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Do Active-Shooter Drills Hurt Students?

An Essay for the Learning Curve by Elc Estrera

May 2023

School shootings have been a constant looming threat for students across the US, with the number of shootings on campuses dramatically increasing in recent years.[1] In response, schools have instituted preparedness and response measures, including school-shooter drills.

From 2003–04 to 2017–18, the share of public schools conducting school-shooter drills that involve students increased from 47 percent to 93 percent.[2] Educators have raised concerns about these drills.[3] The two largest teachers' unions have expressed concerns that the drills could traumatize students,[4] and students have reported experiencing distress after participating in these drills.[5]

The data that are needed to examine the relationship between school-shooter drills and student well-being are not readily available, but studies have documented the negative effects of exposure to

[1] See "School Shootings," Gun Violence Archive, last updated May 1, 2023, https://www.gunviolencearchive.org/school-shootings; and data from The Violence Project at https://www.theviolenceproject.org/.

[2] See the National Center for Education Statistics reports entitled *Crime, Violence, and Safety in U.S. Public Schools*.

[3] The popular press describes these drills in at least two ways. During lockdown drills, students and staff members remain in a room or area within a building with specific procedures to follow. See Melissa Diliberti, Michael Jackson, Samuel Correa, and Zoe Padgett, *Crime, Violence, Discipline, and Safety in U.S. Public Schools: Findings from the School Survey on Crime and Safety: 2017–18* (Washington, DC: US Department of Education, Institute of Education Sciences, National Center for Education Statistics, 2019). Active-shooter drills are an "options-based" approach similar to the "Run, Hide, or Fight" model endorsed by federal agencies (e.g., the US Department of Homeland Security and the Federal Emergency Management Agency). See the website for ALICE Training Solutions at https://www.alicetraining.com/. The setting for this study, Arkansas, reports data on active-shooter drills.

[4] Tim Walker, "Unannounced Active Shooter Drills Scaring Students without Making Them Safer," National Education Association, February 25, 2020, https://www.nea.org/advocating-for-change/new-from-nea/unannounced-active-shooter-drills-scaring-students-without-making-them-safer; and "AFT Resolution: Opposition to Active Shooter Drills," American Federation of Teachers, accessed April 28, 2023, https://www.aft.org/resolution/opposition-active-shooter-drills.

[5] E. Williamson, "When Active-Shooter Drills Scare the Children They Hope to Protect," *New York Times*, April 9, 2019, https://www.nytimes.com/2019/09/04/us/politics/active-shooter-drills-schools.html?smid=em-share.

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traumatic events—namely neighborhood homicides[6] and school shootings[7]—on student outcomes that include test scores and attendance. Thus, if school-shooter drills hurt students, researchers might detect their effects in outcomes of interest to education policymakers.

This essay examines the relationship between active-shooter drills and two school accountability outcomes: attendance rates and proficiency rates on statewide end-of-year tests. There are two main results. First, in English and math, students in grades three through five who test on the school days immediately after an active-shooter drill have lower proficiency rates than their counterparts who test on the days and weeks before the drill. But proficiency rates return to typical levels as tests are administered in the weeks following the week of the drill. Second, attendance rates are slightly lower during quarters when active-shooter drills occur, relative to quarters without these drills.

Is There a Relationship between Active-Shooter Drill Participation and Proficiency Rates?

To examine the relationship between active-shooter drills and end-of-year test proficiency rates, I linked publicly available aggregate data from the Arkansas Department of Education[8] for academic years 2015–16 through 2018–19 to testing calendars that indicate when students in a specific school and grade were scheduled to take statewide, end-of-year accountability tests. Beginning in 2015–16, Arkansas administered to all students in grades 3 through 10 the ACT Aspire tests, which are achievement tests in English, math, science, reading, and writing that assess college readiness according to the ACT College Readiness Benchmarks.[9] Although the tests include separate writing and reading

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[6] Patrick Sharkey, "The Acute Effect of Local Homicides on Children's Cognitive Performance," *Proceedings of the National Academy of Sciences* 107, no. 26 (June 2010): 11733–38, https://doi.org/10.1073/pnas.1000690107; Patrick Sharkey, Amy Ellen Schwartz, Ingrid Gould Ellen, and Johanna Lacoe, "High Stakes in the Classroom, High Stakes on the Street: The Effects of Community Violence on Students' Standardized Test Performance," *Sociological Science* 1 (May 2014): 199, https://doi.org/10.15195/v1.a14; and Patrick T. Sharkey, Nicole Triado-Strayer, Andrew V. Papachristos, and C. Cybele Raver, "The Effect of Local Violence on Children's Attention and Impulse Control," *American Journal of Public Health* 102, no. 12 (December 2012): 2287–93, https://doi.org/10.2105/AJPH.2012.300789.

