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The Impact of Cellphone Bans in Schools on Student Outcomes: Evidence from Florida

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Cellphone bans in schools have become a popular policy in recent years in the United States, yet very little is known about their effects on student outcomes. In this study, we try to fill this gap by examining the causal effects of bans on student test scores, suspensions, and absences using detailed student-level data from Florida. Several important findings emerge. First, we show that the enforcement of cellphone bans in schools led to a significant increase in student suspensions in the short-term, especially among Black students, but disciplinary actions began to dissipate after the first year, potentially suggesting a new steady state after an initial adjustment period. Second, we find significant improvements in student test scores in the second year of the ban after that initial adjustment period. Third, the findings suggest that cellphone bans in schools significantly reduce student unexcused absences, an effect that may explain a large fraction of the test score gains. The effects of cellphone bans are more pronounced in middle and high school settings where student smartphone ownership is more common.

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Abstract: Cellphone bans in schools have become a popular policy in recent years in the United States, yet very little is known about their effects on student outcomes. In this study, we try to fill this gap by examining the causal effects of bans on student test scores, suspensions, and absences using detailed student-level data from Florida. Several important findings emerge. First, we show that the enforcement of cellphone bans in schools led to a significant increase in student suspensions in the short-term, especially among Black students, but disciplinary actions began to dissipate after the first year, potentially suggesting a new steady state after an initial adjustment period. Second, we find significant improvements in student test scores in the second year of the ban after that initial adjustment period. Third, the findings suggest that cellphone bans in schools significantly reduce student unexcused absences, an effect that may explain a large fraction of the test score gains. The effects of cellphone bans are more pronounced in middle and high school settings where student smartphone ownership is more common.

Keywords: cellphone bans in schools; student test scores, disciplinary incidents; absences; human capital

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"Knowing what we know, something must be done. Smartphones and the content students access relentlessly 24/7 are distracting kids from learning and eroding their mental health."

Alberto M. Carvalho, superintendent of the Los Angeles Unified School District[3]

"This is one step to help protect our youth and our kids from the grips of social media. It's also going to create a less distracted classroom and a better learning environment."

Brad Yeagar, Florida State Representative

1. Introduction

Many jurisdictions in the United States and around the world have recently implemented policies banning or restricting cellphone use in schools. One-quarter of countries had banned cellphones in schools through a law or policy by 2023, increasing to 31 percent in 2024.[4] In the United States, as of September 2025, 30 states have passed statewide bans or have recommended local districts to enact their own bans or restrictive policies (Prothero, Langreo, and Klein, 2025). A recent nationwide survey reveals that nine in ten school districts report having some form of cellphone policy (Diliberti et al., forthcoming). To date, however, we know of no causal evidence of the effects of national, state, or district-level policies on student outcomes, and no causal evidence even on school-level policies in the United States, with its unique cultural context.[5]

[3] https://www.washingtonpost.com/education/2024/08/27/cell-phone-school-bans/, accessed on 8/28/2024.
[4] https://world-education-blog.org/2024/10/21/the-growing-movement-to-ban-smartphones-in-schools/#:~:text=Overall%2C%20the%20new%20analysis%20from,countries%20to%20have%20introduced%20bans, accessed on 11/19/2024.
[5] Beland and Murphy (2016), Abrahamsson (2024), and Kessel et al. (2020) present causal evidence from England, Norway, and Sweden, respectively, on the topic, relying upon retrospective surveys of school leaders that identify cellphone ban timing at the school level. Because of the timing of the papers, the studies can analyze school bans as late as 2012 in the English case, 2016 in the Swedish case, and 2018 in the Norwegian case. Ours is the first study, to our knowledge, to investigate the causal consequence of a cellphone ban that carries the weight of national, state, or district-level policy.

We bring to bear new evidence from Florida's statewide cellphone ban, implemented in May 2023. Florida is an ideal environment to study this question, because (1) it is the first state in the United States to implement a statewide cellphone policy, allowing us to observe not just short-run transitional effects of the ban but also longer-run steady-state effects; and (2) in Florida we can measure outcomes of interest at a higher frequency than in most other locations – three times per year in the case of test scores and daily in the case of disciplinary incidents. Using detailed administrative records from a large urban county-level school district (LUSD) – one of the ten largest in the United States – and a research design that differentiates schools based on their pre-ban levels of student cellphone use, we find evidence that Florida's cellphone ban led to meaningful improvements in student test scores in year two of the program, which is also when disciplinary incidents began to decline after an initial surge following the cellphone ban. To identify the effects of cellphone bans in an environment in which all students are subject to the ban, we compare schools where there was a larger pre-ban difference in cellphone use between regular school days and teacher in-service days (high effect schools) and those with a smaller pre-ban difference in cellphone use (low effect schools), based on data from Advan; this design likely understates the positive effects of the ban on students, because both high effect and low effect schools are treated by the ban. We also present evidence that the Advan contrasts between high effect and low effect schools are due to student cellphone usage differentials, rather than other idiosyncratic or community-level features.

This work, and the cellphone bans such as the one we study, occur in a context in which smartphone ownership among school-aged children has surged over the past decade in the United States: In 2021, 42 percent of 8- to 12-year-olds and 88 percent of 13- to 18-year-olds reported owning a smartphone, up from 24 percent for the former group and 67 percent for the

latter group in 2015 (Rideout et al., 2022; Common Sense Media, 2016). Along similar lines, smartphone and social media use among children and adolescents is on the rise across the globe. 90 percent of teenagers in OECD countries report that they own a smartphone and 20 percent report that they use their smart phones for more than 6 hours every day (OECD, 2018; Bakken 2022). At the same time as the rapid increase in youth smartphone ownership and use (Rideout et al, 2022), incidents of depression and anxiety among adolescents have soared. For example, the rate of adolescent depression nearly doubled from 8.1 percent in 2009 to 15.9 percent in 2019 in the United States (Wilson & Dumonrey, 2022), and the share of high school students who experience persistent feelings of sadness and hopelessness went up from 30 percent in 2013 to 40 percent in 2023 (Centers for Disease Control and Prevention, 2024). Similar patterns have emerged in academic achievement over the same time frame, with Programme for International Student Assessment (PISA) scores in reading, mathematics, and science for 15-year-old students declining considerably over the past decade.[6]

These trends have triggered public debates about the causal link between the rise in smartphone use among adolescents and the decline in their well-being, yet the rigorous evidence about this causal link is scant and mixed (e.g., Odgers & Jensen, 2020; Wacks & Weinstein, 2021). On the one hand, some argue that the adverse effects of smartphones on mediators such as social deprivation, sleep deprivation, and attention fragmentation are responsible for the observed declines in adolescent outcomes (Haidt, 2024). There is indeed descriptive evidence in

[6] Between 2012 and 2022, the average PISA score for 15-year-olds in OECD countries declined by 13 points in science, by 19 points in reading, and by 20 points in math. These correspond to declines of 13 percent of the standard deviation in science (0.13σ), 0.19σ in reading, and 0.20σ in math. https://www.gisreportsonline.com/r/worsening-2022-pisa-tests-results-oecd/, accessed on 11/17/2024. While a sizable portion of this drop can be attributed to the adverse effects of the Covid-19 pandemic on student achievement (For example, between 2018 and 2022, the average PISA score in math among OECD countries dropped by 16 points), average PISA scores were flat (math) or in decline (reading and science) even before the pandemic. For example, between 2012 and 2018, average scores on PISA science test declined by 15 points in OECS countries.

the literature suggesting that prolonged use of smartphones in children and adolescents are associated with higher rates of anxiety and depression (Riehm et al., 2019); body dissatisfaction and eating disorders especially among girls (Thai et al., 2024; Lonergan et al., 2020); sleep issues (Alonzo et al., 2021); and cyberbullying (Bartlett, 2023; Englander, 2018).[7] For these reasons and others, teachers tend to strongly support cellphone bans: According to recent surveys, 72 percent of U.S. public high school teachers report that students being distracted by cellphones is a major problem in their classroom (Pew Research Center, 2024) and 83 percent of National Education Association (NEA) members support policies prohibiting cellphone and personal device use during the entire school day with exceptions for medical or assistive-technology needs.[8] In a 2023 report, UNESCO recommended a global ban on smartphone use in schools (UNESCO, 2023).

That said, such restrictions could also have unintended consequences. For example, Covid-19 pandemic led to a significant increase in teachers' use of digital materials in classrooms: A recent RAND report finds that 38 percent of teachers in the U.S. use digital materials for half or more of instructional time in 2020 (Tosh et al., 2021). Restricting the use of smartphones in classrooms could hinder student access to these digital resources especially in disadvantaged school settings where smartphones serve as the primary device for students to access these resources. Further, there are concerns among parents that cellphone bans in schools could hinder effective communication with students in case of an emergency.[9]

[7] Nearly half of U.S. teens ages 13 to 17 report that they experienced cyberbullying at some point in their lives (Pew Research Center, 2022; 2023).
[8] https://www.nea.org/resource-library/impact-social-media-and-personal-devices-mental-health, accessed on 11/18/2024.
[9] https://www.k12dive.com/news/safety-concerns-school-cell-phone-bans-mental-health/726668/, accessed on 11/18/2024.

We first examine the trends in disciplinary incidents and test scores in LUSD right before and after the ban took effect. We observe a significant jump in student disciplinary incidents and suspensions right after the transition period in the first year of the ban when the district started referring students for disciplinary action due to cellphone use infractions: suspension rate more than doubled in the month after disciplinary enforcement started compared to the month before and was 25 percent higher compared to the same month in the school year right before the ban. These heightened suspension rates persisted throughout the rest of the school year and returned to pre-ban levels in the second year. Interestingly, we observe significantly improved student test scores in the second year of the ban (about 2-3 percentiles higher than the year before the ban) when suspensions revert to pre-ban levels.

We then turn to our causal analysis comparing schools with different degrees of apparent pre-ban student cellphone use, after vs. before Florida's cellphone ban. We show that the ban increased disciplinary incidents and suspensions significantly in the first year, immediately after the district started referring students for disciplinary action for cellphone use infractions. In particular, our difference-in-differences estimates suggest that the ban increased suspension rates by 12 percent (relative to the comparison group mean) and in-school suspension rates by roughly 20 percent in the first year. These adverse effects are much more pronounced for Black students and male students: we find that the ban increased in-school suspensions by about 30 percent among the former group. In the second year, these effects mostly dissipate overall, yet the numbers portray a different picture for students in elementary school versus middle and high school. In elementary schools, we find that the ban significantly reduces disciplinary incidents and suspensions in the second year while the elevated disciplinary outcomes continued though had begun to dissipate in the second year for middle and high schools.

Second, we find significant positive effects of the ban on student test scores, primarily in the second year. Overall, we show that student test scores improved by 0.6 percentiles, with the ban increasing spring test scores 1.1 percentiles in the second year relative to the spring test right before the ban took effect. These positive test score effects are larger for male students (an effect of 1.4 percentiles on the spring test in the second year) and for students in middle and high schools (1.3 percentiles). Third, our difference-in-difference analysis reveals that the ban significantly reduced unexcused absences (excluding suspensions) in both first and second years, especially for students in middle and high schools, providing suggestive evidence that improved student engagement and school climate could be important factors behind the observed test score benefits. In fact, our exploratory analysis suggests that nearly half of the test score effects of the ban in middle and high schools in the first two years can be explained by the effect of the ban on unexcused absences.

Overall, our findings reveal that cellphone bans could improve student outcomes, yet these benefits come at the cost of elevated suspension rates in the short term. The challenge that educators face then is to minimize these short-term adverse effects until a new status quo without cellphones is established in schools. In what follows, we detail Florida's cellphone ban policy and describe how it differs from other policies implemented in the United States and abroad.

2. Florida's Technology in K-12 Public Schools Legislation

Enacted in July 2023, Florida's House Bill 379 titled "Technology in K-12 Public Schools" prescribes specific measures a district school board must undertake to protect instructional time and ensure the safety of students while accessing the Internet at school. Citing trends in mental health issues and cyberbullying among children and adolescents as well as research documenting the association between these outcomes and smart phone and social media

use, the bill imposes a "cellphone ban" prohibiting students from using wireless communications devices (including smartphones, earbuds, headphones, and smartwatches) at school during instructional time, except when expressly directed by a teacher solely for educational purposes and requires a teacher to designate an area for wireless communications devices during instructional time. That said, the legislation embraces a more comprehensive approach and differs from cellphone bans in other states and countries in several ways.[10]

First, the bill requires school districts to provide and adopt an Internet safety policy for student access to the Internet provided by the school district. This policy must limit student access to only age-appropriate material, protect students using electronic communications, prohibit student access to data or information and other unlawful activities, and prevent access to technology which does not protect a students' personal information.

