative action bans matched to 32 public medical schools in 24 states without bans from 1985 to 2019.

Measurements: Percentage of total enrollment from racial and ethnic groups underrepresented in medicine (Black, Hispanic, American Indian or Alaska Native, and Native Hawaiian or other Pacific Islander).

Results: The percentage of enrollment from underrepresented racial and ethnic groups was 14.8% in U.S. public medical schools in the year before ban implementation in states with bans. The adjusted percentage of underrepresented students in ban schools decreased by 4.8 percentage points (95% CI, −6.3 to −3.2 percentage points) 5 years after ban implementation relative to the year before implementation, whereas the adjusted percentage in control schools increased by 0.7 percentage point (CI, −0.1 to 1.6 percentage points), for a relative difference, or difference-in-differences estimate, of −5.5 percentage points (CI, −7.1 to −3.9 percentage points).

Limitation: Inability to account for the effect of these bans on undergraduate enrollment.

Conclusion: State affirmative action bans were associated with significant reductions in the percentage of students in U.S. public medical schools from underrepresented racial and ethnic groups.

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Increasing the diversity of the U.S. physician workforce can improve the health of patients from historically underserved racial and ethnic groups (1). However, the percentage of U.S. physicians who identify as being from an underrepresented racial or ethnic group, such as Black or Hispanic, remains low relative to their proportion in the U.S. population (2). One possible contributor to this low representation may be state bans on the use of affirmative action, or the use of race and ethnicity as one of many factors in making admission decisions (3), in public postsecondary institutions, which may affect student diversity in U.S. public medical schools. These bans have been passed through various avenues (such as voter-approved initiatives, executive decision, and legislative vote), and Florida did explicitly allow institutions to otherwise make inclusion-oriented efforts, such as targeted recruitment and retention (3, 4). Although prior studies have evaluated the effect of affirmative action bans on the admission of students from underrepresented racial and ethnic groups into college (5, 6), limited attention has focused on their effect on admission rates to public medical schools (3). This study examined the association between state affirmative action bans and percentage of enrollment in U.S. public medical schools from underrepresented racial and ethnic groups.

Methods

Data Sources and Study Population

We used publicly available data on state affirmative action bans (Appendix Table 1, available at Annals.org) and on the racial and ethnic composition of students enrolled at U.S. public medical schools (7, 8). The data include enrollment by self-reported race and ethnicity at each medical school each year from 1985 to 2019. Only schools with enrollment each year from 1985 to 2019 were included. Race and ethnicity were not recorded for non–U.S. citizens and nonpermanent residents. We examined the following 4 mutually exclusive racial and ethnic groups that are underrepresented in medicine: Black, Hispanic, American Indian or Alaska Native, and Native Hawaiian or other Pacific Islander (2).

Outcome Measures and Covariates

Our outcome was the percentage of total enrollment in a given school and year from the 4 underrepresented racial and ethnic groups. We also separately examined the 2 larger groups—Black and Hispanic—as well as men and women. In regression models, we included the following 3 covariates measured yearly at the state level: unemployment rate, per capita income, and the percentage of those aged 25 years or older with a bachelor's degree. We did this to account for time-varying, state-level characteristics that may

Table. Sample Characteristics in States With and Without Affirmative Action Bans for the Year Before Ban or Imputed Ban*