[7] Louis-Philippe Beland and Dongwoo Kim, "The Effect of High School Shootings on Schools and Student Performance," *Educational Evaluation and Policy Analysis* 38, no. 1 (March 2016): 113, https://doi.org/10.3102/0162373715590683; and Phillip B. Levine and Robin McKnight, *Exposure to a School Shooting and Subsequent Well-Being* (working paper, National Bureau of Economic Research, Cambridge, Massachusetts, 2020), https://doi.org/10.3386/w28307.

[8] The Arkansas Department of Education maintains accountability information for public schools across the state. These data include safety drills, student enrollment and attendance, and proficiency rates on an end-of-year summative assessment called the ACT Aspire Summative Assessment. See "Statewide Information Systems Reports," Arkansas Department of Education Data Center, accessed May 2, 2023, https://adedata.arkansas.gov/statewide/; and Jeff Allen and Justine Redunzel, "What Are the ACT College Readiness Benchmarks?" (ACT, 2017).

[9] Arkansas Bureau of Legislative Research, "The Arkansas Comprehensive Testing, Assessment, and Accountability Program (ACTAAP)," letter to the House and Senate Committees on Education, November 3, 2015, https://www.arkleg.state.ar.us/Committees/Document?type=pdf&source=assembly%2f2015%2fMeeting%20Attachments/810/I14141&filename=ACTAAP%20Report%20Bureau%20Brief; Allen and Redunzel, "What Are the ACT College Readiness Benchmarks?"; and Statewide Information Systems Reports," Arkansas Department of Education Data Center.

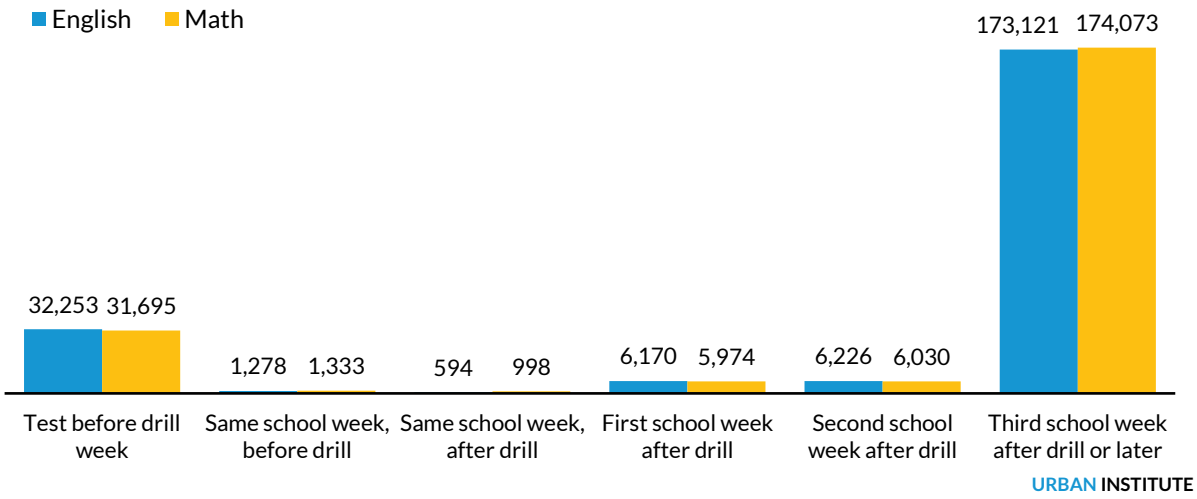
subject tests, I excluded these from my analyses because the scale for the writing scores is based on a rubric, and neither writing nor reading factor into school accountability calculations. Ultimately, I restricted my analysis to English and math.