Second, the bill requires school districts to prohibit and prevent students from accessing social media platforms through district-provided Internet access, unless expressly directed by a teacher solely for educational purposes. Additionally, the bill prohibits the use of the TikTok platform on district-owned devices, through school-provided Internet access, or as a platform to communicate or promote any district school, school-sponsored club, extracurricular organization, or athletic team.

Third, under the bill, students in grades 6 through 12 are required to receive instruction on the social, emotional, and physical effects of social media including (1) information on the negative effects of social media on mental health, including addiction; (2) the distribution of misinformation on social media; (3) how social media manipulates behavior; (4) the permanency of material shared online; (5) how to maintain personal security and identify cyberbullying,

[10] https://www.kff.org/mental-health/issue-brief/a-look-at-state-efforts-to-ban-cellphones-in-schools-and-implications-for-youth-mental-health/, accessed on 11/20/2024.

predatory behavior, and human trafficking on the Internet; and (6) how to report suspicious behavior encountered online.

LUSD took an even more prohibitive approach to cellphone use in schools. While the statewide ban only requires districts to ban wireless communication devices "during instructional time", LUSD requires that wireless communications device(s) be silenced and put away in students' backpacks or purse during the entire school day while on campus, including lunchtime and transitioning between classes.[11] If a student violates this rule, the student's device may be confiscated (to be returned at the end of the day); and the student may be punished, including being suspended from school, after the end of an initial grace period on September 4, 2023, about a month after the beginning of 2023-24 school year. (Note that the cellphone ban was in effect from the outset of the school year, but disciplinary actions did not kick in at the very beginning of the ban.)

To mitigate concerns about students with special needs, LUSD allows students to use their devices if they need to monitor a health condition that is documented through medical records provided to the school. Students are allowed to contact their parents in the school's administrative office if they have an emergency. Further, in the case of a schoolwide emergency, students are allowed to take out their devices from their backpacks and use them.

3. Data

Student-Level Administrative Records

In our analysis, we use two sources of data. The first is student-level administrative data from LUSD covering the school years between 2022-23 and 2024-25. We drop years before

[11] The district rationalizes prohibiting the use of cellphones during lunch or transitions in three ways: (1) prioritizing school as a place for learning that is distraction-free; (2) limiting/eliminating the opportunity for students to have pictures and videos taken of them by other students without their permission; and (3) minimizing inappropriate use of social media.

2022-23 because (1) Florida started administering the new statewide standardized test (Florida Assessment of Student Thinking [FAST]) in the 2022-23 school year and (2) 2022-23 school year (and later years) are less susceptible to the data availability and data quality issues related to the Covid-19 pandemic.

Student-level administrative records include information about student test scores (in grades 3 through 10 in English language arts [ELA] and in grades 3 through 8 in math); student demographics, English learner status, special education status, student absences (overall and unexcused), school enrollment, and disciplinary incidents (including date, action taken).[12] In the analysis, our primary outcomes of interest are student test scores (in nationally-normed percentile points) averaged across subjects, disciplinary incidents, and student absences. What makes these data unique compared to administrative school records from other state or local education agencies is that we observe the test scores and disciplinary incidents at a higher frequency than the annual frequency that is typical in most administrative datasets. This is because Florida administers FAST three times a year: once at the beginning of the school year in August or early September, once at the end of December, and once at the beginning of May (the end-of-year test which is higher-stakes for students and schools as the results are used for school accountability purposes and decisions such as course placement and grade promotions). Further, we observe the date of each disciplinary incident, allowing us to examine how disciplinary incidents and suspensions changed during the first year of the ban right after the district started referring students for disciplinary action for cellphone use infractions.

[12] In Florida, middle school students either take the regular FAST test in math or the end of course test if they are enrolled in advanced math courses such as Algebra I, Geometry, or Algebra II. As such, in the analysis, we restrict the math scores to students in grades 3 through 6 – grades in which all students take the regular FAST test in math.

Figure 1A portrays disciplinary incident rates (Panel A), suspension rates (Panel B), in-school suspension rates (Panel C), and out-of-school suspension rates (Panel D) per 10,000 enrolled students in LUSD by school month in 2022-23 (the school year before the ban), 2023-24 (first year of the ban), and 2024-25 school years (second year of the ban), relative to the last school month in 2022-23 school year (school month right before the ban took effect).[13] In each figure, the black vertical line represents the beginning of the ban and the red vertical line represents the beginning of the enforcement period when the district started referring students for disciplinary action for cellphone infractions.

The results reveal a dramatic jump in disciplinary incident and suspension rates immediately after the grace period in the first year of the ban. Relative to the same month in 2022-23, the school year before the cellphone ban, disciplinary incident and suspension rates jumped by roughly 25 percent (increases in disciplinary incident and suspension rates of 43 and 50, respectively, per 10,000 students in the first year of the policy, once it was being fully enforced). Incident and suspension rates fell considerably in the second year of the cellphone ban, though remained somewhat higher than pre-ban levels.

Figure 1B presents the results from a similar analysis, portraying average student test scores (averaged across subjects, in nationally-normed percentiles) relative to the third test period in 2022-23 (end-of-year test, right before the ban took effect). On average, test scores remained stable in the first year of the ban compared to the school year right before, yet they improved significantly in the second year (by about 3.5 percentiles compared to the third test in 2023-24 and by about 2.5-3 percentiles compared to the pre-ban year average).

Smartphone Activity Data

[13] We define a school month as 20 consecutive school days, starting with the beginning of the school year.

Our identification strategy relies upon our ability to calculate school-specific measures of smartphone activity that we can attribute to students, rather than adults in the building. To do so, we use detailed smartphone activity data from Advan between January 2023 and December 2024 that we link to LUSD schools using point-of-interest coordinates.[14] In particular, we focus on the average number of unique smartphone visits (pings) between 9am and 1pm on school days (a common time frame that elementary, middle, and high schools in LUSD are all in session during school days) in the last two months of the 2022-23 school year (right before the ban took effect) and the first two months of the 2023-24 and 2024-25 school years.[15] To disentangle student activity from the smartphone activity of teachers/staff, we subtract the average number of unique smartphone visits between 9am and 1pm on teacher workdays (in the same school year) from the same average on regular school days. We also check the robustness of our findings to alternative measures of smartphone activity.

Panel (A) in Figure 2 presents the average daily smartphone visits (relative to teacher workdays) per 100 enrolled students in the two school months before the ban took effect and the two months after the ban. Once again, the black vertical line indicates the beginning of the cellphone ban and the red vertical line represents the end of the transition period (note that the cellphone ban was still enacted during this time frame even though students were not referred to disciplinary action). The results suggest a significant drop in student smartphone activity with the average daily visits dropping to about one-third of the pre-ban levels in the first two months of the ban. Panel (B) repeats the same analysis using other locations in the county and reveals no

[14] We were able to link smartphone activity data to school records for more than 90 percent of the schools, covering more than 95 percent of the students in LUSD.

[15] We focus on the last two months of the 2022-23 school year to define pre-ban smartphone activity because high-stakes testing in Florida typically takes place in those two months and the observed differences across schools are less likely to be driven by differences in student absences across school settings. That said, we check the robustness of our findings to an alternative pre-ban activity measure using the entire Spring semester in 2022-23 school year.

significant changes in average daily smartphone visits, providing evidence that the drop in smartphone activity in schools is likely driven by the ban rather than district-level confounding factors.

Panel (C) examines the average daily smartphone measures aggregated at the school year level (the last two months of 2022-23, the first two months of 2023-24 and 2024-25) broken down by grade level. The findings reveal that, as expected, pre-ban smartphone activity rate was higher in middle and high schools compared to elementary schools, yet declined considerably and immediately in the two years after the ban. Finally, in Panel (D), we present the variation in pre-ban smartphone activity across schools by grade level, demonstrating considerable differences in pre-ban activity either due to differences in cellphone ownership or differences in school policy.

4. Empirical Strategy

To examine the extent to which the observed trends in disciplinary incidents and test scores indeed reflect the causal effects of the cellphone ban, we use an event study and a difference-in-difference approach, comparing the difference in outcomes of interest between high smartphone activity schools and lower smartphone activity schools in the periods (school months for disciplinary incidents, testing periods for tests, and years for attendance) before the policy took effect and the periods after, with the period before the ban serving as the omitted category. While this approach likely underestimates the causal effects of cellphone bans (as it is plausible to expect that low activity schools were also affected by the ban, albeit to a lesser extent), it should remove the effects of district-level confounding factors from the observed changes in student outcomes and could be considered as a lower bound for the causal effects of the policy.

Formally, we estimate equations in the following general format using OLS:

$$Y_{igst} = \alpha + \sum_{t \neq -1} \beta_t * HighAct_s * D_t + \sum_{t \neq -1} \gamma_t * D_t + \delta_s + \vartheta_g + \varepsilon_{igst} \quad (1)$$

where Y_{igst} is the outcome of interest for student *i* in grade *g* in school *s* in time period *t*, $HighAct_s$ is an indicator for high pre-ban smartphone activity schools, D_t is a series of time period dummies ($t = 0$ indicates the first period after the ban took effect), δ_s is school fixed effects, and ϑ_g is grade fixed effects. In this setting, β_t are the parameters of interest, reflecting the difference in the outcome of interest between treatment and comparison schools for each period, with the period before the ban serving as the omitted category, holding grade level constant.

Our primary outcomes of interest are indicators for whether the student was involved in a disciplinary incident, suspended, received an in-school suspension, received an out-of-school suspension in that school month; student test scores averaged across subjects (in nationally-normed percentile points); and student absences (percent absent days, and percent unexcused absent days excluding suspensions). For ease of interpretation, we multiply the incident and suspension indicators by 10,000 so the outcome in those analyses represent incident and suspension rates by school month per 10,000 enrolled students. We de-seasonalize incidents and suspensions using school month indicators and test scores by test period indicators to account for any seasonality in those outcomes (e.g., if suspensions pick up every year during the same time of the school year). We cluster our standard errors at the school-by-period level.

In our main specification, we define high smartphone activity schools as those in the top tercile of the pre-ban smartphone activity distribution (as depicted in Panel D of Figure 2) and low pre-ban activity schools as those in the lowest tercile of the distribution. Table 1 compares student characteristics in our treatment and comparison groups in the year before the ban took

effect (2022-23 school year), revealing slight differences. For example, students in high pre-ban smartphone activity schools scored about 3 percentile points, were about 4 percentage points (about 50 percent) more likely to be involved in a disciplinary incident, were slightly more likely to be Hispanic, and subsidized meal eligible. Middle and high school students are disproportionately represented in our treatment schools as expected given that smartphone activity is higher in those settings (evidence presented in Panel C of Figure 2).

5. Results

Figures 3A and 3B present the trends in Figures 1A and 1B separately for high and low pre-ban smartphone activity schools and illustrate our event study approach. In the four panels of Figure 3A, we observe that high and low pre-ban smartphone activity schools follow similar trends in the pre-ban year and during the transition period in the first year of the ban, yet the incident and suspension rates diverge considerably (with higher rates in high activity schools) after the district started referring students for disciplinary action for cellphone use infractions. These differences mostly persist in the first year of the ban and vanish in the second year. Figure 3B repeats the same analysis for student test scores and reveals that test scores in treatment and comparison schools are similar until the second year of the ban, yet they improve at a faster pace for the students in the former group starting with the second test period of the second year.

Figures 4A and 4B present the event study estimates, practically taking the difference between high- versus low-activity schools for each time period (with the period right before the ban took effect serving as the baseline), and reach the same conclusion. In particular, while $\widehat{\beta_t}$ are mostly statistically indistinguishable from zero at 5 percent level in the four panels of Figure 4A, positive effects of the ban on student disciplinary incidents and suspensions (especially for in-school suspensions) in the first year are apparent. Similarly, we find positive effects of the ban

on student test scores starting with the second test period of 2024-25 school year. In both exercises, we do not find any concerning differences in pre-treatment trends between treatment and comparison schools.