Characteristic	Arizona (*n* = 1)	California (*n* = 5)	Florida (*n* = 3)	Michigan (*n* = 3)	Nebraska (*n* = 1)	Oklahoma (*n* = 1)	Texas (*n* = 6)	Washington (*n* = 1)	Average Across All Medical Schools in Ban States (*n* = 21)	Average Across Matched Control Schools (*n* = 32)
Medical student race and ethnicity										
Underrepresented group, %	7.2	17.1 (4.4)	17.9 (4.4)	11.1 (2.4)	2.7	3.2	18.9 (8.0)	11.2	14.8 (7.1)	7.5 (3.7)
Black, %	2.0	5.2 (2.6)	9.5 (5.8)	10.2 (2.7)	1.9	0.6	4.0 (3.7)	1.8	5.5 (4.3)	3.6 (3.2)
Hispanic, %	4.2	10.8 (2.2)	7.8 (1.6)	0.7 (0.5)	0.4	0.6	14.2 (4.8)	4.7	8.3 (5.9)	1.6 (1.8)
American Indian or Alaska Native, %	0.8	0.5 (0.5)	0.6 (0.5)	0.1 (0.1)	0.2	2.0	0.5 (0.3)	4.1	0.7 (0.9)	1.9 (3.6)
Native Hawaiian or other Pacific Islander, %	0.2	0.6 (0.2)	0.1 (0.1)	0.1 (0.1)	0.2	0.0	0.2 (0.2)	0.5	0.2 (0.3)	0.4 (2.0)
Asian, %	15.3	35.3 (3.8)	17.5 (3.1)	19.1 (7.3)	4.9	16.9	15.9 (4.7)	14.4	20.6 (9.7)	12.8 (11.7)
White, %	64.7	46.5 (3.7)	64.0 (6.8)	60.1 (6.5)	87.0	70.9	64.8 (8.0)	73.9	61.5 (11.5)	77.7 (13.0)
State characteristics										
Unemployment rate, %	10.1	6.4	3.7	6.7	3.2	5.2	5.8	5.0	5.8 (1.5)	5.1 (1.8)
Per capita income, $	21 000	14 910	16 760	20 000	23 400	22 630	13 220	20 050	16 730 (3400)	16 860 (3920)
People aged ≥25 y with bachelor's degree, %	28.9	26.9	24.3	25.8	28.2	26.9	22.0	28.7	25.2 (2.4)	23.3 (5.5)

* Values are averages (SDs); SDs were calculated where appropriate. Underrepresented students are defined as Black, Hispanic, American Indian or Alaska Native, and Native Hawaiian or other Pacific Islander. Counts in column headings refer to number of schools. Values are from the year before the ban or from the year before the imputed ban.

be associated with both the timing of implementation of an affirmative action ban in a state and trends in enrollment of underrepresented racial and ethnic groups in public medical schools.

Statistical Analysis

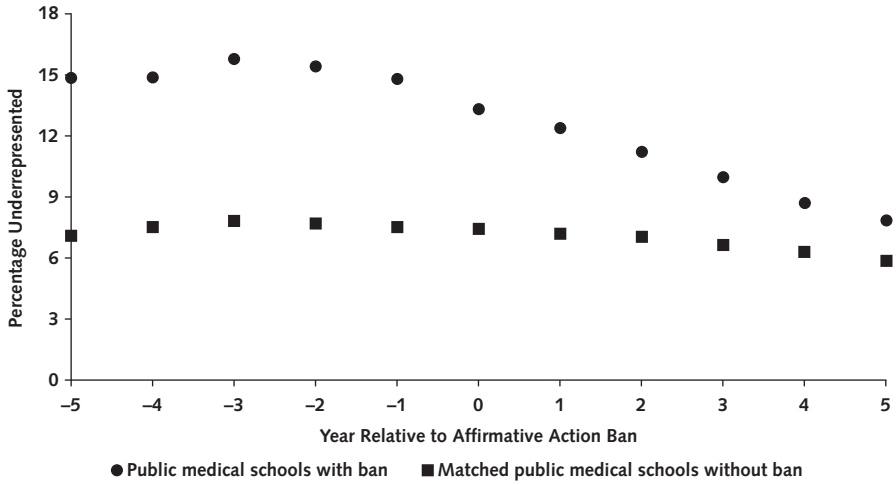
Primary Analyses

We first matched public medical schools in states that implemented affirmative action bans ("ban schools") to public medical schools in states without bans ("control schools"). To do so, we matched each ban school to its 5 nearest control schools (with replacement; that is, allowing a given control school to be matched to >1 ban school) using Mahalanobis distance (9), with distance calculated on the basis of total enrollment by subgroups of sex and race and ethnicity in order to match schools of similar size and composition. Matching was done in the year before each state's affirmative action ban, and the same ban year was imputed for matched control schools.

