

The Effect of Discipline Reform Plans on Exclusionary Discipline Outcomes in Minnesota

Appendix A. Methods

Appendix B. Supporting analysis

See <https://go.usa.gov/xFzWy> for the full report.

Appendix A. Methods

This appendix includes information on the data elements, data preparation, missing data, and analytic models used in this study.

Data elements

The study used administrative data on exclusionary discipline actions, student background characteristics and academic achievement, and local education agency characteristics that the Minnesota Department of Education shared with the Regional Educational Laboratory Midwest. The Minnesota Department of Education assigned each student a unique, deidentified primary key prior to sharing the data. Discipline data included information about specific discipline actions. Student characteristics data included data by school year about student background characteristics and academic achievement on standardized tests in math and English language arts. Local education agency data included information about the characteristics of local education agencies and whether the local education agency was identified by the Minnesota Department of Human Rights (MDHR) for a discipline reform plan. The study also accessed publicly available data from the National Center for Education Statistics' Common Core of Data on local education agency locale (U.S. Department of Education, n.d.).

Data preparation

The study team prepared the data for analysis in three steps: recording and calculating variables, combining data from multiple datasets, and creating a matched sample of local education agencies with a discipline reform plan and local education agencies with similar characteristics that were not identified by MDHR and did not create a plan. The variables used in the analyses are described in table A1.

Table A1. Variables used in analyses

Variable	Data source	Description
<i>Student characteristic</i>		
Gender	MDE	Binary indicator of whether a student is female
Race/ethnicity	MDE	Binary indicators of whether a student was Black, American Indian, Asian, Hispanic, Native Hawaiian/Pacific Islander, multiracial, or White
Eligible for the National School Lunch Program	MDE	Binary indicator of whether a student was eligible for the National School Lunch Program
English learner student status	MDE	Binary indicator of whether a student was an English learner student
Special education status	MDE	Binary indicator of whether a student was in special education
Middle school	MDE	Binary indicator of whether a student was in grade 6, 7, or 8
High school	MDE	Binary indicator of whether a student was in grade 9, 10, 11, or 12
Any prior discipline actions	MDE	Binary indicator of whether a student experienced a discipline action in the prior school year
Total prior discipline actions	MDE	Count of the number of discipline actions experienced by a student in the prior school year
<i>Local education agency characteristic</i>		
Local education agency type	MDE	Binary indicator if local education agency type was a charter network
Local education agency size	MDE	Binary indicator of whether a local education agency is in the 75th percentile or greater in total enrollment
Local education agency locale	CCD	Binary indicators of whether a local education agency was in a city, rural, suburban, or town locale
Student enrollment	MDE	Count of the number of students assigned to a local education agency
Percentage of students eligible for the National School Lunch Program	MDE	Percentage of students in the local education agency who were eligible for the National School Lunch Program
Percentage of English learner students	MDE	Percentage of students in the local education agency who were English learner students
Percentage of students in special education	MDE	Percentage of students in the local education agency who received special education services
Average standardized test score in math	MDE	Average student performance on Minnesota Comprehensive Assessments math assessments, centered on the state mean
Prior-year average standardized test score in math	MDE	Average student performance on Minnesota Comprehensive Assessments math assessments, centered on the state mean in the prior year
Average standardized test score in English language arts	MDE	Average student performance on Minnesota Comprehensive Assessments English language arts assessments, centered on the state mean
Prior-year average standardized test score in English language arts	MDE	Average student performance on Minnesota Comprehensive Assessments English language arts assessments, centered on the state mean in the prior year
Percentage of students experiencing any discipline action	MDE	Percentage of students in a local education agency experiencing any discipline action
Average discipline actions per student	MDE	Average number of discipline actions in a local education agency per student
Rate of discipline actions for racial/ethnic minority students	MDE	Rate of discipline actions in a local education agency with racial/ethnic minority students per 100 racial/ethnic minority students
Rate of discipline actions for American Indian and Black students	MDE	Rate of discipline actions in a local education agency with American Indian or Black students per 100 American Indian or Black students

