

Research

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# Association of Friday School Report Card Release With Saturday Incidence Rates of Agency-Verified Physical Child Abuse

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 Editorial

**IMPORTANCE** Corporal punishment is a leading risk factor for physical abuse. Strong anecdotal evidence from physicians and other professionals working in child protection suggest that punishment-initiated physical abuse for school-aged children increases after release of report cards. However, no empirical examination of this association has occurred.

**OBJECTIVE** To examine the temporal association between school report card release and incidence rates (IRs) of physical abuse.

**DESIGN, SETTING, AND PARTICIPANTS** This retrospective study reviewed calls to a state child abuse hotline and school report card release dates across a single academic year in Florida. Data were collected in a 265-day window from September 8, 2015, to May 30, 2016, in the 64 of 67 Florida counties with report card release dates available (16 960 days). Participants included all children aged 5 to 11 years for whom calls were made. A total of 1943 verified cases of physical abuse were reported in the study period in the 64 counties. Data were analyzed from October 2017 through May 2018.

**EXPOSURES** School report cards release across a single academic year, measured daily by county.

**MAIN OUTCOMES AND MEASURES** Daily counts of calls to a child abuse hotline that later resulted in agency-verified incidents of child physical abuse across a single academic year by county.

**RESULTS** During the academic year, 167 906 calls came in to the child abuse hotline for children aged 5 to 11 years; 17.8% (n = 29 887) of these calls were suspected incidents of physical abuse, and 2017 (6.7%) of these suspected incidents were later verified as cases of physical abuse before excluding the 3 counties with no release dates available. Among the 1943 cases included in the analysis (58.9% males [n = 1145]; mean [SD] age, 7.69 [1.92] years), calls resulting in verified reports of child physical abuse occurred at a higher rate on Saturdays after a Friday report card release compared with Saturdays that do not follow a Friday report card release (IR ratio, 3.75; 95% CI, 1.21-11.63; P = .02). No significant association of report card release with IRs was found for any other days of the week.

**CONCLUSION AND RELEVANCE** This association of school report card release and physical abuse appears to illustrate a unique systems-based opportunity for prevention.

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Corporal punishment is broadly defined as using physical force to correct or control a child's behavior. More than half of parents report using corporal punishment for children younger than 10 years, and 75% to 95% of parents reporting using corporal punishment for children aged 2 to 8 years.<sup>1,2</sup> Although corporal punishment is legal in every US state and often a common practice, it is also a source of toxic stress and a leading risk factor for physical abuse.<sup>3-7</sup> Corporal punishment may include pain but is not supposed to result in injury<sup>3</sup>; corporal punishment resulting in injury is physical abuse.<sup>8</sup> The goal of corporal punishment is to attempt to increase a child's compliance with parental expectations or rules, and as such physical abuse is often accompanied by parental anger about a child's behavior or failure to meet demands.<sup>9,10</sup> A thorough review of the variants, precipitants, and outcomes of corporal punishment is beyond the scope of this study but can be found elsewhere.<sup>11,12</sup>

One context that may elicit corporal punishment and in turn lead to physical abuse is poor behavior or academic performance at school. Children who receive poor grades or negative remarks on their school report card may be at risk of physical punishment if their performance is not to the parent's standard or if they are reported misbehaving, inattentive, or disruptive in the classroom. Importantly, short-term consequences associated with physical abuse include poor academic achievement, emotional and behavioral problems, and conduct disorders.<sup>13-15</sup> Thus, the nature of an association between school performance and abuse may be reciprocal.

Anecdotal evidence from physicians and other child protection professionals suggests that the incidence of punishment-oriented physical abuse for school-aged children increases within a short window of time after the release of school report cards (R. Alexander, MD, PhD, written communication, January 30, 2017). However, to our knowledge, no empirical examination of this association has been undertaken. This study used a unique, multisource, state-level data set to examine the temporal association between school report card release and incidents of child physical abuse. The main hypothesis was that the incidence of physical abuse increases after the release of school report cards.