We then used an event study design (10, 11), also known as a dynamic difference-in-differences design with variation in treatment timing, that compared the percentage of underrepresented students in a ban school, by year, from 5 years before state ban implementation to 5 years after, with the year before ban implementation as the reference category. We similarly compared the percentage of underrepresented students in matched control schools (each of which had an imputed ban year that was the same as that of the ban school to which it was matched) from 5 years before this imputed ban year to 5 years after. Specifically, we estimated a multivariable linear regression of percentage of underrepresented students as a function of year relative to ban implementation and imputed ban implementation in ban and control schools, respectively (binary indicator variables for each relative year). The model included interactions of relative year with an indicator variable for whether a school was in a state with a ban. In this specification, the coefficient on the interaction term for a given relative year can be interpreted as the difference-in-differences estimate of the effect of the ban by year. The model included the 3 state-year covariates described in the previous section along with year fixed effects (binary indicator variables for each year to account for general national trends) and medical school fixed effects (binary indicator variables for each medical school to compare changes in percentage of underrepresented students within the same medical school in the years before and after a ban).

In addition to the baseline analysis, we estimated similar models for Black and Hispanic students, separately, and for men and women, separately. We also divided schools into above-median and below-median total enrollment and reestimated the main model to examine whether changes in percentage of underrepresented students associated with bans vary by school. Finally, to assess the duration of changes in percentage of underrepresented students associated with bans, we also examined a longer period before and after ban implementation (8 years before to 8 years after, excluding Oklahoma, whose ban was implemented in 2013).

Figure 1. Unadjusted percentage of underrepresented students in public medical schools with state affirmative action bans vs. matched public medical schools without bans, by year relative to affirmative action ban.



Underrepresented, %											
Public medical schools with ban	14.82	14.84	15.74	15.38	14.77	13.28	12.35	11.19	9.95	8.68	7.82
Matched public medical schools without ban	7.07	7.50	7.80	7.67	7.50	7.41	7.17	7.03	6.62	6.28	5.85

Year 0 is the year of implementation for the affirmative action ban. Underrepresented students were defined as Black, Hispanic, American Indian or Alaska Native, and Native Hawaiian or other Pacific Islander. New Hampshire, which had an affirmative action ban in 2012, did not have a public medical school during the examined time period and was therefore not analyzed.

Sensitivity Analyses

We did sensitivity analyses using 2 alternative research designs. First, we used a traditional event study design without explicit matched controls in which treated groups (that is, ban schools) were compared with untreated groups (that is, public schools in states without a ban) and periods using the Stata package "csdid" created by Callaway and Sant'Anna (11). Second, we used an interrupted time series design by replacing the binary indicator variables for relative year with a linear time trend and estimating 2 models: a version with a change in slope after state ban implementation and a version with changes in both level and slope after state ban implementation.

Standard errors for all regressions were clustered at the state level. We used a significance threshold of 0.05 using a 2-sided test. Stata, version 17.0 (StataCorp), was used for analyses. The study was exempted from human subjects review at University of California, Los Angeles.

Role of the Funding Source

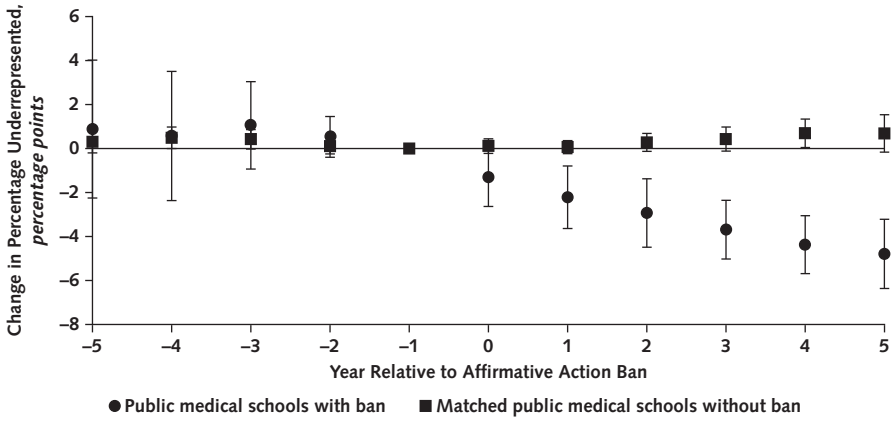
This work was not funded. No entity had a role in the design or conduct of the study; collection, management, analysis, or interpretation of the data; preparation, review, or approval of the manuscript; or decision to submit the manuscript for publication.