Variable	Data source	Description
<i>Model element</i>		
Plan status	MDHR	Binary indicator of whether a local education agency was ever identified by Minnesota Department of Human Rights and created a discipline reform plan
Time	MDHR	A continuous measure of the time before or since the plan was created, centered on zero. School years after the creation of discipline reform plans are positive, school years before the creation of the discipline reform plans are negative
Post	MDHR	Binary indicator of whether the year is after the discipline reform plan was created
Plan status and time	MDHR	An interaction between plan status and the time variable
Plan status and post	MDHR	An interaction of plan status and the post variable that demonstrates the effect of creating a discipline reform plan after other factors are adjusted for

MDE is Minnesota Department of Education. MDHR is Minnesota Department of Human Rights. CCD is the National Center for Education Statistics' Common Core of Data.

Source: Authors' compilation.

First, the study team recoded the data elements. The study team transformed incident-level discipline data by collapsing multiple exclusionary discipline action observations about one student to a single student-level observation that captured all discipline actions data. This transformation created the following student-level measures that were used in the analyses:

- Binary indicator of whether a student experienced any discipline action.
- Total number of discipline actions a student experienced.
- Binary indicator of whether a student experienced any discipline action in the prior year.
- Total number of discipline actions a student experienced in the prior year.

This step also involved converting student characteristics into binary indicators for the analyses, as well as converting student-level data elements into local education agency-level characteristics by school year.

Student characteristics created through transforming the provided data elements included:

- Binary indicator of student identified as a racial/ethnic minority student.
- Binary indicator of student identified as American Indian or Black.

The local education agency-level variables created included:

- Total enrollment of students in the local education agency.
- Average student performance on the Minnesota Comprehensive Assessments math assessments, centered on the state mean.
- Average student performance on the Minnesota Comprehensive Assessments English language arts assessments, centered on the state mean.
- Average student performance on the Minnesota Comprehensive Assessments math assessments, centered on the state mean in the prior year.
- Average student performance on the Minnesota Comprehensive Assessments English language arts assessments, centered on the state mean in the prior year.

- Total count of students in the local education agency who were of a racial/ethnic background other than White.
- Total count of students in the local education agency who were American Indian or Black.
- Total count of students in the local education agency who were White.
- Percentage of students in the local education agency who were of a racial/ethnic background other than White.
- Percentage of students in the local education agency who were American Indian or Black.
- Percentage of students in the local education agency who were White.
- Percentage of students in the local education agency who were eligible for the National School Lunch Program.
- Percentage of students in the local education agency who were English learner students.
- Percentage of students in the local education agency who were in special education.
- Percentage of students in a local education agency experiencing any exclusionary discipline action.
- Average number of exclusionary discipline actions per student in a local education agency.
- Rate of exclusionary discipline actions taken in a local education agency with racial/ethnic minority students per 100 racial/ethnic minority students.
- Rate of exclusionary discipline actions taken in a local education agency with American Indian or Black students per 100 American Indian or Black students.
- Rate of discipline actions taken in a local education agency with students in special education per 100 students in special education.

Second, the study team appended datasets from multiple years together to create a single analytic dataset across the years included in the study and then merged the transformed data on discipline actions with the data on student characteristics. The study team first ensured that records were unique to a student in a local education agency in a given year. If a student attended schools in multiple local education agencies in a year, the student was assigned to the predominantly attended local education agency. After ensuring datasets on discipline and student background characteristic and academic achievement were unique by student, local education agency, and year, the study team combined the datasets.

Third, the study team used the combined dataset to create a comparison group of local education agencies similar to the local education agencies with a discipline reform plan. The comparison group comprised students in local education agencies chosen through propensity score matching (Rubin, 1997), using a one-to-one nearest-neighbor approach without replacement. The study team used the larger analytic dataset for research question 2 and used only the dataset for local education agencies with a discipline reform plan and matched comparison local education agencies for research question 3. The numbers of students in local education agencies with discipline reform plans, comparison local education agencies, and all local education agencies without a discipline reform plan, by student characteristics, are shown in table A2.