## Methods

We performed a retrospective study of calls made to the Florida Department of Children and Families child abuse hotline merged with dates of report card release for public schools across the state of Florida. Primary school-aged children (5-11 years) were chosen as the focus (1) because this is the age range for which the child abuse pediatricians believed they observed increases in physical abuse after report card release (R. Alexander, MD, PhD, written communication, January 30, 2017), and (2) because of the ages of children who would receive school report cards (ie, 5-18 years), primary school children have the highest rates of corporal punishment and physical abuse.<sup>2</sup> Data were managed using REDCap (Research Electronic Data Capture), a secure web-based application designed to support data capture for research studies.<sup>16</sup> The

## Key Points

**Question** Are school report cards a precipitant to child physical abuse?

**Findings** This study of report card release dates and state child welfare agency-verified incidents of child physical abuse across an entire state included 1943 cases of abuse. Release of report cards on Monday through Thursday was not associated with increased incidence rates of child physical abuse the same day or the day after the release; however, nearly a 4-fold increase in the incidence rate of verified child physical abuse reports was found on Saturdays after a Friday report card release.

**Meaning** These findings offer an actionable, policy-level strategy for school districts that may reduce incidents of child physical abuse linked to report cards.

institutional review board of the University of Florida, Gainesville, approved the study protocol and waived the need for informed consent for the use of deidentified data.

## Sample

The units of analysis for this study were calendar days (level 1 units) during the 2015-2016 academic year nested within Florida counties (level 2 units). Owing to some variation across counties with regard to school year commencement and ending, we used a 265-day window from September 8, 2015, to May 30, 2016, to exclude any possible summer vacation days. Three of the 67 counties in Florida were excluded because report card release dates were unavailable, resulting in a final analysis sample of 265 days for each of 64 counties (16 960 total days). This study followed the Strengthening the Reporting of Observational Studies in Epidemiology (STROBE) reporting guideline, and **Figure 1** illustrates the study sample selection.

## Measures

### Outcome: County-Specific Daily Counts of Verified Cases of Child Physical Abuse

The Florida child abuse hotline is a toll-free, 24-hour, 7 day per week hotline for reporting suspected maltreatment of children. State legislation mandates that all individuals who suspect abuse or neglect of a child must file a report with the hotline (FL Stat § 39.201). A database was extracted that included initial Florida Department of Children and Families call data (ie, demographics of the child [age, race/ethnicity, and sex]) as well as follow-up information including the outcome of the call (screened out or investigated), the outcome of the investigation (no indicator of maltreatment, some indication but not enough to substantiate, or verified maltreatment), the type of maltreatment suspected and/or verified, and the county identifier.

This study focuses exclusively on calls that became verified cases, henceforth referred to as cases of physical abuse. Physical abuse included physical injury, bizarre punishment, asphyxiation, burns, bone fracture, or internal injuries. Within the specified date range (September 8, 2015, through May 30, 2016), 167 906 calls for children aged 5 to 11 years were logged. Calls for nonphysical abuse types of maltreatment and calls for suspected physical abuse that were later unverified were

excluded, resulting in a total of 1943 cases of physical abuse with the 265-day window of observation across the 64 counties. Each verified case on a given day represents a unique case of physical abuse; however, these data are not linked to specific individuals, so cases across days may reflect repeated incidents for the same child and/or family.

**Exposure: Report Card Release**

Dates of report card release were identified for the 2015-2016 academic year for each county in the state of Florida through internet search and follow-up telephone calls. Based on the release dates, each of the 265 days in the observation window for each county was identified as a report card release day, a postrelease day (ie, a day immediately after a report card release day), or a nonrelease day (ie, neither a release nor a post-release day). For all analyses, nonrelease days were used as the reference category.

**Day-Level Covariates**

Time-varying covariates were included in the analyses to account for daily variation in cases of physical child abuse within a county. Primary of these were indicators for the day of the week. For all analyses, Monday was used as the reference weekday. The other day-level covariate was whether a school was out of session on a particular day because of a school holiday or other reason.