Tables 2 and 3 present the difference-in-differences estimates, comparing disciplinary incidents and suspensions (Table 2) and test scores (Table 3) between high-activity and low-activity schools in the first two years of the ban versus the year before the ban, overall and by student group (race/ethnicity, gender, and grade level). The results suggest significant positive effects on (increases in) disciplinary incidents and suspensions in the first year, especially for Black students and students in middle and high schools.

In particular, we find that the ban increased disciplinary incidents and suspensions in the first year (after the transition period) by 12 percent of the comparison group mean and in-school suspensions by about 20 percent. These positive effects disappear in the second year. We do not find any significant effects on out-of-school suspensions. The first-year effects seem to be mostly driven by the effect on Black students: For example, the ban increased in-school suspensions by roughly 30 percent for Black students while it had no significant effect for White and Hispanic students. There is also heterogeneity by gender (with larger and significant effects for male students, yet no effect on female students) and grade level. In middle and high schools where student smartphone use is more common, the ban increased disciplinary incidents by 15 to 20 percent in the first year (these effects persist for out-of-school suspensions in the second year) while it had no effect or had negative and significant effects in elementary schools, especially in the second year of the ban (by about 40 to 50 percent of the comparison group mean).[16]

[16] That said, it is important to note that suspensions are much less frequent events in elementary schools compared to middle and high schools (58 suspensions per 10,000 students in a given month in elementary schools versus 217 in middle and high schools in LUSD).

The DiD estimates presented in Table 3 also reveal significant positive effects of the ban on student test scores in the second year, with average test scores increasing by about 0.6 percentiles in high-activity schools, compared to low-activity schools. We find slightly larger effects for White students (the estimates are roughly equal to a percentile and statistically significant at 5 percent level in both years) and for students in middle and high school (by about 0.7 percentiles in the first year and 0.9 percentiles in the second year, both statistically significant at 5 percent level). While our test score results are modestly smaller and statistically insignificantly distinct from zero for Black students – the group with the largest increase in disciplinary consequences of the ban – we note that the point estimate for Black students is still positive in the second year. Appendix Figures 1A, 1B, 2A, and 2B present the event study estimates by student subgroup for suspensions and test scores and confirm the general conclusion while revealing no concerning differences in pre-treatment trends in outcomes for different student groups.

Appendix Table 1 repeats the analysis in Table 3 using only the spring tests (end of year tests in the third testing periods) that typically carry more ramifications for schools and students as the district/state use these scores for school accountability purposes (e.g., school grades), and high-stakes student-level decisions such as grade promotion and course placement. The results reveal stronger test score effects in the second year overall and for subgroups with the ban increasing test scores by 1.1 percentiles overall, 1.2 percentiles for Black students, 1.4 percentiles for White students, 1.4 percentiles for male students, and 1.3 percentiles for middle and high school students. We do not find any significant effects for female students or for students in elementary school.

To what extent can these positive effects on test scores be driven by the potential effects of the ban on school climate and student engagement? While we do not have direct measures of student engagement, we use student absences (overall and unexcused absences excluding suspensions) and student stability (i.e., the student staying in the same school during non-transitional grades) as proxies. Table 4 presents the DiD estimates, overall and by student groups, comparing the first two years of the ban with the year before the ban in treatment versus comparison schools for percent absent days (top panel), percent unexcused absent days excluding suspensions (middle panel) and the likelihood that the student stayed in the same school as the previous year (for students in non-transitional grades which are typically 6th and 9th grades in LUSD).

The results provide evidence suggesting that the ban significantly improved student attendance, especially when we look at unexcused absences. These effects are roughly equivalent to 5-10 percent of the comparison group mean, driven primarily by students in middle and high school while we find no significant effect on student absences in elementary schools. In middle and high school, we also show that the ban slightly improved student stability, but these effects are small and marginally significant at conventional levels. An exploratory mediation analysis suggests that the effect of the ban on unexcused absences in middle and high schools explains nearly half of the positive effect on student test scores, though it's important to note that the change in absences may reflect many other unmeasured dimensions of school climate.

Appendix Figure 2 and Appendix Figure 3 check the robustness of our findings to alternative treatment and comparison school definitions. In the former, we define pre-ban smartphone activity using the entire spring semester of 2022-23 school year (rather than the last two months) and in the latter, we identify high- and low-activity schools as those that fall into the

top and bottom terciles among schools serving similar grade levels (elementary versus middle and high). In both cases, we find results similar to our main specification: For example, using the first alternative specification, we find a first-year effect of 31.7 (p-value: 0.021) in middle and high schools compared to 33.7 in our main specification while the effect using the second specification is 24.7 (p-value: 0.045).

6. Concluding Remarks

There is a nationwide surge in policies that restrict or ban the use of cellphones in public schools. In this study, we present the first evidence about the effects of statewide cellphone bans in schools on student outcomes using detailed student-level school records that are linked to smartphone activity data at the school level from a LUSD in Florida. Several important findings emerge. Our combined findings that the ban significantly increased student test scores, reduced unexcused absence rates, and increased – at least temporarily – disciplinary incidents and suspensions paint a picture of a policy that apparently improved student learning climate, at least after a period of transition. These findings imply that cellphone bans in schools could be beneficial for student outcomes in the long run, but the enforcement of these bans could lead to elevated suspension rates in the short term, and provide lessons for jurisdictions introducing cellphone bans, and the schools tasked with implementing and enforcing these bans. There is some evidence of racial differences in the disciplinary consequences of the cellphone ban, and it will be important to study longer-run effects of the policy in the coming years to gauge whether the policy has any differential effects on outcomes such as high school graduation and college-going, once students have aged sufficiently to investigate such outcomes.

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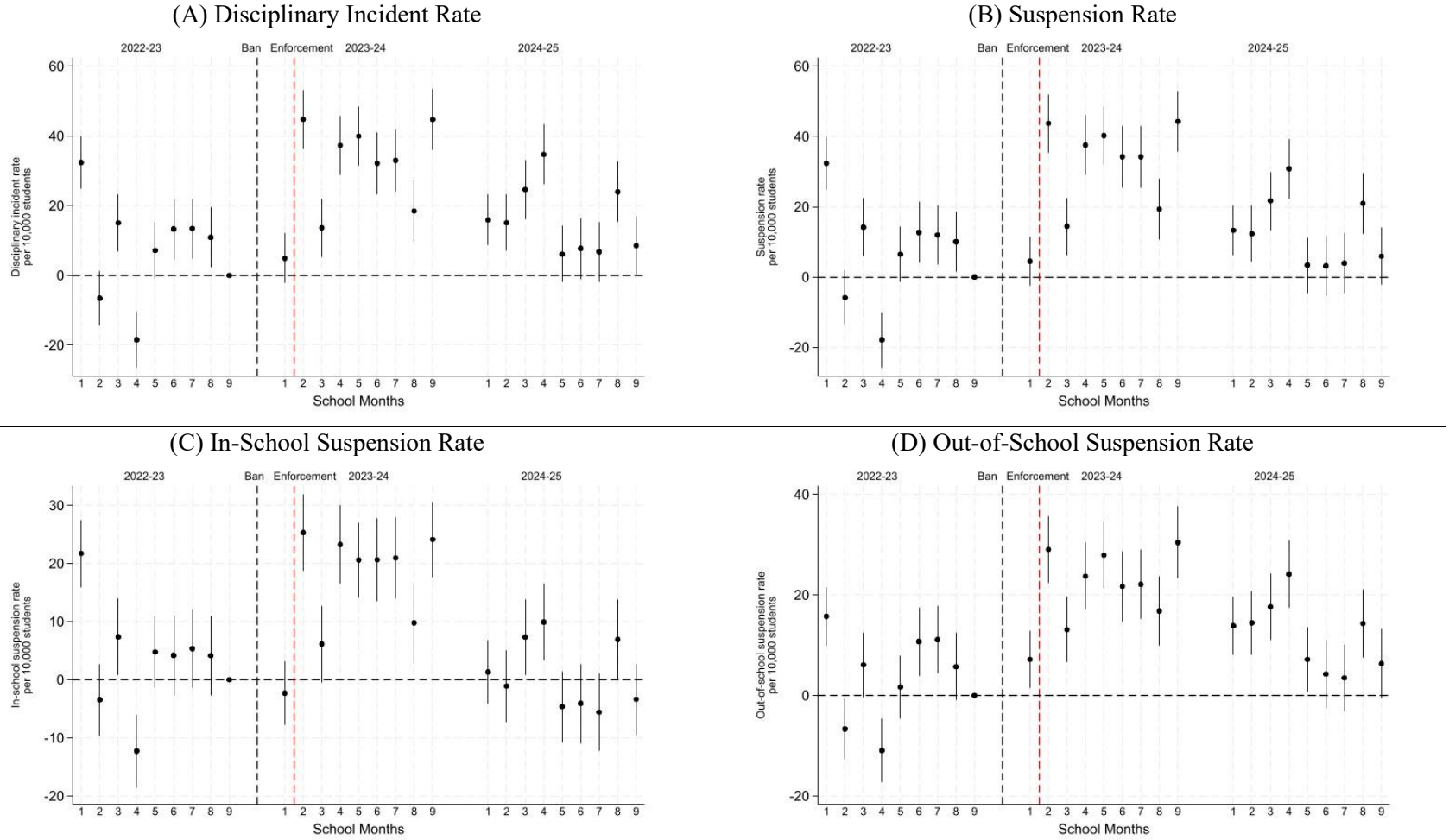
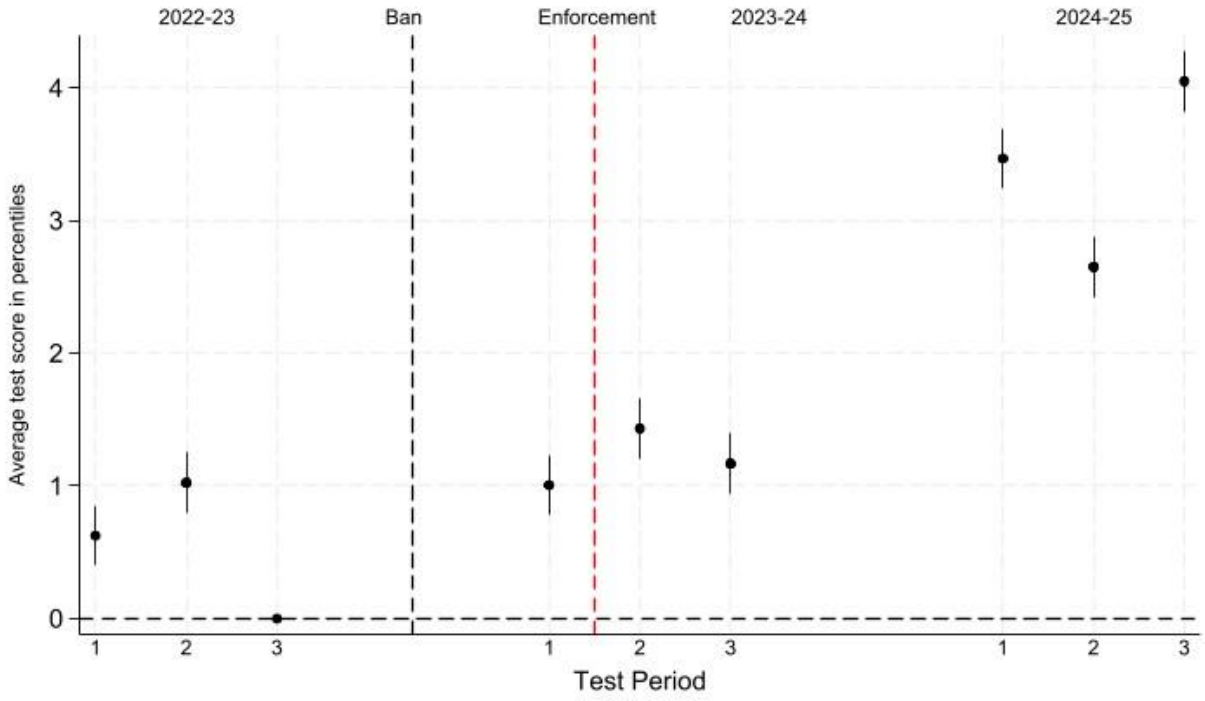
Figure 1A: Disciplinary Incident, Suspension, Out-of-School Suspension, and In-School Suspension Rates, Before and After the Ban



Notes: Each dot represents the estimated difference in the outcome of interest between the given month in 2022-23, 2023-24, or 2024-25 and the last month in 2022-23 (the school year before the ban took effect). Outcomes are deseasonalized using school month indicators. Spikes represent 95 percent confidence intervals obtained using robust standard errors. The red vertical line indicates the beginning of cellphone ban disciplinary enforcement in schools in LUSD, and the black vertical line is the beginning of the first school year after the ban took effect.