Table A2. Counts of students and local education agencies included in the analyses for research questions 2 and 3, by student group

Characteristic included in analyses	Research question	Local education agencies with discipline reform plans (n = 41)	Comparison local education agencies (n = 41)	All local education agencies without discipline reform plans (n = 469)
Total student enrollment	2, 3	495,172	243,113	761,470
American Indian and Black students	2, 3	117,091	28,603	70,095
All racial/ethnic minority students	2, 3	255,783	90,934	202,989
Students eligible for the National School Lunch Program	3	263,561	96,127	320,002
English learner students	3	86,047	30,660	62,104
Students in special education	2, 3	84,826	41,237	134,817
Students ever suspended	2, 3	33,955	13,297	38,385
Students ever excluded	2, 3	18	2	29
Students ever expelled	2, 3	84	29	135

Source: Authors' analysis of data provided by the Minnesota Department of Education.

The study team assessed baseline equivalence by examining the effect size of preintervention outcome measures for local education agencies with discipline reform plans and for comparison local education agencies. For a quasi-experimental study to meet the requirements of the What Works Clearinghouse Group Design Standards with Reservations Version 4.1 without the inclusion of a preintervention outcome in the analysis, the effect size of baseline differences between an intervention and comparison group must be less than 0.05 (What Works Clearinghouse, 2020). If the effect size is 0.05–0.25, the analytic design must include a measure of the preintervention outcome to meet standards. The baseline equivalence analysis found differences of 0.077 to 0.082 standard deviations, indicating that analyses must include measures of preintervention outcomes to have the potential of meeting What Works Clearinghouse Group Design Standards With Reservations (table A3).

Table A3. Baseline equivalence for preintervention measures of discipline outcomes, 2014/15–2016/17

Outcome	Students in local education agencies with discipline reform plans (n = 409,751)		Students in comparison local education agencies (n = 198,007)		Effect size
	Mean	Standard deviation	Mean	Standard deviation	
Any exclusionary discipline action experienced by student	0.041	0.198	0.027	0.162	0.077
Total number of exclusionary discipline actions per student	0.077	0.513	0.042	0.321	0.082

Source: Authors' analysis of data provided by Minnesota Department of Education.

Missing data

Data provided by the Minnesota Department of Education were considered population data; as a result, statistical testing was not necessary for answering research questions 1 and 2. The Minnesota Department of Education provided discipline data and student demographic data separately. In total, 49 cases appeared in the discipline data for which the student identification number and year combination did not match a student identification number and year combination in the student demographic data. These 49 records were excluded from the analyses and represented 0.002 percent of the dataset. It is also possible that discipline data were not reported to the Minnesota Department of Education. There is no available reference by which this possibility can be

checked. The possibility of missing data is a limitation to any potential inferences. No data were imputed for any of the analyses.

Analytic models

The following section describes the analytic models used to answer the four research questions in this study.

Research question 1. For research question 1 the study team compared key characteristics of local education agencies with discipline reform plans and key characteristics of all local education agencies in Minnesota. The characteristics included local education agency locale, average student enrollment, percentage of female students, percentages of students by race/ethnicity, percentage of students eligible for the National School Lunch Program, percentage of students in special education, percentage of English learner students, average standardized test scores in math and English language arts, and prior exclusionary discipline actions. Differences of 5 percentage points or greater were considered meaningful.

Research question 2. For research question 2 the study team calculated the rates of students who experienced an exclusionary discipline action, by school year. First, the study team calculated the total number of discipline actions experienced by American Indian or Black students, all racial/ethnic minority students, White students, students in special education, and students not in special education. Discipline action rates per 100 students were calculated separately for local education agencies with discipline reform plans and local education agencies without discipline reform plans, by school year.

The formula used to calculate the exclusionary discipline action rate for a student group in a given school year was as follows (where x is the student group of interest and j is the school year of interest):

$$Rate_{xj} = Total\ Discipline\ Actions_{xj} / \left(\frac{Total\ Enrollment_{xj}}{100} \right)$$

Research question 3. For research question 3 the study team used a multilevel comparative interrupted time-series model with a matched comparison group. A comparative interrupted time series is a quasi-experimental design that can be used for causal inference when a comparison or control series can be constructed (Shadish et al., 2001). This method compares the outcomes of a treatment group with outcomes for a comparison group after a treatment occurs, relative to their baseline prior to program implementation, to determine program effect after controlling for prior trends. This method is appropriate for contexts in which an abrupt policy change occurs and in which preintervention and postintervention data are available.