RESULTS

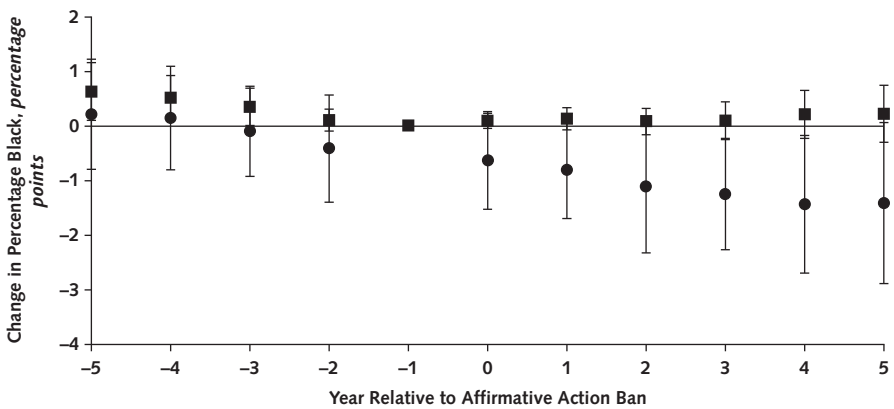
Our data included 21 public medical schools in 8 states with affirmative action bans and 32 public medical schools in 24 states without bans across 35 years, which encompassed 1855 school-year observations. The Table T1 presents sample characteristics. The average percentage of underrepresented students in ban schools in the year before the ban was 14.8% (5.5% Black, 8.3% Hispanic, 0.7% American Indian or Alaska Native, and 0.2% Native Hawaiian or other Pacific Islander), and that in control schools in the year before the imputed ban was 7.5% (3.6% Black, 1.6% Hispanic, 1.9% American Indian or Alaska Native, and 0.4% Native Hawaiian or other Pacific Islander).

Figure 1 presents the unadjusted percentage of underrepresented students relative to ban year for ban schools and relative to imputed ban year for control schools. The difference between ban schools and control schools in percentage of underrepresented students was 7.3 percentage points in the year before ban implementation and 2.0 percentage points 5 years after ban implementation. In our main event study design, the adjusted percentage of underrepresented students in ban schools decreased by 4.8 percentage points (95% CI, −6.3 to −3.2 percentage points) 5 years after ban implementation relative to the year before implementation, whereas that in control schools increased by 0.7 percentage point (CI, −0.1 to 1.6 percentage points), for a relative difference, or difference-in-differences estimate, of −5.5 percentage points (CI, −7.1 to −3.9 percentage points) (Figure 2, *A*). The absolute reduction in the percentage of underrepresented students in states implementing a ban corresponded to large relative reductions. Specifically,

Figure 2. Change after state affirmative action bans in adjusted percentage of underrepresented students in public medical schools vs. matched public medical schools in states without bans.