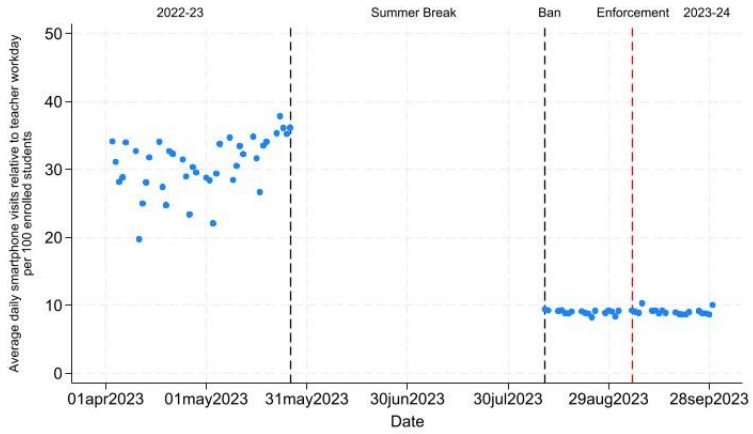
Figure 1B: Average Test Scores Before and After the Ban, in Percentiles



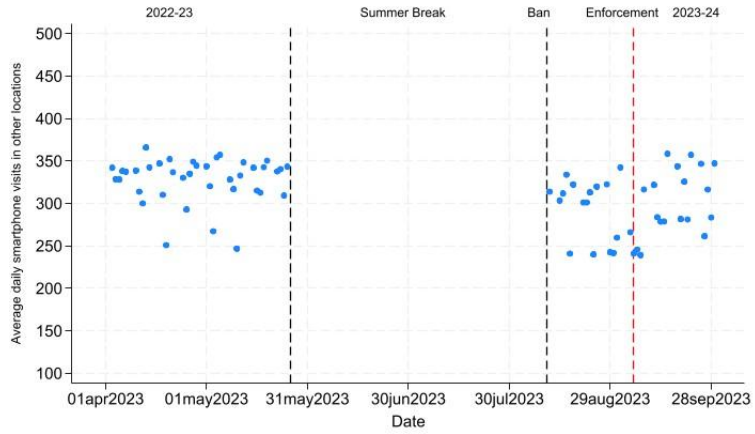
Notes: Each dot represents the estimated difference in the outcome of interest between the given test period in 2022-23, 2023-24, or 2024-25 and the last testing period in 2022-23 (the testing period right before the ban took effect). Test scores are deseasonalized using test period indicators. Spikes represent 95 percent confidence intervals obtained using robust standard errors. The red vertical line indicates the beginning of cellphone ban disciplinary enforcement in schools in LUSD, and the black vertical line is the beginning of the first school year after the ban took effect.

Figure 2: Smartphone Activity in LUSD Before and After the Ban

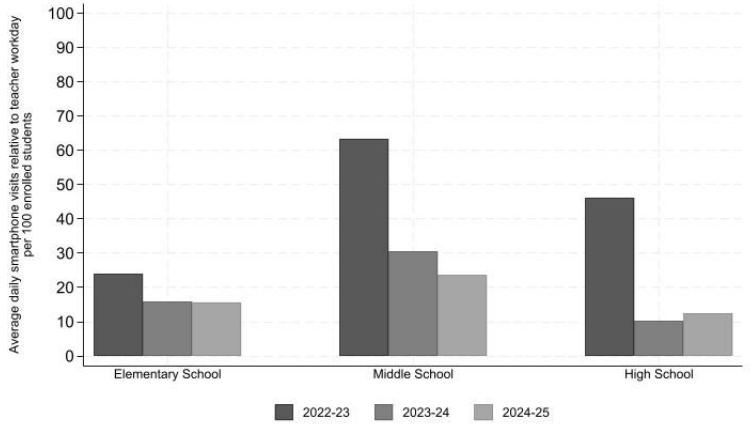
(A) Average Daily Smartphone Visits in Schools, Right Before and Right After the Ban



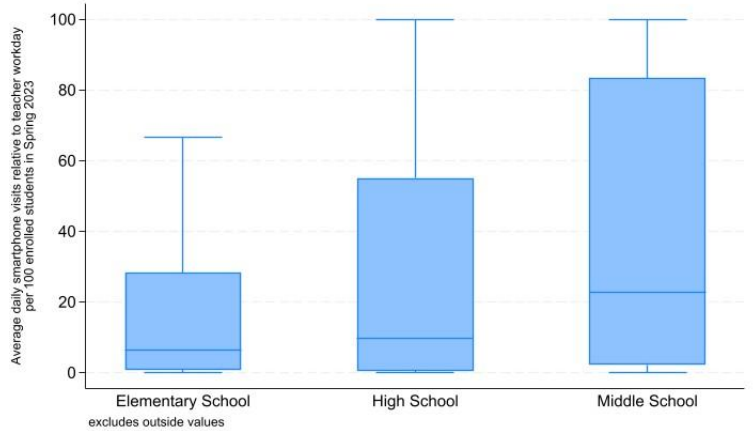
(B) Average Daily Smartphone Visits in Other Locations, Right Before and Right After the Ban



(C) Average Daily Smartphone Visits in Schools, by Year and Grade Level



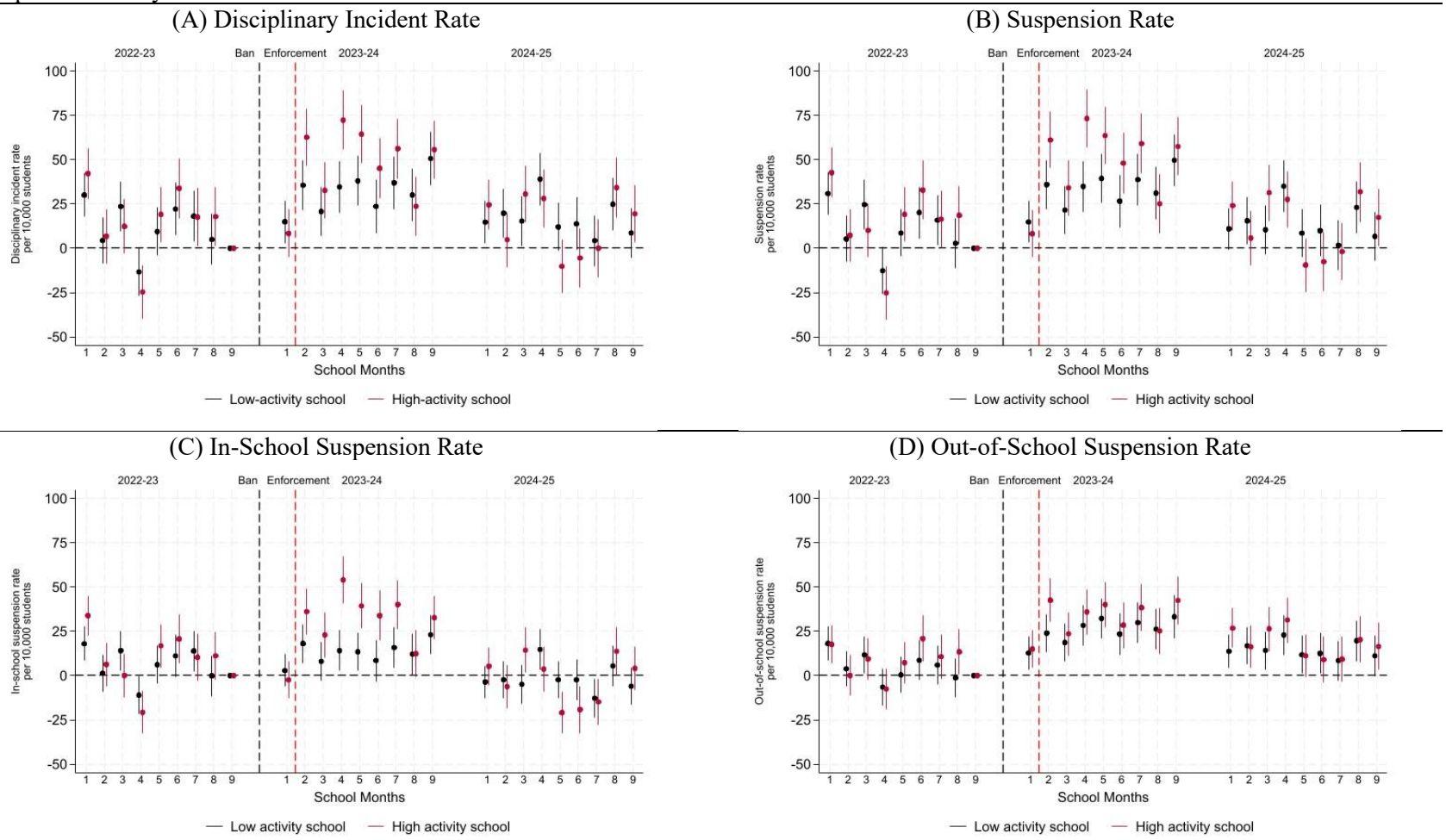
(D) Variation in Average Daily Smartphone Visits in Schools in the Year Before the Ban by Grade Level



Notes: Panel (A) presents the average daily smartphone visits during regular school days (relative to teacher workdays) between 9am and 1pm (per 100 enrolled students) in the two months before and after the ban took effect in LUSD schools. Panel (B) repeats the same exercise in other locations in LUSD. Panel (C) presents the average daily smartphone visits (per 100 enrolled students) during regular school days (relative to teacher workdays) between 9am and 1pm in the

two months before the ban took effect in 2022-23 school year, the two months after the ban took effect in 2023-24, and the first two months of 2024-25 school year, broken down by grade level. Panel (D) presents the variation in pre-ban average daily smartphone visits (per 100 enrolled students) by grade level. In Panel (A) and Panel (B), the red vertical line indicates the beginning of cellphone ban disciplinary enforcement in schools in LUSD.

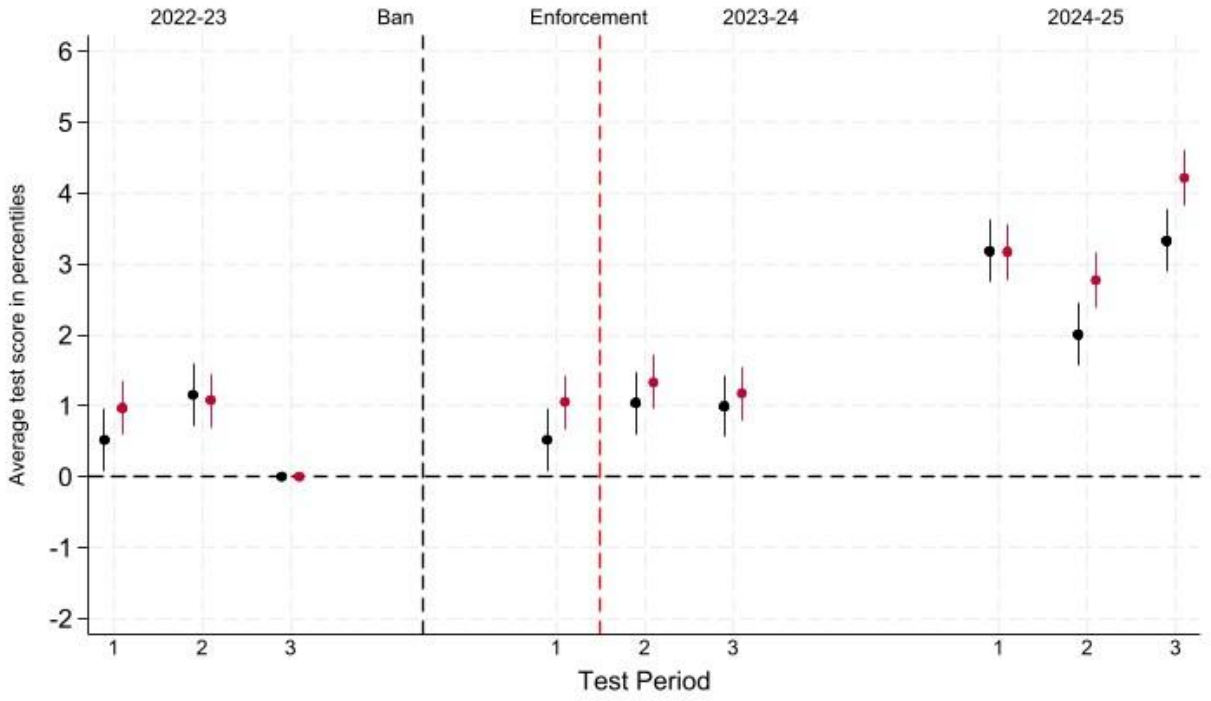
Figure 3A: Disciplinary Incident, Suspension, Out-of-School Suspension, and In-School Suspension Rates, Before and After the Ban, by Pre-Ban Smartphone Activity