The intervention group comprised students in the 41 local education agencies that created discipline reform plans in 2017/18. The comparison group comprised students in 41 similar local education agencies not required to create discipline reform plans chosen through propensity score matching (Rubin, 1997). An advantage of using a comparative interrupted time-series design with a matched comparison group is that the model is flexible and able to account for nonparallel trends in pretreatment outcomes between the intervention and comparison groups.

To construct the comparison group, the study team matched local education agencies with discipline reform plans to other local education agencies on their characteristics prior to the creation of discipline reform plans, including average student enrollment; the percentage of racial/ethnic minority students; the percentage of students eligible for the National School Lunch Program; the percentage of students in special education; agencies' use of discipline actions (the percentage of students with any discipline action, the discipline action rate per 100 students, the discipline action rate per 100 students for American Indian or Black students, the discipline action rate per 100 students for all racial/ethnic minority students, and the discipline action rate per 100 students for students in special education); average standardized test score in math; average standardized test score in English language arts; whether the local education agency was a traditional district or a charter network, and locale (see table A4).

Table A4. Differences between local education agencies with discipline reform plans and comparison agencies without discipline reform plans

Local education agency characteristics included in matching analyses	Local education agencies with discipline reform plans average (n = 41)	Comparison local education agencies average (n = 41)	Standardized mean difference
Average student enrollment	7,733.24	3,843.59	-2.47*
Percent racial/ethnic minority students	56.76	58.60	0.26
Percent students eligible for the National School Lunch Program	55.69	59.71	0.67
Percent students in special education	15.65	14.58	-1.07
Percent students with any discipline action	5.96	6.92	0.76
Total number of discipline actions per 100 students	10.50	12.82	0.78
Total number of discipline actions for American Indian and Black students per 100 American Indian and Black students	20.02	19.48	-0.15
Total number of discipline actions for racial minority students per 100 racial minority students	13.89	15.17	0.42
Total number of discipline actions for students in special education per 100 students in special education	11.61	13.78	0.90
Math performance compared with state average	-5.89	-4.72	0.60
English language arts performance compared with state average	-5.66	-5.34	0.17
Percent local education agencies with charter status	19.51	39.02	1.96*
Town locale	9.76	14.63	0.67
Suburb locale	41.46	34.15	-0.68
City local	36.59	39.02	0.23
Rural local	12.20	12.20	<0.00

* Significant at $p < .05$; ** significant at $p < .01$.

Source: Authors' analysis of data provided by the Minnesota Department of Education.

The study team used two similar analytic models to answer research question 3 and examine the robustness of the findings. The primary model was a three-level hierarchical linear model that incorporated local education agency and cohort-level random intercepts and adjusted for prior trends in exclusionary discipline actions; whether a student experienced a discipline action in the prior school year; student background characteristics (including gender, race/ethnicity, eligibility for the National School Lunch Program, special education status, English learner student status, and grade level); and the characteristics of the local education agency (including whether a local education agency was a traditional district or a charter network, total student enrollment, and average student performance on standardized tests in math and English language arts in the prior school year). This model allowed the study team to examine how discipline outcome changes varied across local education agencies.

The second analytic model was a fixed effects model with cohort fixed effects, local education agency covariates, and clustered standard errors accounting for the same student appearing in the dataset over multiple years. The model adjusted for the same variables as in the first model. For each outcome the most methodologically appropriate model was used based on the distribution of the outcome data (for example, the study team used generalized linear models for the total discipline actions per student outcome but used logistic regression models for the student experiencing any discipline action outcome).