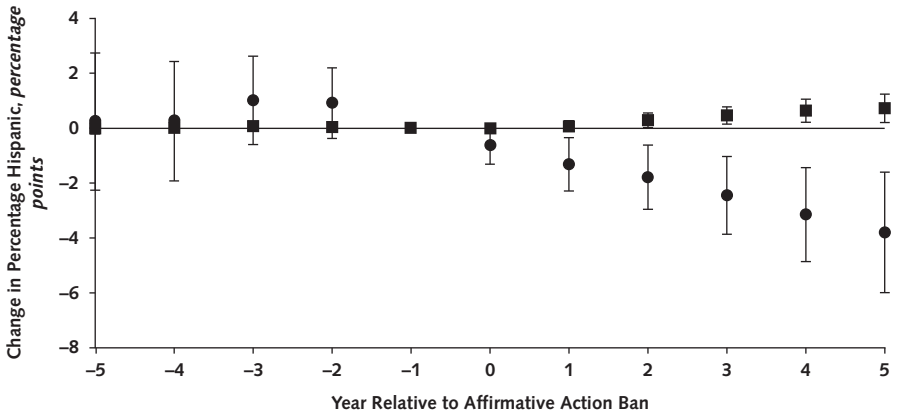
Underrepresented, %											
Public medical schools with ban	0.89	0.58	1.06	0.54	0	−1.29	−2.19	−2.91	−3.67	−4.35	−4.76
Matched public medical schools without ban	0.32	0.50	0.43	0.13	0	0.12	0.08	0.29	0.44	0.70	0.70
Value to add and subtract for 95% CI: with ban	3.13	2.93	1.98	0.92		1.33	1.42	1.55	1.33	1.31	1.57
Value to add and subtract for 95% CI: without ban	0.51	0.49	0.44	0.37		0.33	0.30	0.41	0.55	0.65	0.85



Underrepresented, %											
Public medical schools with ban	0.22	0.15	−0.09	−0.41	0	−0.63	−0.80	−1.11	−1.24	−1.43	−1.41
Matched public medical schools without ban	0.63	0.52	0.35	0.11	0	0.10	0.14	0.09	0.10	0.22	0.23
Value to add and subtract for 95% CI: with ban	1.01	0.95	0.83	0.98		0.89	0.89	1.21	1.02	1.26	1.48
Value to add and subtract for 95% CI: without ban	0.53	0.41	0.34	0.20		0.14	0.20	0.24	0.35	0.44	0.52

Underrepresented students were defined as Black, Hispanic, American Indian or Alaska Native, and Native Hawaiian or other Pacific Islander. New Hampshire, which had an affirmative action ban in 2012, did not have a public medical school during the examined time period and was therefore not analyzed. Year 0 is the year of implementation for the affirmative action ban. **Top.** Underrepresented students, overall. **Middle.** Black students. **Bottom.** Hispanic students.

Figure 2–Continued



Underrepresented, %	−5	−4	−3	−2	−1	0	1	2	3	4	5
Public medical schools with ban	0.24	0.26	1.02	0.92	0	−0.64	−1.31	−1.78	−2.44	−3.14	−3.79
Matched public medical schools without ban	0.01	0.04	0.08	0.05	0	0.01	0.08	0.29	0.46	0.64	0.73
Value to add and subtract for 95% CI: with ban	2.50	2.17	1.61	1.29		0.67	0.97	1.17	1.42	1.71	2.19
Value to add and subtract for 95% CI: without ban	0.22	0.17	0.14	0.09		0.11	0.19	0.26	0.32	0.42	0.51

given that underrepresented students accounted for approximately 14.8% of medical students in ban schools in the year before ban implementation, the 5.5-percentage point reduction in underrepresented students (by year 5) associated with ban implementation implies about a 37% relative reduction in underrepresented students.

Patterns were similar when Black students (**Figure 2**, *B*) and Hispanic students (**Figure 2**, *C*) were examined separately, although the decrease was larger for Hispanic students. We found similar patterns when examining men and women separately (**Appendix Figure 1**, available at Annals.org), when examining 8 years before ban implementation to 8 years after (**Appendix Figure 2**, available at Annals.org), and in schools with above- versus below-median total enrollment (**Appendix Figure 3**, available at Annals.org). Patterns were also similar when a traditional event study was done without matched controls (**Appendix Figure 4**, available at Annals.org). In the interrupted time series design, in the model with a change in slope only, the change in slope after ban implementation for percentage of underrepresented students in ban schools relative to control schools was −0.95 (CI, −1.42 to −0.48) per year; in the model with changes in slope and level, the change in slope after ban implementation for percentage of underrepresented students in ban schools relative to control schools was −0.76 (CI, −1.15 to −0.38) per year and the coefficient on the change in level was not statistically significant (coefficient, −1.16 [CI, −4.14 to 1.83]) (**Appendix Table 2**, available at Annals.org).