Notes: Each dot represents the estimated difference in the outcome of interest between the given month in 2022-23, 2023-24, or 2024-25 and the first month in 2023-24 (the month right before the disciplinary enforcement took effect) by school pre-ban smartphone activity. Outcomes are deseasonalized using school month indicators. Spikes represent 95 percent confidence intervals obtained using robust standard errors. Pre-ban smartphone activity is defined as the average number of smartphone visits between 9am and 1pm on regular school days in the last two months of 2022-23 school year relative to the same activity in teacher workdays, per 100 enrolled students in school. Low-, medium-, and high-smartphone activity schools are categorized based on their tercile along this pre-ban

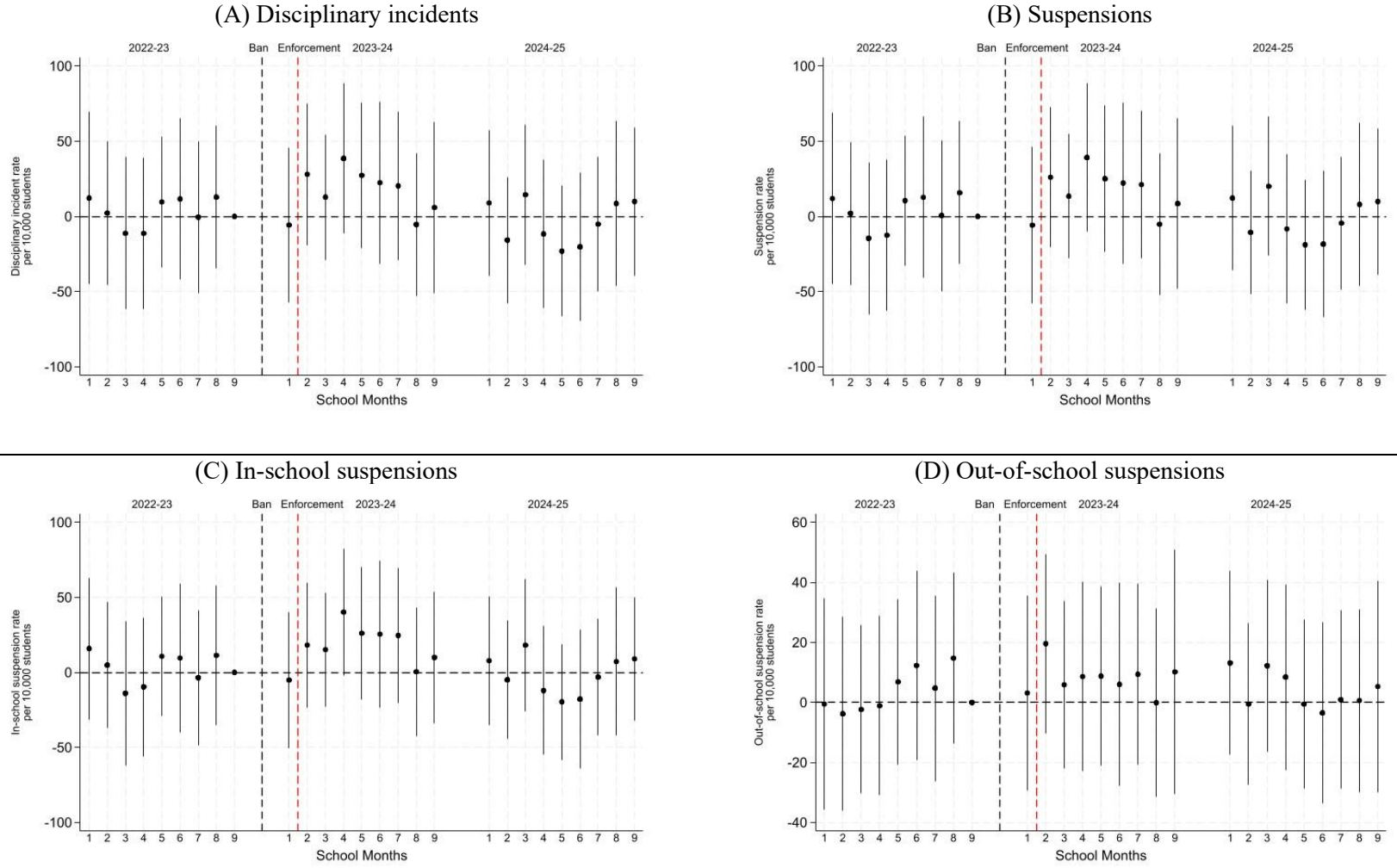
activity distribution (top tercile is high activity). The red vertical line indicates the beginning of cellphone ban disciplinary enforcement in schools in LUSD, and the black vertical line is the beginning of the first school year after the ban took effect.

Figure 3B: Average Test Scores Before and After the Ban in Percentiles, by Pre-Ban Smartphone Activity



Notes: Each dot represents the estimated difference in the outcome of interest between the given test period in 2022-23, 2023-24, or 2024-25 and the last testing period in 2022-23 (the testing period right before the ban took effect). Test scores are deseasonalized using test period indicators. Spikes represent 95 percent confidence intervals obtained using robust standard errors. Pre-ban smartphone activity is defined as the average number of smartphone visits between 9am and 1pm on regular school days in the last two months of 2022-23 school year relative to the same activity in teacher workdays, per 100 enrolled students in school. Low-, medium-, and high-smartphone activity schools are categorized based on their tercile along this pre-ban activity distribution (top tercile is high activity). The red vertical line indicates the beginning of cellphone ban disciplinary enforcement in schools in LUSD, and the black vertical line is the beginning of the first school year after the ban took effect.

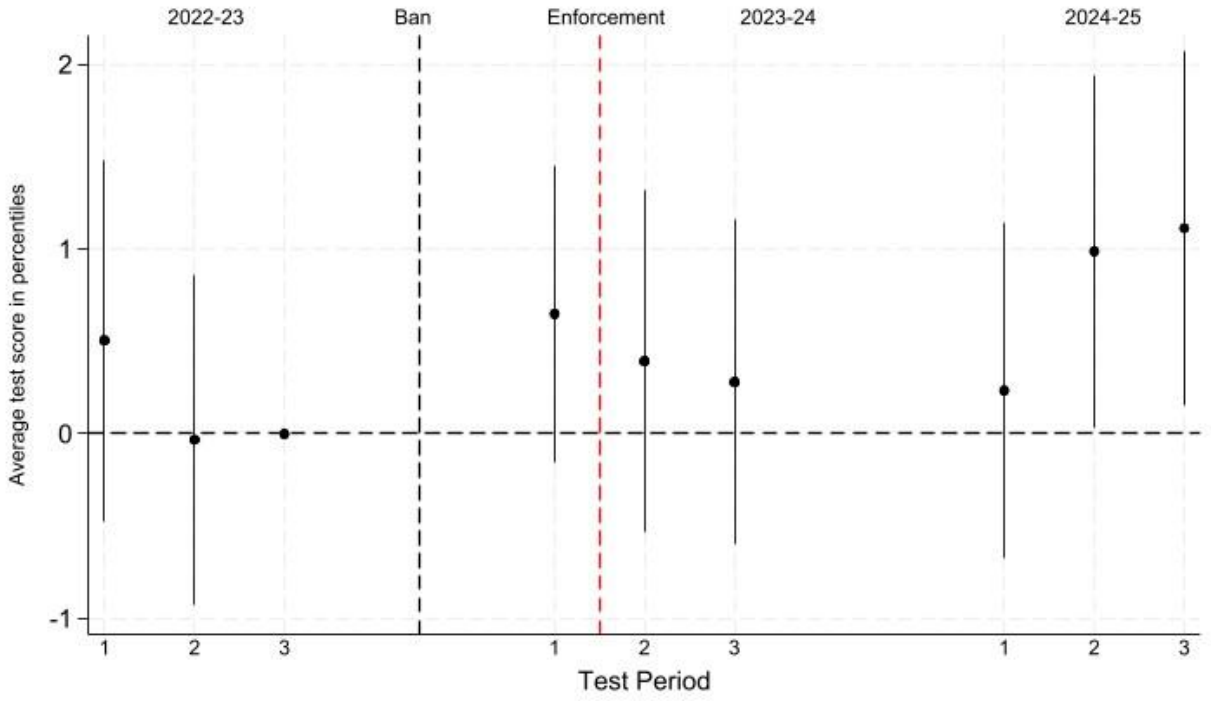
Figure 4A: Effects of Cellphone Bans on Disciplinary Incidents and Suspensions, Event Study Estimates



Notes: Each panel presents the event study estimates, comparing high -pre-ban smartphone activity schools with low pre-ban smartphone activity schools, school months in 2022-23, 2023-24, and 2024-25 school years compared to the school month before the ban took effect (the last month of 2022-23 school year). Pre-ban smartphone activity is defined as the average number of smartphone visits between 9am and 1pm on regular school days in the last two months of 2022-23 school year relative to the same activity in teacher workdays, per 100 enrolled students in school. Low-, medium-, and high-smartphone activity schools are categorized based on their tercile along this pre-ban activity distribution (top tercile is high activity). Panel (A) examines the likelihood of being involved in a

disciplinary incident, Panel (B) examines the likelihood of being suspended, Panel (C) examines in-school suspensions, and Panel (D) examines out-of-school suspensions. All outcome variables are multiplied by 10,000. Spikes present 95 percent confidence intervals using robust standard errors clustered at the school-by-year-by-school month level. Outcomes are deseasonalized using school month indicators. The red vertical line indicates the beginning of cellphone ban disciplinary enforcement in schools in LUSD, and the black vertical line is the beginning of the first school year after the ban took effect.

Figure 4B: Effects of Cellphone Bans on Test Scores, Event Study Estimates



Notes: The figure presents the event study estimates, comparing high -pre-ban smartphone activity schools with low pre-ban smartphone activity schools, test periods in 2022-23, 2023-24, and 2024-25 school years compared to the test period before the ban took effect (the last test period of 2022-23 school year). Pre-ban smartphone activity is defined as the average number of smartphone visits between 9am and 1pm on regular school days in the last two months of 2022-23 school year relative to the same activity in teacher workdays, per 100 enrolled students in school. Low-, medium-, and high-smartphone activity schools are categorized based on their tercile along this pre-ban activity distribution (top tercile is high activity). Spikes present 95 percent confidence intervals using robust standard errors clustered at the school-by-year-by-test period level. Test scores are deseasonalized using test period indicators. The red vertical line indicates the beginning of cellphone ban disciplinary enforcement in schools in LUSD, and the black vertical line is the beginning of the first school year after the ban took effect.

Table 1: Differences in Student Attributes Between Low-, Medium-, and High-Smartphone Activity Schools in the Pre-Ban Year

	Low Smartphone Activity	High Smartphone Activity
Averaged test scores (in percentiles)	49.17	46.42
	(27.88)	(27.63)
Involved in a disciplinary incident	0.080	0.126
	(0.272)	(0.332)
% absent days	0.120	0.124
	(0.127)	(0.131)
White	0.272	0.244
	(0.445)	(0.429)
Black	0.259	0.248
	(0.438)	(0.432)
Hispanic	0.429	0.467
	(0.495)	(0.499)
Male	0.513	0.515
	(0.500)	(0.500)
English non-native	0.407	0.432
	(0.491)	(0.495)
Subsidized meal eligible	0.683	0.765
	(0.465)	(0.424)
English learner	0.155	0.131
	(0.362)	(0.337)
Special education student	0.112	0.123
	(0.315)	(0.328)
Elementary school	0.494	0.345
	(0.500)	(0.475)
Middle school	0.154	0.275
	(0.361)	(0.446)
High school	0.351	0.380
	(0.477)	(0.485)
N	60,730	73,607

Note: Columns present the characteristics of students in 2022-23 school year (the year before the cellphone ban) in low-, medium-, and high-smartphone activity schools in the same year. Pre-ban smartphone activity is defined as the average number of smartphone visits between 9am and 1pm on regular school days in the last two months of 2022-23 school year relative to the same activity in teacher workdays, per 100 enrolled students in school. Low-, medium-, and high-smartphone activity schools are categorized based on their tercile along this pre-ban activity distribution (top tercile is high activity). Standard errors are given in parentheses.