These data allow me to explore whether participation in active-shooter drills on days leading up to a test might be associated with students performing worse on the test, relative to participating in these drills before the test. The analysis below focuses on students in grades three through five at schools for which I recovered test schedules via a public records request and internet searches.[10] Appendix table A.1 shows that the schools for which test schedules were recovered are similar to all traditional public schools serving these grades.

A small share of students over this period tested in English or math on the days immediately following, or two weeks after participating in, an active-shooter drill (6 percent of test takers in English and 3 percent in math).

FIGURE 1

Student Test Taking Relative to Active-Shooter Drills



Source: Author's calculations based on data available from the Arkansas Department of Education Statewide Longitudinal Information System (see "Statewide Information Systems Reports," Arkansas Department of Education, accessed April 27, 2023, https://adedata.arkansas.gov/statewide/) and test schedules recovered through a public records request.
Notes: Each bar denotes the number of unique students in grades three through five that tested relative to active-shooter drills. The sample is restricted to schools for which at least one school-grade test schedule was recovered.

Students who tested after an active-shooter drill had lower ACT Aspire proficiency rates than those who tested before the drill (figure 2). Notably, proficiency rates appear to dip when testing occurred on the days after a drill and during the same school week. Rates then rise when testing during subsequent weeks. Whereas 75.9 percent of students in grades three through five scored at least proficient if they took their ACT Aspire English tests the same week as the active-shooter drill but before the drill, only

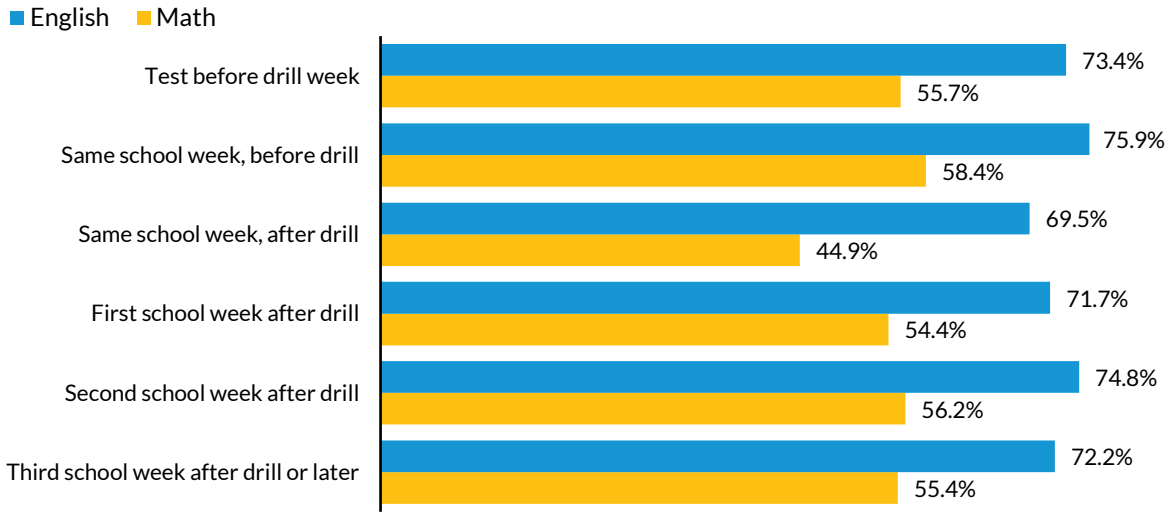
[10] I focus on these grade levels because they had the largest sample sizes.

69.5 percent who tested the same week but after the drill scored the same. An analysis of math scores returns a similar result. Whereas 58.4 percent of students in grades three through five scored at least proficient if they took their tests the same week as the active-shooter drill but before the drill, 44.9 percent who tested the same week but after the drill scored at least proficient.