**County-Level Covariates**

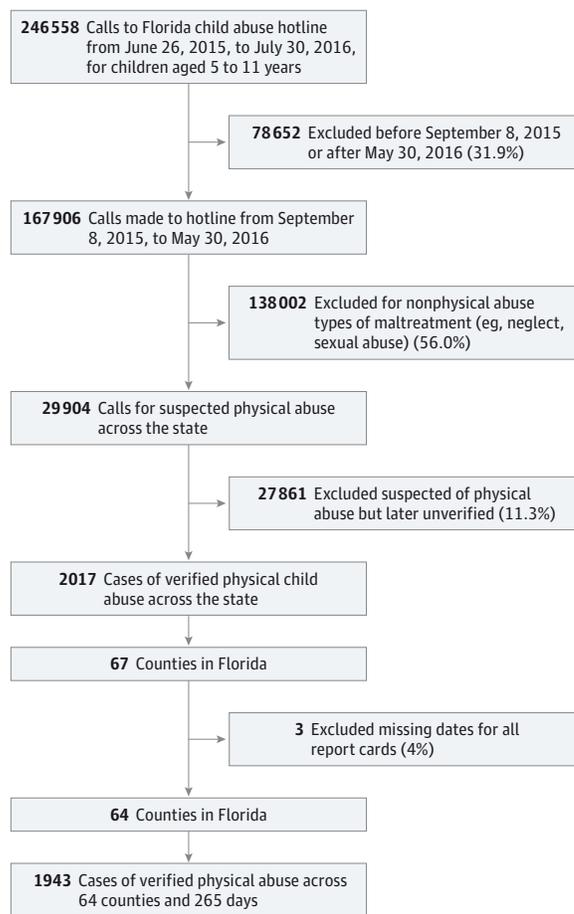
County-level demographic variables were included to control for between-county variability. These data were abstracted from FLHealthCHARTS, a multiagency-sourced, community health assessment resource tool set created by Florida's Bureau of Vital Statistics. Covariates included the percentages of individuals who were black, Hispanic, living below the poverty line, receiving free and reduced-price lunch, incoming kindergarteners identified as ready for school, or retained in their grade level, the median household income, the 2014 per capita child maltreatment rate, and whether the county is urban or rural.

**Statistical Analysis**

Data were analyzed from October 2017 through May 2018. This study used multilevel negative binomial regression to evaluate the association between report card release and counts of daily cases of child physical abuse.<sup>17,18</sup> This model accounted for overdispersion in the outcome due to the between-county variability in daily incidence rates (level 2) as well as overdispersion due to the low daily mean incidence rate within the county (level 1). A random intercept was specified in this model to account for the nesting of days within county. Two-way interactions between day of the week indicators and report card release indicators were included to allow the effects of report card release on cases of physical abuse to vary by day of the week. Nested model comparisons were performed to test overall effects of day of the week, report card release, and the corresponding interactions. The final model reported herein included all covariates and interaction terms with the exposure variables.

County-specific child population was included in the model as an offset variable to account for differences between coun-

**Figure 1. Flow Diagram of Data Extracted From the Child Abuse Hotline and County Report Cards**



The 1943 cases of verified physical abuse constituted the final sample.

ties in daily counts of physical child abuse cases simply owing to differences in the number of children aged 5 to 11 years who live within that county. Results of the final model are reported as daily incidence rates (IRs [cases per 100 000 child-days]) and IR ratios (IRRs).

**Sensitivity Analyses**

To determine whether the results were sensitive to choices of model specification, we estimated a logistic regression model using a binary outcome variable. We also evaluated multilevel Poisson, zero-inflated Poisson, and multilevel zero-inflated negative binomial models. We tested whether the findings were sensitive to the incorporation of first and second order-lagged autoregressive terms and to calendar-day time trends, including academic terms. Two-sided *P* values were calculated using the *t* statistic for null hypothesis testing of single regression parameters, while 1-sided *P* values were calculated using the  $\chi^2$  likelihood ratio test statistic for testing of nested models (corresponding to multiparameter null hypothesis testing). *P* < .05 indicated significance. All statistical analyses were conducted in Mplus (version 8; Muthen &

Table 1. Descriptive Statistics for County-Level Variables<sup>a</sup>

Variable	Mean (SD) [Range]
Black, %	24.52 (11.65) [8.99-67.24]
Hispanic, %	18.73 (15.10) [2.92-61.60]
2014 Maltreatment rate (per capita)	1222.63 (534.38) [435.50-2928.50]
Median household income, \$	43 953.61 (8089.41) [25 390.00-66 194.00]
Household living below poverty line, %	13.31 (4.57) [6.40-23.80]
Eligible for free or reduced-price lunch, %	63.42 (11.42) [26.70-96.10]
Grade retention rate, %	3.49 (2.31) [0.00-12.80]
Kindergarten readiness rate, %	91.67 (4.15) [78.10-100.00]
Child population (5-11 y old)	39 921.33 (66 893.36) [1080.00-359 971.00]
Urban indicator, % <sup>b</sup>	55.00 (NA) [0-1]

Abbreviation: NA, not applicable.