Table 2: Effects of Cellphone Bans in Schools on Disciplinary Incidents and Suspensions, Difference-in-Differences Estimates, Overall and by Student Subgroups

	Involved in a disciplinary incident							
	Overall	Black	White	Hispanic	Male	Female	Elementary school	Middle and high school
First year of ban	16.765*	36.691*	1.123	14.994	19.656*	12.929	-10.581	32.426**
	(9.081)	(19.988)	(7.202)	(9.863)	(11.513)	(8.328)	(7.440)	(13.949)
Second year of ban	-5.759	-10.019	-8.265	-2.019	-9.859	-2.385	-33.874***	18.503
	(8.512)	(18.276)	(7.481)	(9.176)	(10.928)	(7.721)	(7.050)	(13.182)
Comparison group mean	144.2	245	90.34	132.9	188.5	97.63	67.94	218.9
	Suspended							
	Overall	Black	White	Hispanic	Male	Female	Elementary school	Middle and high school
First year of ban	16.762*	38.826*	1.319	14.072	18.878	13.699	-12.120*	33.690**
	(9.094)	(20.001)	(7.125)	(9.862)	(11.496)	(8.342)	(7.237)	(14.017)
Second year of ban	-3.190	-1.685	-6.579	-1.540	-6.325	-0.809	-32.212***	20.447
	(8.526)	(18.313)	(7.355)	(9.161)	(10.876)	(7.749)	(6.750)	(13.274)
Comparison group mean	138.3	236.6	85.61	127.1	179.6	94.89	57.76	217.2
	Received an in-school suspension							
	Overall	Black	White	Hispanic	Male	Female	Elementary school	Middle and high school
First year of ban	18.022**	47.916***	5.169	10.636	26.113***	8.970	1.375	24.377**
	(7.813)	(15.887)	(6.144)	(9.031)	(9.703)	(7.153)	(5.187)	(12.202)
Second year of ban	-3.699	14.442	-11.710*	-8.687	-1.798	-6.350	-16.074***	7.110
	(7.464)	(14.968)	(6.203)	(8.397)	(9.428)	(6.621)	(4.692)	(11.853)
Comparison group mean	97.76	163.4	61.94	91.45	126.8	67.20	29.23	164.9
	Received an out-of-school suspension							
	Overall	Black	White	Hispanic	Male	Female	Elementary school	Middle and high school
First year of ban	5.140	8.553	-2.101	6.656	1.580	8.278	-12.381**	16.645**
	(5.540)	(13.497)	(4.408)	(5.554)	(7.563)	(5.170)	(5.811)	(8.467)
Second year of ban	0.608	-16.686	2.056	8.576*	-2.899	3.786	-25.597***	18.028**
	(5.018)	(12.489)	(4.413)	(5.117)	(6.893)	(4.727)	(5.609)	(7.549)

Comparison group mean	73.45	134.1	41.26	64.69	96.60	49.10	38.94	107.3
N	3,569,886	910,746	901,224	1,614,798	1,833,678	1,736,208	1,479,033	2,090,853

Notes: Each panel presents the difference-in-differences estimates, comparing high -pre-ban smartphone activity schools with low pre-ban smartphone activity schools, in the first two years of the ban (excluding the first month of the ban without disciplinary enforcement) compared to the year before the ban (and the first month of the ban without disciplinary enforcement), overall and by student group. Pre-ban smartphone activity is defined as the average number of smartphone visits between 9am and 1pm on regular school days in the last two months of 2022-23 school year relative to the same activity in teacher workdays, per 100 enrolled students in school. The top panel examines the likelihood of being involved in a disciplinary incident, the second panel examines the likelihood of being suspended, the third panel examines in-school suspensions, and the bottom panel examines out-of-school suspensions. All outcome variables are multiplied by 10,000 and are deseasonalized using school month indicators. Robust standard errors clustered at the school-by-year-by-school month level are given in parentheses.

Table 3: Effects of Cellphone Bans in Schools on Student Test Scores, Difference-in-Differences Estimates, Overall and by Student Subgroups

	Overall	Black	White	Hispanic	Male	Female	Elementary school	Middle and high school
First year of ban	0.283	-0.292	1.006***	0.380	0.373	0.190	0.213	0.711**
	(0.257)	(0.363)	(0.357)	(0.288)	(0.275)	(0.280)	(0.321)	(0.350)
Second year of ban	0.622**	0.657	0.965***	0.643**	0.819***	0.455	0.509	0.905**
	(0.276)	(0.403)	(0.372)	(0.315)	(0.298)	(0.299)	(0.349)	(0.391)
Comparison group mean	50.95	42.60	61.74	45.91	49.62	52.35	49.28	52.25
N	677,088	162,027	172,769	311,565	347,144	329,944	245,817	431,271

Notes: Each column presents the difference-in-differences estimates, comparing high -pre-ban smartphone activity schools with low pre-ban smartphone activity schools, in the first two years of the ban compared to the year before the ban, overall and by student group. Pre-ban smartphone activity is defined as the average number of smartphone visits between 9am and 1pm on regular school days in the last two months of 2022-23 school year relative to the same activity in teacher workdays, per 100 enrolled students in school. Outcome of interest is nationally-normed percentile scores on ELA and math tests averaged across subjects for each student, year, and testing period. Averaged test scores are deseasonalized using testing period indicators. Robust standard errors clustered at the school-by-year-by-testing period level are given in parentheses.

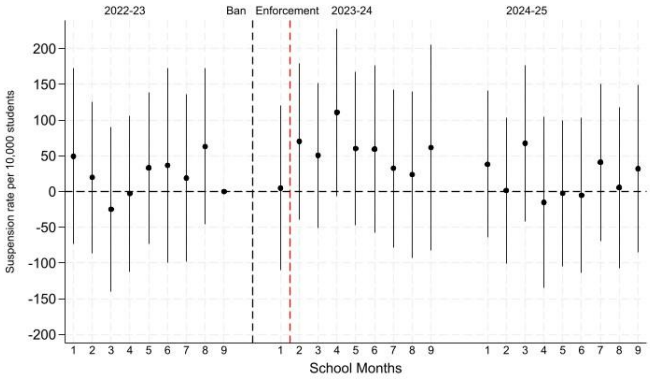
Table 4: Effects of Cellphone Bans in Schools on Student Absences and Mobility Across Schools, Difference-in-Differences Estimates, Overall and by Student Subgroups

	Percent absent days							
	Overall	Black	White	Hispanic	Male	Female	Elementary school	Middle and high school
First year of ban	0.018	0.471	-0.294	0.047	-0.046	0.088	-0.492	-0.651**
	(0.373)	(0.693)	(0.294)	(0.352)	(0.359)	(0.400)	(0.500)	(0.276)
Second year of ban	0.100	0.561	-0.222	0.089	0.065	0.138	-0.585	-0.423
	(0.401)	(0.721)	(0.325)	(0.377)	(0.387)	(0.427)	(0.554)	(0.295)
Comparison group mean	11.96	14.04	9.914	12.65	11.86	12.07	11.95	11.98
	Percent unexcused absent days excluding suspensions							
	Overall	Black	White	Hispanic	Male	Female	Elementary school	Middle and high school
First year of ban	-0.488***	-0.733**	-0.440***	-0.374**	-0.492***	-0.481***	-0.061	-0.737***
	(0.156)	(0.286)	(0.150)	(0.182)	(0.159)	(0.170)	(0.199)	(0.239)
Second year of ban	-0.458**	-0.679**	-0.438***	-0.394*	-0.423**	-0.492**	-0.120	-0.668***
	(0.178)	(0.307)	(0.161)	(0.214)	(0.180)	(0.194)	(0.248)	(0.256)
Comparison group mean	7.461	8.385	5.896	8.300	7.483	7.437	5.890	9.004
	Continuing in the same school as previous year							
	Overall	Black	White	Hispanic	Male	Female	Elementary school	Middle and high school
First year of ban	0.073	-0.290	0.322	0.072	0.059	0.084	-1.127	1.064*
	(0.783)	(0.801)	(0.760)	(1.225)	(0.817)	(0.884)	(1.470)	(0.602)
Second year of ban	-0.615	-0.994	-0.448	-0.566	-0.267	-0.990	-1.974	0.722
	(0.895)	(0.884)	(1.020)	(1.347)	(0.889)	(1.027)	(1.576)	(0.805)
Comparison group mean	79.64	74.18	85.97	77.72	79.43	79.87	76.56	82.46
N	259,434	64,736	67,117	116,545	133,238	126,196	103,210	156,224

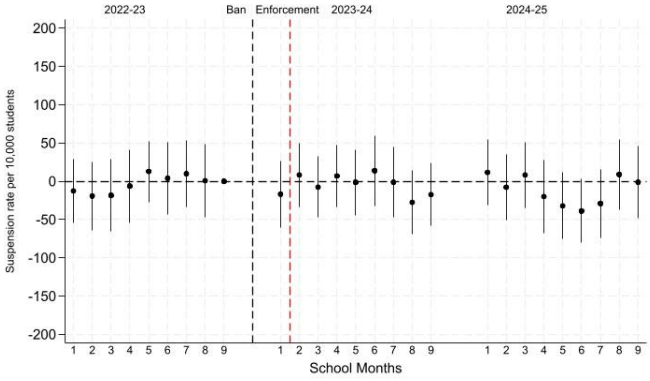
Notes: Each panel presents the difference-in-differences estimates, comparing high -pre-ban smartphone activity schools with low pre-ban smartphone activity schools, in the first two years of the ban compared to the year before the ban, overall and by student group. Pre-ban smartphone activity is defined as the average number of smartphone visits between 9am and 1pm on regular school days in the last two months of 2022-23 school year relative to the same activity in teacher workdays, per 100 enrolled students in school. The top panel examines percent absent days, the second panel examines percent unexcused absent days excluding suspensions, and the third panel examines the likelihood that the student continues in the same school as in previous year (for students in non-transitional grades). All outcome variables are multiplied by 100. Robust standard errors clustered at the school-by-year level are given in parentheses.

Appendix Figure 1A: Effects of Cellphone Bans on Suspensions, Event Study Estimates by Student Race/Ethnicity