Given that the Arkansas accountability system weights school-level achievement as 35 percent of the index score,[11] the test score differences associated with the timing of active-shooter drills could change a school's accountability letter grade. With the exception of A and F letter grades, letter grade ranges span about seven points.[12] Thus, for math, the difference between taking the test before the drill or after the drill in the same week is about 70 percent of a letter grade in the Arkansas accountability system, and for English, the corresponding difference is approximately 30 percent. Accounting for math and English together, the combined difference is about 50 percent of a letter grade.

FIGURE 2

Share of Students in Grades Three through Five Scoring Proficient or Higher on the ACT Aspire End-of-Year Summative Assessments, by Timing of the Test Relative to an Active-Shooter Drill



Source: Author's calculations based on data available from the Arkansas Department of Education Statewide Longitudinal Information System (see "Statewide Information Systems Reports," Arkansas Department of Education, accessed April 27, 2023, https://adedata.arkansas.gov/statewide/) and test schedules recovered through a public records request.
Notes: Each bar denotes the mean proficiency rate (percentage) for students in grades three through five testing relative to the drill, weighted by the number of test takers. The sample is restricted to schools for which at least one school-grade test schedule was recovered.

[11] Arkansas Division of Elementary and Secondary Education (DESE), "What Is the ESSA School Index?" (Little Rock: DESE, n.d.).

[12] "Report Card," Arkansas Division of Elementary and Secondary Education, accessed April 28, 2023, https://dese.ade.arkansas.gov/Offices/public-school-accountability/school-performance-and-monitoring/report-card.

There are three plausible explanations for the above pattern. First, active-shooter drills might negatively affect student well-being and in turn their performance on tests. This explanation would be consistent with the theory that these drills induce emotional distress—and perhaps trauma—and would also be consistent with studies documenting the negative effects of traumatic events on student performance on tests. Second, participation in an active-shooter drill on the days immediately preceding a test could reduce critical instructional time that could otherwise be used for test preparation. Indeed, recent work shows that interruptions to instructional time, including fire and "intruder" drills, are associated with declines in achievement.[13] Finally, schools that schedule active-shooter drills on the days leading up to a test might be systematically different from schools that do not schedule these drills in ways that are correlated with drill scheduling and proficiency rates. This explanation seems least likely, however, as I found similar estimates of average proficiency rates when I estimated an ordinary least squares (OLS) regression model that controls for a robust set of school and school-by-grade characteristics. (See the appendix for details.)

Is There a Relationship between Active-Shooter Drills and Attendance Rates?

Some students avoid school after participating in school-shooter drills,[14] which might partially explain the lower proficiency rates associated with testing after these drills. After all, research has shown that missing more days of school is associated with lower test scores, including among elementary school students.[15]

To test the relationship between active-shooter drills and attendance, I used the same data but extended the sample to all schools serving students in grades 3 through 10. (See appendix table A.1 for summary statistics for these schools.) For these schools, I can estimate the relationship between a school's quarterly attendance rate—calculated as average daily attendance divided by average daily membership—and whether the school conducted an active-shooter drill during that quarter. To do so, I estimated an OLS model that compares attendance rates within the same school over time. (See the appendix for details.)

When a school conducts one or more active-shooter drills during a quarter, that school's attendance rate declines slightly (0.09 percentage points) compared with times when it conducts only fire or tornado drills. To be sure, 0.09 percentage points is an extremely small difference. Moreover, this effect could be attributed to students avoiding school in anticipation of an active-shooter drill (e.g., they

[13] Matthew A. Kraft and Manuel Monti-Nussbaum, "The Big Problem with Little Interruptions to Classroom Learning," *AERA Open* 7 (July 2021), https://doi.org/10.1177/23328584211028856.

[14] Anya Kamenetz and Lee Gaines, "A Look at the Value of Active Shooter Drills in Schools," NPR, November 22, 2019, https://www.npr.org/2019/11/22/782130813/a-look-at-the-value-of-active-shooter-drills-in-schools.

[15] Estaban M. Aucejo and Teresa Foy Romano, "Assessing the Effect of School Days and Absences on Test Score Performance," *Economics of Education Review* 55 (December 2016): 70, https://doi.org/10.1016/j.econedurev.2016.08.007; Seth Gershenson, Alison Jacknowitz, and Andrew Brannegan, "Are Student Absences Worth the Worry in U.S. Primary Schools?" *Education Finance and Policy* 12, no. 2 (Spring 2017): 137, https://doi.org/10.1162/EDFP_a_00207; and Dave E. Marcotte and Steven W. Hemelt, "Unscheduled School Closings and Student Performance," *Education Finance and Policy* 3, no. 3 (Summer 2008): 316, https://doi.org/10.1162/edfp.2008.3.3.316.

might be made aware days in advance) or because they do not want to return to school after participating in the drill.