The following model was used for identifying the effect on discipline outcomes:

$$f(Y_{ijt}) = \beta_0 + \beta_1 X_{ijt} + \beta_2 W_{jt} + \beta_3 MDHR_j + \beta_4 Time_t + \beta_5 Post_{jt} + \beta_6 Time_t * MDHR_{jt} + \beta_7 Post * MDHR_{jt} + v_j + u_{jt} + e_{ijt}$$

where $f(Y_{ijt})$ is the outcome of interest and Y_{ijt} is a latent variable connected to the outcome through the function $f()$; $f()$ is the link function appropriate for a given outcome variable (logit for binary outcomes such as

whether the student received any discipline action, natural log for the number of discipline actions per student in a given year); X_{ijt} is a vector of student characteristics for student i in district j at time t ; W_{jt} is a vector of local education agency characteristics at time t ; $MDHR_j$ is an indicator of whether a local education agency is part of the intervention group; and β_3 is the difference in the average outcome between local education agencies with a discipline reform plan and comparison local education agencies; β_4 is an estimate of change in the outcome from year to year, where $Time_t$ is equal to zero when the school year is the 2017/18 school year, prior years are negative decreasing from zero, and following years are positive increasing from zero; $Post_{jt}$ is an indicator for the postintervention time period t (the 2018/19 school year); β_6 is a vector showing the change in difference in outcomes between local education agencies with discipline reform plans and comparison local education agencies at each time t ; β_7 is a vector showing the change in difference in outcomes between local education agencies with discipline reform plans and comparison local education agencies for the 2018/19 school year; and v_j, u_{jt}, e_{ijt} are local education agency, time, and individual-level random-error terms.

This analysis produced estimates of regression coefficients (betas) and standard errors that identified statistically significant predictors of outcomes. However, because different link functions were used for different outcomes, the interpretation of the regression coefficients varied. For example, when the outcome was binary (whether a student experienced any discipline action or not), the link function was logit. The estimates from the analyses were reported as predicted probabilities in the report to facilitate interpretation (more detail is included in table B5 in appendix B). Estimates were also reported as odds ratios (see table B4); odds ratios greater than 1 indicated a positive statistical relationship and those less than 1 indicated a negative relationship. When the outcome was a count variable (such as the total number of discipline actions a student experienced in a school year), the link function was the natural log, and the regression coefficients were interpreted as the difference between the log of expected counts.

Research question 4. For research question 4 the study team examined the content of the discipline reform plans. First, the study team reviewed the discipline reform plans published by MDHR for all 41 local education agencies with discipline reform plans, as well as the updates that had been published since fall 2017 (which are released in September and February of each year). Plan updates included any changes or shifts that were made to the initial plan, as well as progress reports of all previously laid out action steps. To develop the categories for discipline reform approaches, two team members noted recurring themes in the plans and updates. Then, the team members consolidated related reforms into categories based on the content of each reform, consulting the literature as needed. After creating this initial set of categories, the team consulted with the Minnesota Department of Education and MDHR to verify the accuracy of the categories. Next, two team members conducted pilot reviews of the same three discipline reform plans to test the coding framework and calibrate their ratings. After achieving agreement, they coded the remaining discipline reform plans and updates.

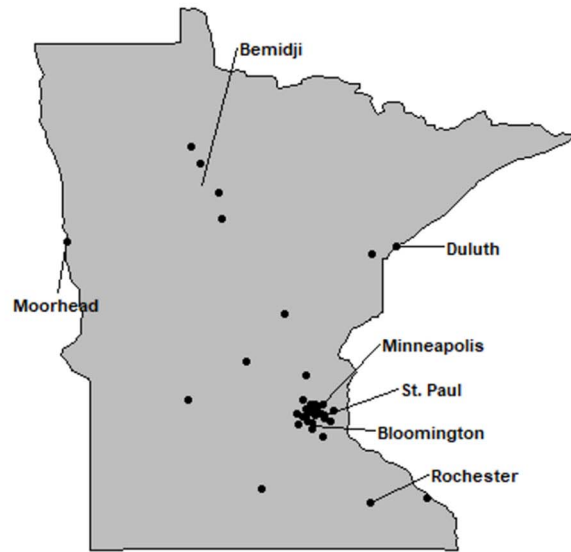
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Appendix B. Supporting analysis

For research question 1 the study team identified the locale types and locations of local education agencies with discipline reform plans. The study team mapped the local education agency locations to display the geographic distribution (map B1).