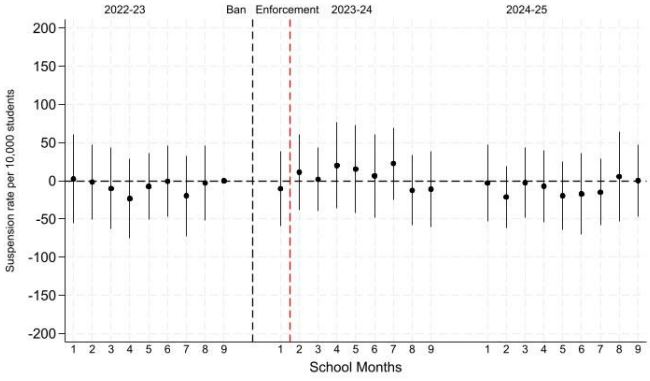
(A) Black



(B) White



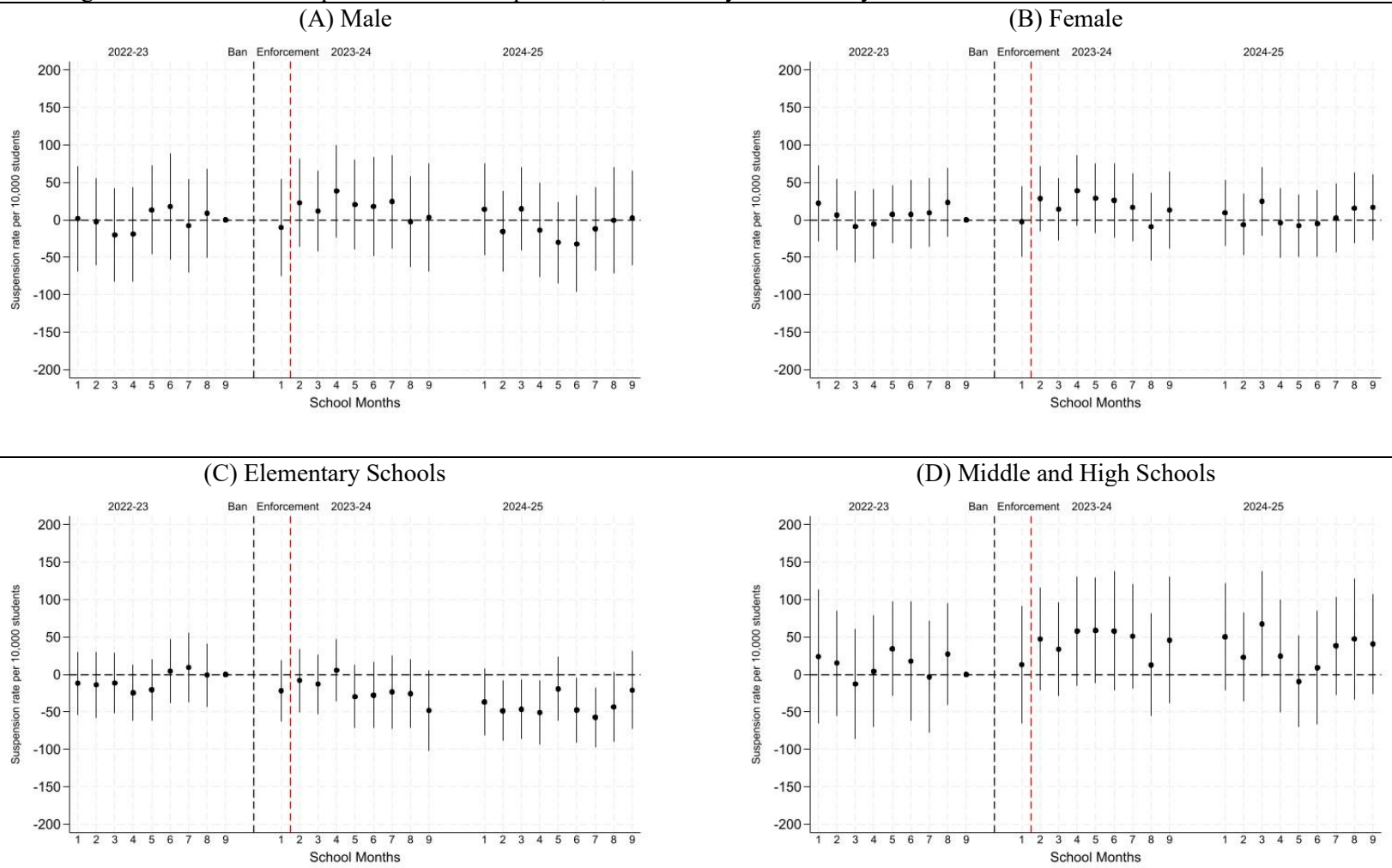
(C) Hispanic



Notes: Each panel presents the event study estimates, comparing high -pre-ban smartphone activity schools with low pre-ban smartphone activity schools, school months in 2022-23, 2023-24, and 2024-25 school years compared to the school month before the ban took effect (the last month of 2022-23 school year) for suspensions, by student race/ethnicity. The suspension indicator is multiplied by 10,000. Spikes present 95 percent confidence intervals using robust standard errors clustered at the school-by-year-by-school month level. Outcomes are deseasonalized using school month indicators. Pre-ban smartphone activity is defined as the average number of smartphone visits between 9am and 1pm on regular school days in the last two months of 2022-23 school year relative to the same activity in teacher workdays, per 100 enrolled students in school. Low-, medium-, and high-smartphone activity schools are categorized based on their tercile along this pre-ban activity distribution (top tercile is high activity). The

red vertical line indicates the beginning of cellphone ban disciplinary enforcement in schools in LUSD and the black vertical line is the beginning of the first school year after the ban took effect.

Appendix Figure 1B: Effects of Cellphone Bans on Suspensions, Event Study Estimates by Gender and Grade Level

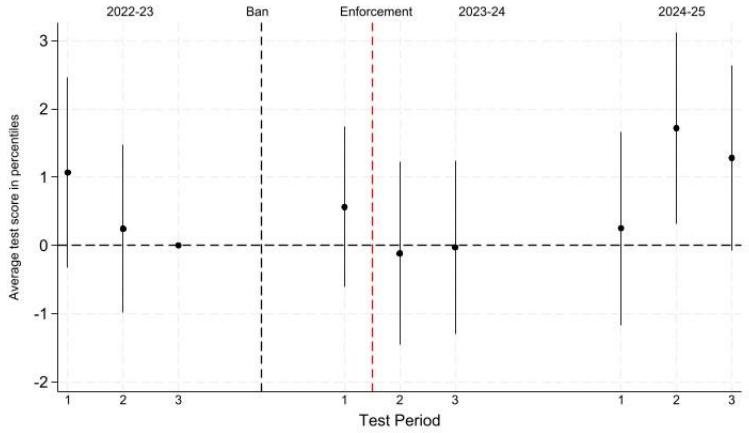


Notes: Each panel presents the event study estimates, comparing high -pre-ban smartphone activity schools with low pre-ban smartphone activity schools, school months in 2022-23, 2023-24, and 2024-25 school years compared to the school month before the ban took effect (the last month of 2022-23 school year) by student gender and grade level. The suspension indicator is multiplied by 10,000. Spikes present 95 percent confidence intervals using robust standard errors clustered at the school-by-year-by-school month level. Outcomes are deseasonalized using school month indicators. Pre-ban smartphone activity is defined as the average number of smartphone visits between 9am and 1pm on regular school days in the last two months of 2022-23 school year relative to the same activity in

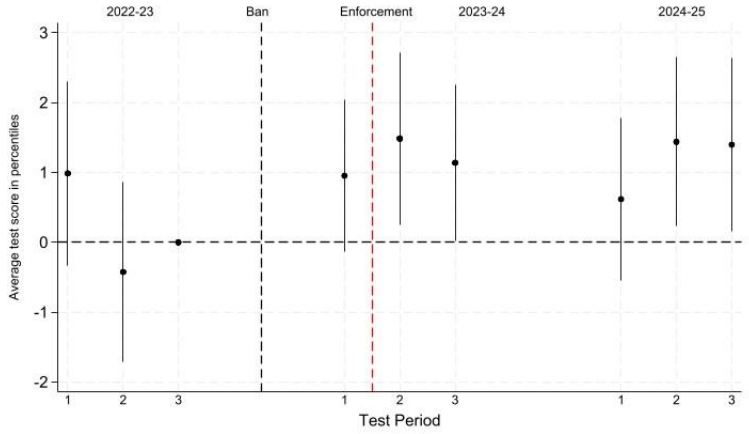
teacher workdays, per 100 enrolled students in school. Low-, medium-, and high-smartphone activity schools are categorized based on their tercile along this pre-ban activity distribution (top tercile is high activity). The red vertical line indicates the beginning of cellphone ban disciplinary enforcement in schools in LUSD and the black vertical line is the beginning of the first school year after the ban took effect.

Appendix Figure 2A: Effects of Cellphone Bans on Test Scores, Event Study Estimates by Student Race/Ethnicity

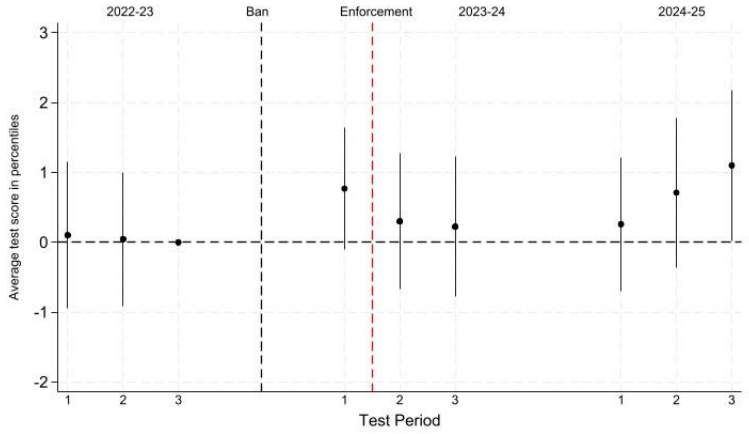
(A) Black



(B) White



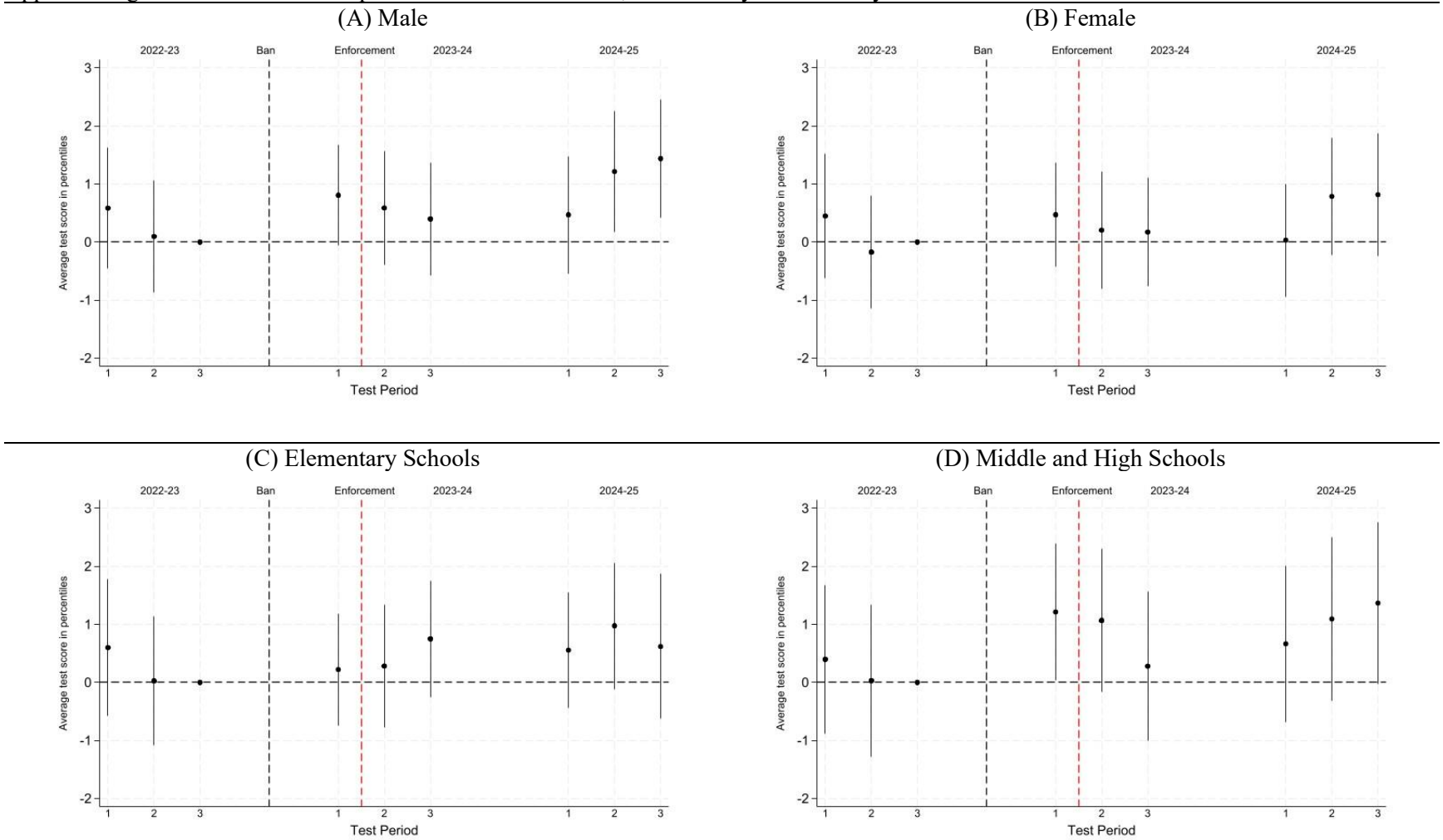
(C) Hispanic



Notes: The figure presents the event study estimates, comparing high -pre-ban smartphone activity schools with low pre-ban smartphone activity schools, test periods in 2022-23, 2023-24, and 2024-25 school years compared to the test period before the ban took effect (the last test period of 2022-23 school year) by student race/ethnicity. Spikes present 95 percent confidence intervals using robust standard errors clustered at the school-by-year-by-test period level. Test scores are deseasonalized using test period indicators. Pre-ban smartphone activity is defined as the

average number of smartphone visits between 9am and 1pm on regular school days in the last two months of 2022-23 school year relative to the same activity in teacher workdays, per 100 enrolled students in school. Low-, medium-, and high-smartphone activity schools are categorized based on their tercile along this pre-ban activity distribution (top tercile is high activity). The red vertical line indicates the beginning of cellphone ban disciplinary enforcement in schools in LUSD, and the black vertical line is the beginning of the first school year after the ban took effect.