Conclusion

The School Safety Drill Research Act of 2021 (H.R. 3432), introduced in the US House of Representatives on May 20, 2021, called for the study of the mental health effects of lockdown and active-shooter drills. But the bill has not moved forward since its introduction. Nevertheless, policymakers should continue to dig into whether, and how much, school-shooter drills affect student outcomes and weigh the benefits of conducting these drills with the potential costs to student success and well-being. Although additional research is needed to inform school leaders' decisions, for now they might simply avoid scheduling active-shooter drills on days leading up to major tests.

Appendix

TABLE A.1

Summary Statistics for Traditional Public Schools Servings Grades 3 through 5

	Schools Serving Grades 3 through 5						Schools Serving Grades 3 through 10		
	All Schools			Analytic Sample for Proficiency Rate Analysis			All Schools		
	Obs.	Mean	SD	Obs.	Mean	SD	Obs.	Mean	SD
Safety drill characteristics									
Share of schools reporting active-shooter drill dates	1,212	0.76	N/A	952	0.83	N/A	2,091	0.75	N/A
Number of active-shooter drills	917	1.25	1.04	780	1.11	0.63	1,533	1.23	0.97
Share of schools reporting fire drill dates	1,212	1.00	N/A	952	1.00	N/A	2,091	0.99	N/A
Number of fire drills	1,209	8.76	1.90	951	8.87	1.92	2,077	8.73	1.92
Share of schools reporting tornado drill dates	1,212	0.99	N/A	952	0.99	N/A	2,091	0.97	N/A
Number of tornado drills	1,195	2.88	0.58	942	2.92	0.60	2,053	2.85	0.59
Student and educator characteristics									
Share of Black students	1,212	0.20	N/A	952	0.19	N/A	2,091	0.21	N/A
Share of Hispanic students	1,212	0.15	N/A	952	0.15	N/A	2,091	0.14	N/A
Share of students of other races	1,212	0.06	N/A	952	0.07	N/A	2,091	0.06	N/A
Share of white students	1,212	0.58	N/A	952	0.59	N/A	2,091	0.59	N/A
Share of students not speaking English at home	1,212	0.14	N/A	952	0.15	N/A	2,091	0.13	N/A
Share of retained students	820	0.04	N/A	661	0.03	N/A	1,288	0.03	N/A
Share of economically disadvantaged students	1,212	0.63	N/A	952	0.63	N/A	2,090	0.58	N/A
Share of schools with school-wide federal program status	1,212	0.80	N/A	952	0.77	N/A	2,091	0.60	N/A
Share of schools with target-assisted federal program status	1,212	0.04	N/A	952	0.05	N/A	2,091	0.05	N/A
Share of Black certified teachers	1,210	0.08	N/A	950	0.08	N/A	2,088	0.08	N/A
Share of Hispanic certified teachers	1,210	0.01	N/A	950	0.01	N/A	2,088	0.01	N/A
Share of certified teachers of other races	1,210	0.02	N/A	950	0.02	N/A	2,088	0.02	N/A
Share of white certified teachers	1,210	0.90	N/A	950	0.90	N/A	2,088	0.89	N/A
Student-teacher ratio	1,201	15.37	2.53	938	15.01	2.85	2,075	13.41	3.32
Share of schools with a new-to-school principal	1,212	0.16	N/A	952	0.16	N/A	2,091	0.19	N/A
Proficiency rate across English and math	559	64.80	14.25	952	63.96	13.93	559	64.80	14.25
Quarterly attendance rate	1,212	94.59	1.37	952	94.63	1.41	2,091	94.37	1.76
Structural characteristics									
Share of schools serving grades 3–5	1,212	1.00	N/A	952	0.62	N/A	2,091	0.49	N/A