Discussion

Examining medical student enrollment and state affirmative action bans from 1985 to 2019, we observed that affirmative action bans were associated with significant reductions in the percentage of underrepresented students in U.S. public medical schools in the years after ban implementation. The study's findings are consistent with those of a prior study that examined the relationship between state affirmative action bans and underrepresented student enrollment in medical schools, although the prior study evaluated bans in fewer states, had fewer years of follow-up after ban implementation, and used a different study design (3). We therefore could better investigate preban trends and show the broader and longer-term effect of these bans. Prior studies have also shown an adverse effect of these bans on undergraduate enrollment of underrepresented groups (5, 6), which could have downstream effects on medical school enrollment; we could not account for this in our analyses.

The implications of these findings are important to understanding the overall lag in diverse representation of the medical student body and ultimately the physician workforce. Our findings suggest that despite national efforts to improve these rates–including premedical or "pipeline" training programs in kindergarten through 12th grade and at the undergraduate level; diversity training of admissions staff; and changes to admissions requirements, including the Medical College Admission Test–state-level policy related to admissions is a critical determinant of medical school diversity. National efforts

to advance health equity should consider medical school admissions policies an important target.

Our analysis has limitations. First, our results may capture not only the direct effect that affirmative action bans have on medical school admissions but also their indirect effect on medical school admissions through their influence on undergraduate admissions. Second, public discussion of bans may have led to enrollment changes before ban implementation (4). Third, our data grouped students into mutually exclusive categories of race and ethnicity, which may not fully represent how students identify. Finally, the possibility that some public schools in states without bans did not consider race or ethnicity in admission decisions was not assessed in our analysis (12).

In conclusion, state affirmative action bans were associated with significant reductions in the percentage of students in U.S. public medical schools from underrepresented racial and ethnic groups.

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Note: Dr. Ly had full access to all of the data in the study and takes responsibility for the integrity of the data and the accuracy of the data analysis.

Disclaimer: The views expressed here are those of the authors and do not necessarily represent the views of the U.S. Department of Veterans Affairs or the U.S. government.

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Reproducible Research Statement: *Study protocol:* Not available. *Statistical code:* Available from Dr. Ly (e-mail, dply@mednet.ucla.edu). *Data set:* Publicly available, as described in the Methods section.

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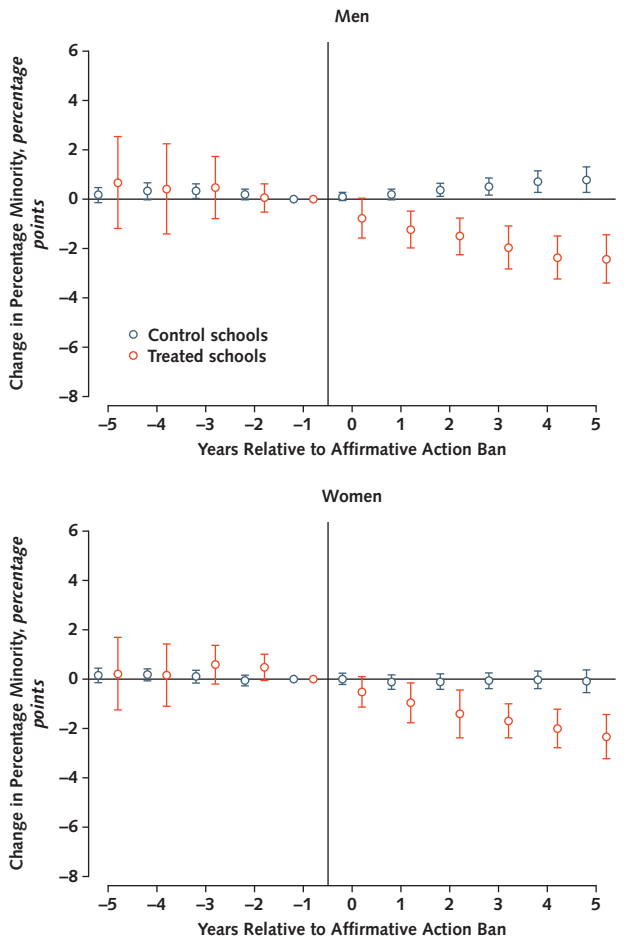
Statistical expertise: A.B. Jena, D.P. Ly, A.R. Olenski.
Administrative, technical, or logistic support: A.B. Jena.
Collection and assembly of data: D.P. Ly.