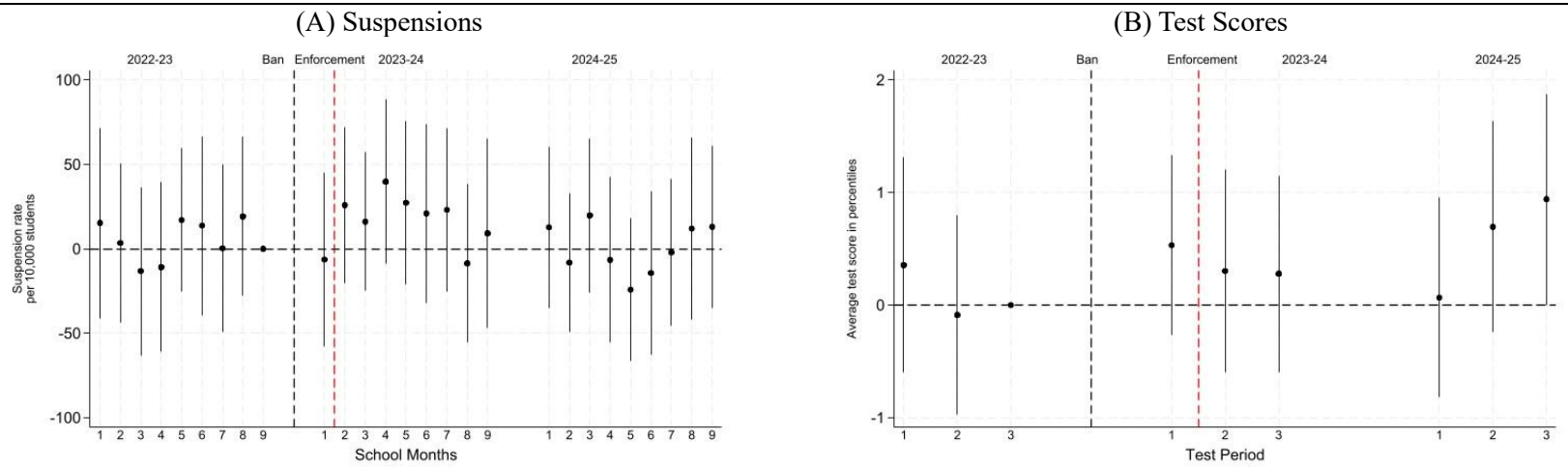
Appendix Figure 2B: Effects of Cellphone Bans on Test Scores, Event Study Estimates by Gender and Grade Level



Notes: The figure presents the event study estimates, comparing high -pre-ban smartphone activity schools with low pre-ban smartphone activity schools, test periods in 2022-23, 2023-24, and 2024-25 school years compared to the test period before the ban took effect (the last test period of 2022-23 school year) by student gender and grade level. Spikes present 95 percent confidence intervals using robust standard errors clustered at the school-by-year-by-test period level. Test scores are deseasonalized using test period indicators. Pre-ban smartphone activity is defined as the average number of smartphone visits between 9am and 1pm on regular school days in the last two months of 2022-23 school year relative to the same activity in teacher workdays, per 100 enrolled students in school. Low-, medium-, and high-smartphone activity schools are categorized based on their tercile along this pre-ban activity distribution (top tercile is high activity).

The red vertical line indicates the beginning of cellphone ban disciplinary enforcement in schools in LUSD, and the black vertical line is the beginning of the first school year after the ban took effect.

Appendix Figure 3: Effects of Cellphone Bans on Suspensions and Test Scores, Event Study Estimates, Alternative Pre-Ban Smartphone Activity Measure

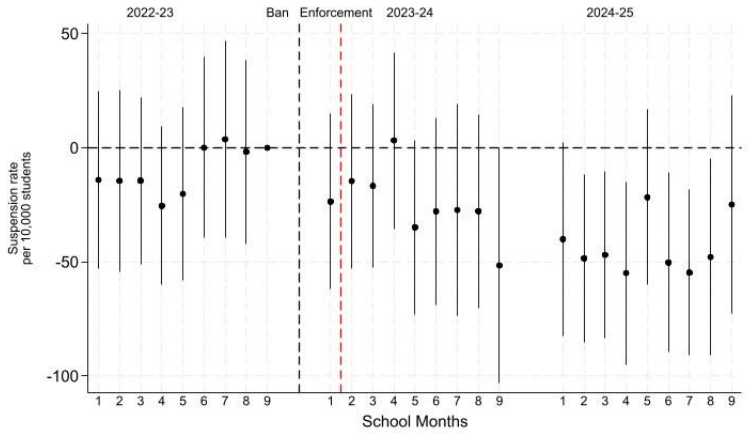


Notes: Each panel presents the event study estimates, comparing high -pre-ban smartphone activity schools with low pre-ban smartphone activity schools, school months in 2022-23, 2023-24, and 2024-25 school years compared to the school month before the ban took effect (the last month of 2022-23 school year) in Panel (A) and the testing period right before the ban took effect in Panel (B). The suspension indicator in Panel (A) is multiplied by 10,000. Spikes present 95 percent confidence intervals using robust standard errors clustered at the school-by-year-by-school month level in Panel (A) and using robust standard errors clustered at the school-by-year-by-test period level in Panel (B). Suspensions (test scores) are deseasonalized using school month (testing period) indicators. Pre-ban smartphone activity is calculated by comparing regular school day activity between 9am and 1pm with teacher workdays in the spring semester of 2022-23 school year. The red vertical line indicates the beginning of cellphone ban disciplinary enforcement in schools in LUSD, and the black vertical line is the beginning of the first school year after the ban took effect.

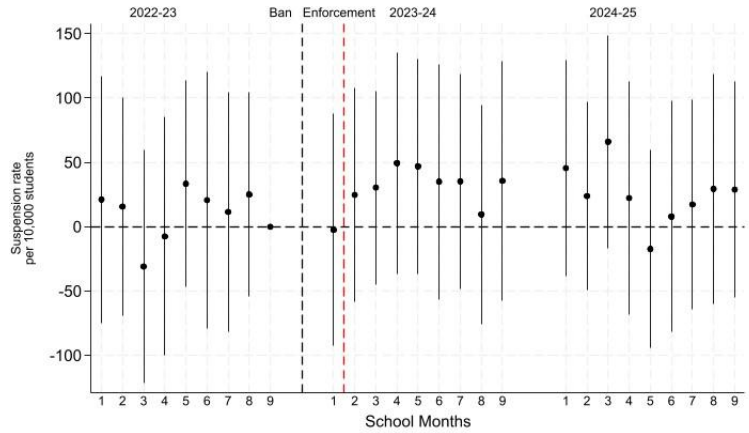
Appendix Figure 4: Effects of Cellphone Bans on Suspensions and Test Scores, Event Study Estimates, Categorizing Schools by Grade Level

Suspensions

(A) Elementary Schools

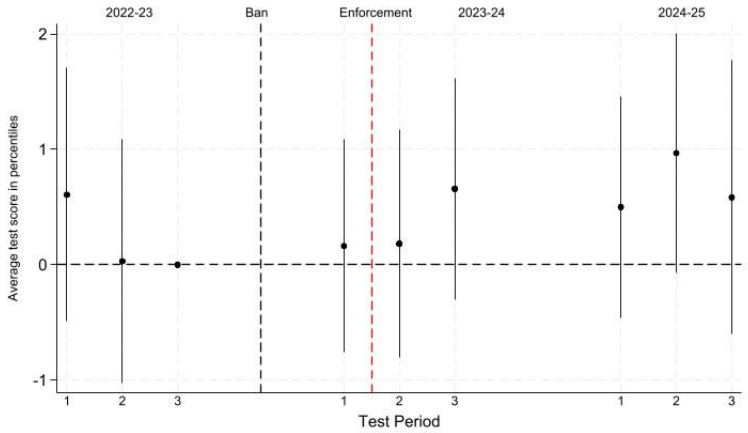


(B) Middle and High Schools

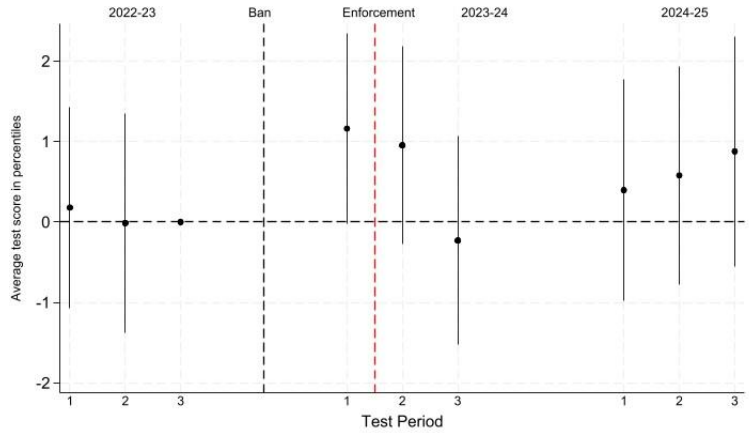


Test Scores

(C) Elementary schools



(D) Middle and High Schools



Notes: Each panel presents the event study estimates, comparing high -pre-ban smartphone activity schools with low pre-ban smartphone activity schools, school months in 2022-23, 2023-24, and 2024-25 school years compared to the month before disciplinary enforcement took effect (the first month of 2023-24 school year). Panel (A) examines the likelihood of being involved in a disciplinary incident, Panel (B) examines the likelihood of being suspended, Panel (C) examines out-of-school suspensions, and Panel (D) examines in-school suspensions. All outcome variables are multiplied by 10,000. Spikes present 95 percent confidence

intervals using robust standard errors clustered at the school-by-year-by-school month level. Outcomes are deseasonalized using school month indicators. Pre-ban smartphone activity is defined as the average number of smartphone visits between 9am and 1pm on regular school days in the last two months of 2022-23 school year relative to the same activity in teacher workdays, per 100 enrolled students in school. Low-, medium-, and high-smartphone activity schools are categorized based on their tercile along this pre-ban activity distribution (top tercile is high activity) among the schools serving similar grades (elementary schools versus middle and high schools). The red vertical line indicates the beginning of cellphone ban disciplinary enforcement in schools in LUSD, and the black vertical line is the beginning of the first school year after the ban took effect.

Appendix Table 1: Effects of Cellphone Bans in Schools on Student Test Scores, Difference-in-Differences Estimates, Overall and by Student Subgroups, Using End-of-Year Tests Only

	Overall	Black	White	Hispanic	Male	Female	Elementary school	Middle and high school
First year of ban	0.238	-0.076	1.099**	0.189	0.346	0.134	0.770	0.212
	(0.381)	(0.549)	(0.471)	(0.440)	(0.417)	(0.418)	(0.482)	(0.540)
Second year of ban	1.083**	1.228*	1.408**	1.076**	1.421***	0.781	0.640	1.333**
	(0.451)	(0.640)	(0.585)	(0.508)	(0.478)	(0.491)	(0.602)	(0.651)
Comparison group mean	50.33	42.17	61.95	45.02	49.06	51.70	49.70	50.81
N	230,065	55,203	57,931	106,513	117,999	112,066	82,558	147,507

Notes: Each column presents the difference-in-differences estimates, comparing high -pre-ban smartphone activity schools with low pre-ban smartphone activity schools, in the first two years of the ban compared to the year before the ban, overall and by student group. Pre-ban smartphone activity is defined as the average number of smartphone visits between 9am and 1pm on regular school days in the last two months of 2022-23 school year relative to the same activity in teacher workdays, per 100 enrolled students in school. Outcome of interest is nationally-normed percentile scores on ELA and math tests averaged across subjects for each student, year, and testing period. Robust standard errors clustered at the school-by-year level are given in parentheses.