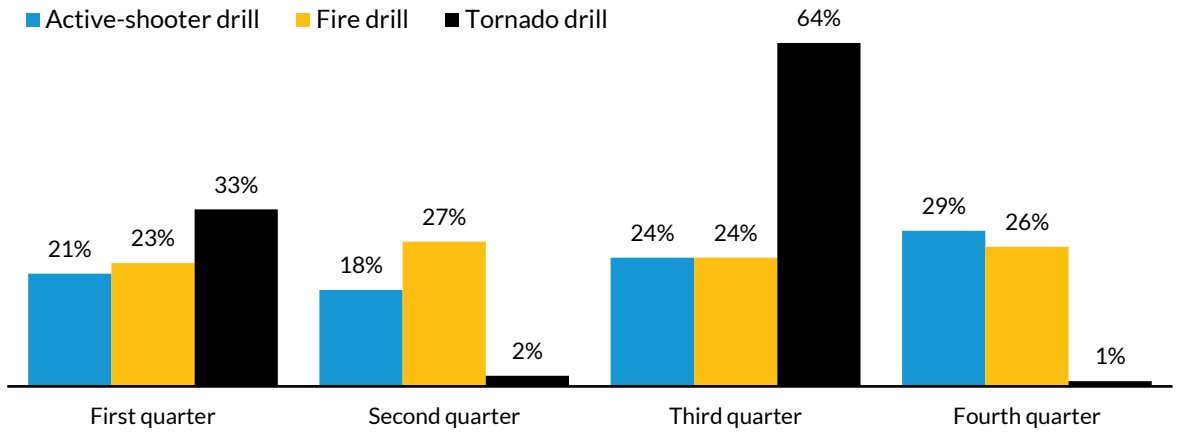
	Schools Serving Grades 3 through 5						Schools Serving Grades 3 through 10		
	All Schools			Analytic Sample for Proficiency Rate Analysis			All Schools		
	Obs.	Mean	SD	Obs.	Mean	SD	Obs.	Mean	SD
Share of schools serving grades 6–8	1,212	0.00	N/A	952	0.00	N/A	2,091	0.18	N/A
Share of schools serving grades 9–10	1,212	0.00	N/A	952	0.00	N/A	2,091	0.33	N/A
Share of schools serving a combination of grades	1,212	0.00	N/A	952	0.38	N/A	2,091	0.00	N/A
Share of schools with a block schedule	1,212	0.00	N/A	952	0.00	N/A	2,091	0.06	N/A
Share of schools with year-round attendance	1,212	0.01	N/A	952	0.01	N/A	2,091	0.01	N/A
Share of alternative schools	1,212	0.01	N/A	952	0.02	N/A	2,091	0.01	N/A
Share of magnet schools	1,212	0.03	N/A	952	0.02	N/A	2,091	0.03	N/A
Share of schools in cities	1,211	0.31	N/A	952	0.36	N/A	2,090	0.32	N/A
Share of schools in suburbs	1,211	0.16	N/A	952	0.10	N/A	2,090	0.17	N/A
Share of schools in towns	1,211	0.19	N/A	952	0.14	N/A	2,090	0.23	N/A
Share of schools in rural areas	1,211	0.33	N/A	952	0.40	N/A	2,090	0.28	N/A

Source: Arkansas Department of Education Data Center, 2015–16 through 2018–19.

Notes: N/A = not applicable. Obs. = observations; SD = standard deviation. The unit of observation is the school year. Means and standard deviations are weighted by total student enrollment. A school is in the analytic sample for the proficiency rate analysis if (1) it reported at least one active-shooter drill on a weekday during the school year and (2) test dates for at least one subject and grade were recovered through a public records request. Economic disadvantage is operationalized as direct certification or submission of an application for free and reduced-price lunch. "Other race" denotes Asian, Native American or Alaska Native, Native Hawaiian or Pacific Islander, and multiracial. Share of students retained is not reported for 2016–17.

FIGURE A.1

The Distribution of Safety Drills across Academic Quarters



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Source: Author's calculations based on data available from the Arkansas Department of Education Statewide Longitudinal Information System (see "Statewide Information Systems Reports," Arkansas Department of Education, accessed April 27, 2023, https://adedata.arkansas.gov/statewide/).
Note: Each bar denotes the share of drills occurring during a quarter.