Appendix Table 1. Year of Affirmative Action Ban, by State*

State	Year
Arizona	2010
California	1998
Florida	2001
Michigan	2006
Nebraska	2008
Oklahoma	2013
Texas	1997
Washington	1999

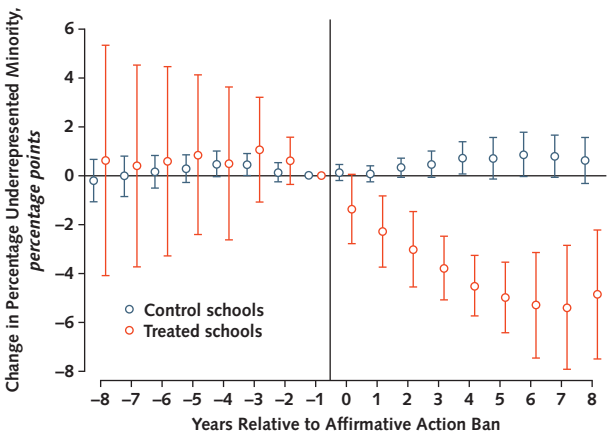
* Texas's affirmative action ban was reversed in 2003. New Hampshire, which had an affirmative action ban in 2012, did not have a public medical school during the examined time period and was therefore not analyzed.

Appendix Figure 1. Change after state affirmative action bans in adjusted percentage of underrepresented students in public medical schools vs. matched public medical schools in states without bans: by sex.



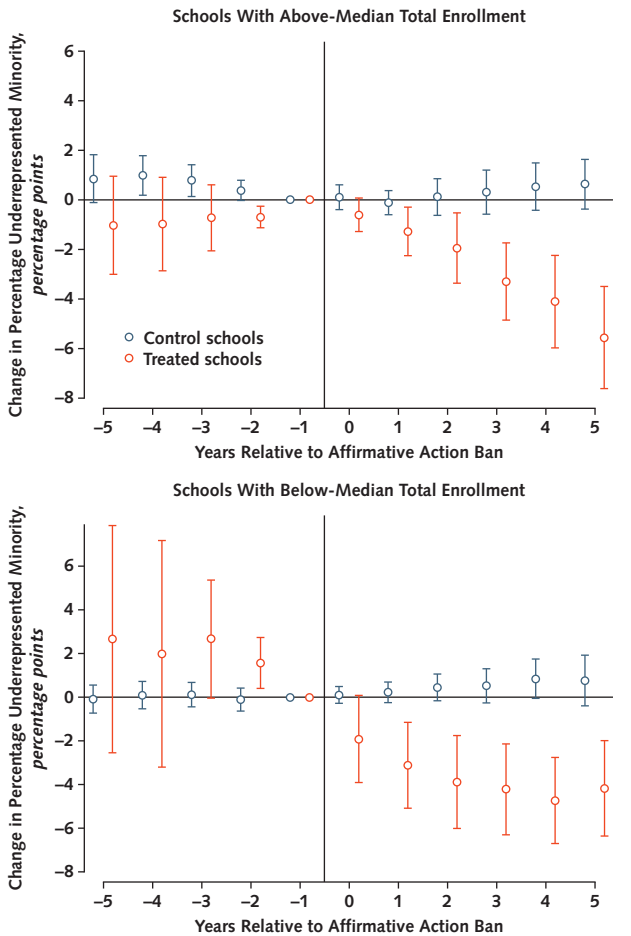
Underrepresented students were defined as Black, Hispanic, American Indian or Alaska Native, and Native Hawaiian or other Pacific Islander. New Hampshire, which had an affirmative action ban in 2012, did not have a public medical school during the examined time period and was therefore not analyzed. Year 0 is the year of implementation for the affirmative action ban.