<sup>a</sup> Includes 64 counties.

<sup>b</sup> Coded as 1 for urban and 0 for rural.

Table 2. Report Card Releases and Daily Unadjusted IRs of Physical Abuse by Day of the Week

Day of the Week	No. of Days	Report Card Release Days, No. (%)	IR of Abuse per 100 000 Child-Days, Mean (SD) [Range]
Monday	2368	28 (13.6)	0.60 (11.96) [0-544]
Tuesday	2432	31 (15.0)	0.41 (2.98) [0-67]
Wednesday	2432	35 (17.0)	0.38 (3.22) [0-91]
Thursday	2432	46 (22.3)	0.30 (1.84) [0-35]
Friday	2432	63 (30.6)	0.34 (3.35) [0-112]
Saturday	2432	2 (1.0)	0.20 (2.34) [0-75]
Sunday	2432	1 (0.5)	0.12 (1.74) [0-77]
All	16 960	206 (100)	0.34 (5.10) [0-544]

Abbreviation: IR, incidence rate.

Mondays had the highest mean IR (SD) (0.60 [11.96]), with the lowest on Saturdays (0.20 [2.34]) and Sundays (0.12 [1.74]) (Table 2). The overall mean (SD) unadjusted daily IR for report card release days was 0.19 (0.89) verified cases per 100 000 child-days, whereas the IR for postrelease days was 0.34 (2.06) verified cases per 100 000 child-days and for nonrelease days was 0.34 (5.16) verified cases per 100 000 child-days.

If we ignored day of the week and county-level variability in abuse IRs, one might mistakenly infer from these bivariate statistics that no association exists between report card release and daily IRs of physical abuse or even that report card release was somehow protective against verified physical abuse. The multilevel negative binomial regression model results, described below, paint a far more nuanced picture.

### Model Results

The results described herein are based on the full multilevel negative binomial regression model with a random intercept to account for the clustering of days within county as well as control variables for school holidays, all previously described county-level demographics, and the offset for a county's child population size. Only 3 counties released report cards on a Saturday or Sunday. The observed counts of physical abuse cases on the 3 weekend release days and corresponding postrelease days in the total sample were all zero. As such, release-day effects for Saturday and Sunday as well as the postrelease-day effects for Sunday and Monday could not be estimated and were fixed at zero. Comparable results were obtained when simply excluding the weekend release days from the model.

Reflecting the pattern evident in the descriptive statistics, we noted significant differences in the nonrelease IRs across the days of the week (Table 3). Specifically, nonrelease Mondays have the highest estimated IR (0.43), whereas Saturdays and Sundays have the lowest (0.15 and 0.12, respectively;  $P < .001$ ). No statistically significant differences occurred in the IR for Monday through Thursday (range, 0.43-0.39). The nonrelease Friday IR is 21% lower ( $P = .04$ ) than for nonrelease Mondays. In addition, the nonrelease Saturday IR is 65% lower ( $P < .001$ ) and the nonrelease Sunday IR is 73% lower ( $P < .001$ ) than the IR for nonrelease Mondays. This effect may be owing to increased visibility of the students by mandatory reporters on these days.

The main-effects models, without the interactions, fit significantly worse than the full model (likelihood ratio test,

Muthen),<sup>19</sup> Stata (version 15; StataCorp), and R (version 3.4.3; R Foundation for Statistical Computing) software.<sup>20</sup>

## Results

### Descriptive Statistics

Of the 167 906 calls to the child abuse hotline for children aged 5 to 11 years, 2017 (6.7%) were verified as physical abuse cases, and 1943 were included in the analysis (1145 boys [58.9%] and 798 girls [41.1%]; mean [SD] age, 7.69 [1.92] years; 937 cases for white children [48.2%], 803 cases for black children [41.3%], 12 cases for Asian children [0.6%], 5 cases for Native American children [0.3%], 87 cases for children of multiple races [4.5%], 99 cases for children of unknown race/ethnicity [5.1%]). Descriptive statistics for all county-level variables are provided in Table 1. County child population sizes ranged from 1080 to 359 971 children aged 5 to 11 years, highlighting the need for an offset variable to account for the different number of children at risk for abuse across the counties on a given day. Table 2 summarizes report card release days and daily unadjusted IRs of physical abuse (per 100 000 child-days). Of the 16 960 total days, 206 (1.2%) were report card release days. Friday was the most common report card release day (63 of 206 [30.6%]) followed by Thursday (46 of 206 [22.3%]). Only 3 of 206 releases (1.5%) occurred on a weekend day.