Map B1. Map of local education agencies identified in 2017 by the Minnesota Department of Human Rights as using exclusionary disciplinary practices disproportionately among racial/ethnic minority students and students in special education



Source: Authors' compilation based on discipline reform plans published on the Minnesota Department of Human Rights' website.

For research question 2 the study team calculated the rates of discipline actions for students by year for American Indian and Black students, all racial/ethnic minority students, White students, students in special education, and students not in special education (table B1). The study team also calculated these rates separately for students in local education agencies with discipline reform plans and students in other local education agencies (table B2).

Table B1. Exclusionary discipline action rates per 100 students among Minnesota public school students, 2014/15–2018/19

Student group	2014/15 (n = 818,127)	2015/16 (n = 825,433)	2016/17 (n = 832,217)	2017/18 (n = 837,568)	2018/19 (n = 840,012)	Overall (n = 1,174,713)
All students (per 100 students)	4.69	5.18	5.06	5.61	5.36	5.18
<i>Race/ethnicity</i>						
American Indian and Black students	17.56	20.01	17.91	19.73	17.90	18.63
All racial/ethnic minority students	9.53	10.66	9.86	10.87	9.93	10.18
White students	2.48	2.55	2.64	2.87	2.89	2.68
<i>Special education status</i>						
Students in special education	15.92	16.68	15.63	16.74	15.69	16.14
Students not in special education	2.80	3.23	3.22	3.62	3.45	3.27

Note: Discipline action rates are the number of suspensions, exclusions, and expulsions per 100 students.

Source: Authors' analysis of data provided by the Minnesota Department of Education.

Table B2. Exclusionary discipline action rates per 100 students among students in local education agencies with discipline reform plans and local education agencies without plans, 2014/15–2018/19

Student group	2014/15		2015/16		2016/17		2017/18		2018/19		Overall (2014/15–2018/19)	
	With plan (n = 313,935)	Without plan (n = 504,192)	With plan (n = 316,102)	Without plan (n = 509,331)	With plan (n = 316,393)	Without plan (n = 515,824)	With plan (n = 317,063)	Without plan (n = 520,505)	With plan (n = 316,479)	Without plan (n = 523,533)	With plan (n = 495,172)	Without plan (n = 761,470)
All students (per 100 students)	7.05	3.21	8.33	3.23	7.71	3.43	8.39	3.92	7.50	4.07	7.80	3.58
<i>Race/ethnicity</i>												
American Indian and Black students	20.66	11.13	24.72	10.51	21.10	11.77	23.44	12.83	20.90	12.54	22.17	11.81
All racial/ethnic minority students	11.71	6.41	13.98	6.06	12.31	6.62	13.55	7.41	11.96	7.41	12.70	6.82
White students	2.74	2.37	2.85	2.43	3.07	2.47	3.00	2.81	2.73	2.95	2.88	2.61
<i>Special education status</i>												
Students in special education	25.46	9.84	27.68	9.81	24.63	10.17	26.10	11.13	23.13	11.30	25.38	10.48
Students not in special education	3.90	2.11	5.02	2.11	4.80	2.25	5.26	2.62	4.66	2.72	4.73	2.37

Note: Discipline action rates are the number of suspensions, exclusions, and expulsions per 100 students.

Source: Authors' analysis of data provided by the Minnesota Department of Education.

Hierarchical linear model analyses findings

For research question 3 the study team used two analytic models. Findings from the primary hierarchical linear model are in tables B3 and B4. Table B5 shows the predicted probability of a student experiencing any discipline action based on enrollment in a local education agency that created a discipline reform plan or in a comparison agency that did not create a reform plan, after student and local education agency characteristics and prior trends in exclusionary discipline actions were controlled for. Table B6 shows the 95 percent confidence interval for the total number of discipline actions a student would experience in a year after student and local education agency characteristics and prior trends in exclusionary discipline actions were accounted for.