Appendix Figure 2. Change after state affirmative action bans in adjusted percentage of underrepresented students in public medical schools vs. matched public medical schools in states without bans: 8 y before and after bans.



Underrepresented students were defined as Black, Hispanic, American Indian or Alaska Native, and Native Hawaiian or other Pacific Islander. New Hampshire, which had an affirmative action ban in 2012, did not have a public medical school during the examined time period and was therefore not analyzed. Year 0 is the year of implementation for the affirmative action ban. This analysis also excluded Oklahoma, which had a ban implemented in 2013.

Appendix Figure 3. Change after state affirmative action bans in adjusted percentage of underrepresented students in public medical schools vs. matched public medical schools in states without bans: by above- vs. below-median total school enrollment.



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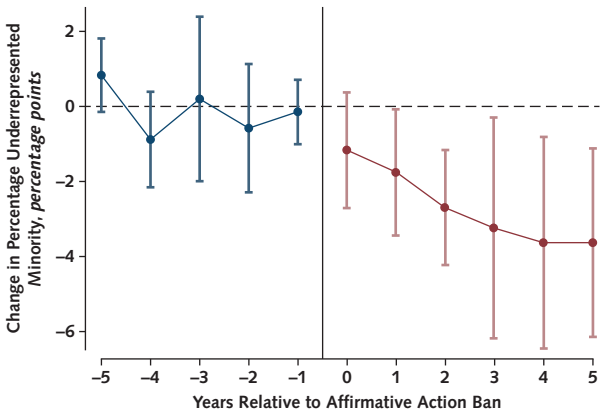
Appendix Figure 4. Change after state affirmative action bans in adjusted percentage of underrepresented students in public medical schools: event study with no matched controls.



Underrepresented students were defined as Black, Hispanic, American Indian or Alaska Native, and Native Hawaiian or other Pacific Islander. New Hampshire, which had an affirmative action ban in 2012, did not have a public medical school during the examined time period and was therefore not analyzed. Year 0 is the year of implementation for the affirmative action ban.

Appendix Table 2. Interrupted Time Series Design*

Variable	Coefficient (95% CI)
Model 1: change in slope for percentage of underrepresented students	
Change in slope after ban implementation in ban schools	−0.77 (−1.15 to −0.40)
Change in slope after ban implementation in control schools	0.18 (−0.04 to 0.40)
Change in slope after ban implementation in ban schools relative to control schools	−0.95 (−1.42 to −0.48)
Model 2: change in slope and change in level for percentage of underrepresented students	
Change in slope after ban implementation in ban schools	−0.62 (−0.89 to −0.35)
Change in slope after ban implementation in control schools	0.15 (−0.07 to 0.37)
Change in slope after ban implementation in ban schools relative to control schools	−0.76 (−1.15 to −0.38)
Change in level after ban implementation in ban schools	−1.30 (−4.10 to 1.50)
Change in level after ban implementation in control schools	−0.14 (−0.85 to 0.57)
Change in level after ban implementation in ban schools relative to control schools	−1.16 (−4.14 to 1.83)

* Underrepresented students are defined as Black, Hispanic, American Indian or Alaska Native, and Native Hawaiian or other Pacific Islander. New Hampshire, which had an affirmative action ban in 2012, did not have a public medical school during the examined time period and was therefore not analyzed.