Active-Shooter Drills and Proficiency Rates

To investigate the relationship between active-shooter drills and proficiency rates, I estimate the following ordinary least squares regression model:

$$y_{sgwt} = \alpha + \sum_{w=2}^{6} \Omega SDrill_{sgwt} + \gamma \boldsymbol{School}_{st} + \sigma_{sg} + \pi_{t} + \varepsilon_{sgtw},$$

which is indexed by school *s*, grade *g*, week *w*, and year *t*. y_{sgwt} denotes the proficiency rate (math or English) for students in a specific school, grade, and year (e.g., third-graders testing in math at Smith Elementary School in 2015–16). $SDrill_{sgwt}$ denotes a categorical variable where each value *w* refers to the timing of the subject test relative to the active-shooter drill, such that (1) *w* = 1 if the test was administered before the school week of the active-shooter drill (reference group); (2) *w* = 2 if the test was administered the same school week as, but before, the drill; (3) *w* = 3 if the test was administered the same school week as, but after, the drill; (4) *w* = 4 if the test was administered the first school week after the week of the drill; (5) *w* = 5 if the test was administered during the second school week after the week of the drill; and (6) *w* = 6 if the test was administered during or after the third school week after the drill. $\boldsymbol{School}_{st}$ denotes a vector of time-varying school-level characteristics that include the share of nonwhite students, the share of students eligible for free and reduced-price lunch, indicators for urbanicity (city, town, suburb, rural [omitted]), and an indicator for a new-to-school principal as a proxy for administrator decisions around scheduling drills. The terms σ_{sg} and π_{t} denote school-by-grade and year fixed effects, respectively. ε_{sgtw} denotes the error term.

Controlling for school-by-grade fixed effects (σ_{sg}) implies that identifying variation comes from the comparison of a school-by-grade's proficiency rate across years, where years vary in the timing of active-shooter drills relative to tests. This approach accounts for both time-invariant unobservable and observable school-by-grade characteristics. The coefficient estimates and *p*-values on the $SDrill$ indicators are effectively the same when controlling for grade-by-year fixed effects instead of year effects.

Active-Shooter Drills and Attendance

To investigate the relationship between active-shooter drills and attendance rates, I estimate the following two-way fixed effects model:

$$AttendanceRate_{stq} = \alpha + \lambda SDrill_{stq} + \gamma \boldsymbol{School}_{st} + \sigma_{sq} + \pi_{t} + \varepsilon_{stq},$$

which is indexed by school *s*, year *t*, and quarter *q*. *AttendanceRate* denotes the attendance rate at the level of the school-year-quarter (i.e., the quarterly attendance rate). $SDrill_{stq}$ denotes a binary indicator variable equal to 1 if one or more active-shooter drills occurred during the quarter and equal to 0 if only fire or tornado drills occurred. $\boldsymbol{School}_{st}$ denotes a vector of time-varying school-level characteristics that include the share of nonwhite students, the share of students eligible for free and reduced-price lunch, indicators for urbanicity (city, town, suburb, rural [omitted]), and an indicator for a new-to-school principal as a proxy for administrator decisions around scheduling drills. The terms σ_{sq} and π_{t} denote school-by-quarter and year fixed effects, respectively. ε_{stq} denotes the error term.

Controlling for school-by-quarter fixed effects (σ_{sq}) implies that identifying variation comes from the comparison of a school's attendance rate during a particular quarter across years for the same school, where in some years, at least one active-shooter drill occurred during that quarter and in other years, no such drills occurred during that quarter. This approach accounts for both time-invariant unobservable and observable school characteristics. The coefficient estimate on $SDrill_{stq}$ and *p*-values are effectively the same when controlling for year-by-quarter fixed effects instead of year effects.

Elc Estrera was a data fellow with the Harvard University Strategic Data Project and is director of data strategy and analytics at the Wake County Public School System.

Acknowledgments

This essay was funded by the Walton Family Foundation and the Bill & Melinda Gates Foundation as part of the Learning Curve essay series. We are grateful to them and to all our funders, who make it possible for Urban to advance its mission.

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