Table B3. Impact of creating a discipline reform plan on student exclusionary discipline outcomes in local education agencies with a discipline reform plan, hierarchical linear model, 2014/15–2018/19

Discipline outcome	Coefficient (standard error)	<i>p</i> -value
Any exclusionary discipline action (odds ratio)	1.063 (0.149)	.664
Total exclusionary discipline actions (count per student)	–0.097 (0.310)	.753

Source: Authors' analysis of data provided by the Minnesota Department of Education.

Table B4. Impact of creating a discipline reform plan on student exclusionary discipline outcomes in local education agencies with a discipline reform plan, with student and local education agency covariates, hierarchical linear model, 2014/15–2018/19

Variable	Any discipline action	Total discipline actions
	Odds ratio (standard error)	Coefficient (standard error)
<i>Student predictor</i>		
Intercept	0.01 (0.00)***	-5.43 (0.05)***
Female	0.52 (0.00)***	-0.63 (0.01)***
American Indian or Black students	2.55 (0.02)***	0.75 (0.01)***
Eligibility for the National School Lunch Program	2.66 (0.03)***	0.92 (0.0)***
Special education status	2.49 (0.02)***	0.97 (0.00)***
English learner student status	0.67 (0.01)***	-0.42 (0.01)***
Enrolled in middle school grade	3.65 (0.04)***	1.07 (0.01)***
Enrolled in high school grade	2.47 (0.02)***	0.74 (0.01)***
Any discipline action in the prior year	4.85 (0.08)***	1.55 (0.01)***
Total discipline actions in the prior year	1.27 (0.01)***	0.10 (0.00)***
<i>Local education agency predictor</i>		
Created discipline reform plan, all years	0.83 (0.11)	0.36 (0.58)
Treatment effect (created discipline reform plan, postidentification)	1.06 (0.15)	-0.10 (0.31)
After creation of discipline reform plans, all local education agencies	0.90 (0.09)	0.06 (0.04)
Time, all local education agencies	1.00 (0.03)	-0.02 (0.01)
Time, local education agencies with a discipline reform plan	0.87 (0.03)**	-0.16 (0.07)*
Average percentage of students eligible for the National School Lunch Program	1.00 (0.00)	0.00 (0.00)
Average percentage of students in special education	1.00 (0.00)**	0.00 (0.00)**
Average percentage of students who were English learner students	1.00 (0.00)	0.00 (0.00)
Average math performance in prior year	1.01 (0.03)	0.01 (0.01)
Average English language arts performance in prior year	1.00 (0.03)	-0.01 (0.01)
City locale	1.36 (0.27)	0.65 (0.10)***
Suburb locale	1.08 (0.22)	0.64 (0.07)***
Town locale	1.07 (0.26)	0.45 (0.08)***
Total student enrollment	1.62 (0.50)	0.00 (0.00)**
<i>Random effect (variance component)</i>		
Variance in cohort (level 2)	0.14	0.49
Variance in local education agency (level 3)	0.24	0.80

* Significant at $p < .05$, ** significant at $p < .01$, *** significant at $p < .001$.

Source: Authors' analysis of data provided by the Minnesota Department of Education.

Table B5. Marginal predicted probability of experiencing any exclusionary discipline action, by discipline reform plan status, after all other model covariates were accounted for, hierarchical linear model, 2014/15–2018/19

Discipline reform plan status	Margin (standard error)	<i>p</i> -value	95% confidence interval	
			Minimum	Maximum
Local education agencies with a discipline reform plan	0.020 (0.00)	.00	0.016	0.024
Comparison local education agencies	0.021 (0.00)	.00	0.015	0.027

Source: Authors' analysis of data provided by the Minnesota Department of Education.

Table B6. Change in total number of exclusionary discipline actions, by discipline reform plan status, after all other model covariates were accounted for, hierarchical linear model, 2014/15–2018/19

Discipline reform plan status	95% confidence interval	
	Minimum	Maximum
Local education agencies with a discipline reform plan	–0.705	0.511
Comparison local education agencies	–0.608	0.608

Source: Authors' analysis of data provided by the Minnesota Department of Education.

Fixed effects analyses findings

To check the robustness of the findings, the study team also analyzed the data using fixed effects models. The results from these analyses are in tables B7 and B8. The findings are similar to those of the hierarchical linear models analyses.

Table B7. Impact of creating discipline reform plan on student exclusionary discipline outcomes in local education agencies with discipline reform plans, fixed effects model, 2014/15–2018/19

Discipline outcome	Coefficient (standard error)	<i>p</i> -value
Any discipline action (odds ratio)	0.988 (0.028)	.67
Total discipline actions (count per student)	0.050 (0.032)	.12

Source: Authors' analysis of data provided by the Minnesota Department of Education.

Table B8. Impact of creating a discipline reform plan on student exclusionary discipline outcomes in local education agencies with discipline reform plans, with student and local education agency covariates and cohort fixed effects, 2014/15–2018/19

Variable	Any discipline	Total discipline
	Odds ratio (standard error)	Coefficient (standard error)
<i>Student predictor</i>		
Intercept	0.01 (0.00)***	–3.81 (0.03)***
Female	0.52 (0.00)***	–0.54 (0.01)***
American Indian or Black	2.64 (0.02)***	0.83 (0.01)***
Eligible for the National School Lunch Program	2.69 (0.03)***	1.00 (0.01)***
Special education status	2.43 (0.02)***	0.95 (0.01)***
English learner student status	0.67 (0.01)***	–0.46 (0.01)***
Enrolled in middle school grade	3.45 (0.03)***	1.02 (0.01)***
Enrolled in high school grade	2.31 (0.02)***	0.53 (0.01)***
Any discipline action in the prior year	5.00 (0.10)***	1.58 (0.01)***
Total discipline actions in the prior year	1.27 (0.01)***	0.10 (0.00)***
<i>Local education agency predictor</i>		
Created discipline reform plan, all years	0.84 (0.01)***	–0.19 (0.02)***
Treatment effect (created discipline reform plan, postidentification)	0.99 (0.03)	–0.05 (0.03)
After creation of discipline reform plans, all local education agencies	0.86 (0.02)***	–0.26 (0.03)***
Time, all local education agencies	1.11 (0.01)***	0.17 (0.01)***
Time, local education agencies with a discipline reform plan	0.94 (0.01)***	–0.10 (0.01)***
Average percentage of students eligible for the National School Lunch Program	1.00 (0.00)***	0.00 (0.00)
Average percentage of students in special education	1.00 (0.00)***	0.00 (0.00)
Average percentage of students who were English learner students	1.00 (0.00)***	0.00 (0.00)
Average math performance in prior year	1.04 (0.01)***	0.06 (0.01)***
Average English language arts performance in prior year	0.93 (0.01)***	–0.10 (0.01)***
City locale	0.83 (0.02)***	–0.27 (0.02)***
Suburb locale	0.79 (0.02)***	–0.30 (0.02)***
Town locale	0.83 (0.02)***	–0.27 (0.02)***
Total student enrollment	1.00 (0.00)***	0.00 (0.00)***

*** Significant at $p < .001$.

Source: Authors' analysis of data provided by Minnesota Department of Education.

Power analyses findings

The study team estimated the minimum detectable effect size using PowerUp! (Dong & Maynard, 2013). The design is a three-level random effects cluster design in which an average of 5,756 students are nested within 409 cohorts in 82 local education agencies. A minimum detectable effect size of 0.27 with 80 percent probability was calculated using a two-tailed test, at a .05 level of significance. This calculation was based on the assumption that 90 percent of the variance in the level 1 outcomes, 25 percent in the level 2 outcomes, and 15 percent in the level three outcomes are explained by level 1, level 2, and level 3 covariates, and an intraclass correlation coefficient of .10 at level 2 and .20 at level 3.

Reference

Dong, N., & Maynard, R. (2013). *PowerUp!* A tool for calculating minimum detectable effect sizes and minimum required sample sizes for experimental and quasi-experimental design studies. *Journal of Research on Educational Effectiveness*, 6(1), 24–67. <https://eric.ed.gov/?id=EJ994691>.