The overall mean (SD) unadjusted daily IR of verified physical abuse was 0.34 (5.10) cases per 100 000 child-days.

15.37;  $df = 8$ ;  $P = .05$ ), so all interaction terms were retained in the model. We found no significant differences in IRs on report card release days compared with nonrelease days for Monday through Friday (Table 3). No significant differences occurred in IRs on postrelease days compared with nonrelease days with one notable exception: the IR for Saturdays after a Friday report card release was nearly 300% higher than the IR for nonrelease Saturdays (IRR, 3.75; 95% CI, 1.21-11.63;  $P = .02$ ). Figure 2 presents model-based estimates of mean IRs for each day of the week by each type of report card release day (nonrelease day, release day, and postrelease day) adjusted for all covariates. In terms of overall effect size, not only is the postrelease IR for Saturdays 3.75 times larger than the nonrelease Saturday IR, it is also higher than the IRs for all other days, regardless of report card release, including being 34% higher than the highest nonrelease IR on Mondays.

The variance of the random intercept and the dispersion parameters were both statistically different from zero, suggesting that both parameters were necessary to account for the count overdispersion. In terms of the covariates in the final model, adjusted IRs were significantly lower on school holidays (IRR, 0.41; 95% CI, 0.32-0.53;  $P < .001$ ) and were significantly higher in urban counties (IRR, 1.80; 95% CI, 1.11-2.90;  $P = .02$ ), counties with higher 2014 rates of child maltreatment (IRR, 1.36; 95% CI, 1.15-1.61;  $P < .001$ ), and counties with higher grade retention rates (IRR, 1.24; 95% CI, 1.01-1.53;  $P = .04$ ).

### Sensitivity Analyses

The multilevel negative binomial regression model fit the data better than a multilevel Poisson model or a multilevel zero-inflated Poisson model (with respect to the log likelihood, Akaike information criterion, and Bayesian information criterion). A zero-inflated negative binomial model was empirically underidentified with the probability of zero inflation converging toward the boundary value of zero. This finding suggested that the overdispersion in the data is adequately captured by the random intercept and dispersion parameters and that an additional zero-inflation factor is not needed. No evidence suggested that including first and second order-lagged autoregressive terms or using a binary outcome resulted in differences in inference or substantive interpretation. Similarly, no significant time trend effects were found for calendar day or school term. As such, these findings were robust to alternative model specifications.

## Discussion

The primary aim of this study was to empirically test the association between release of school report cards and telephone calls that led to verified cases of physical child abuse using state-level data. Release of report cards on Monday through Thursday was not associated with increased IRs of verified cases of child physical abuse the same or the next day. However, a nearly 4-fold increase in the IR of verified physical child abuse occurred on Saturdays after a Friday report card release.

One possibility for this unique finding is that when report cards are released earlier in the week, caregivers are

**Table 3. Model-Estimated IRs of Physical Abuse for Nonrelease Days and IRRs for Report Card Release Days and Postrelease<sup>a</sup>**

Day of the Week	Estimated IR per 100 000 Child-Days <sup>b</sup>	Estimated IRR (95% CI) <sup>c</sup>	
		Release vs Nonrelease Day	Postrelease vs Nonrelease Day
Monday	0.43	0.36 (0.08-1.60)	Fixed at 1
Tuesday	0.39	1.35 (0.42-4.29)	0.34 (0.06-1.86)
Wednesday	0.36	1.23 (0.34-4.50)	0.76 (0.18-3.19)
Thursday	0.39	0.99 (0.38-2.61)	0.96 (0.25-3.67)
Friday	0.34	0.44 (0.09-2.16)	0.23 (0.04-1.16)
Saturday	0.15	Fixed at 1	3.75 (1.21-11.63) <sup>d</sup>
Sunday	0.12	Fixed at 1	Fixed at 1

Abbreviations: IR, incidence rate; IRR, incidence rate ratio.

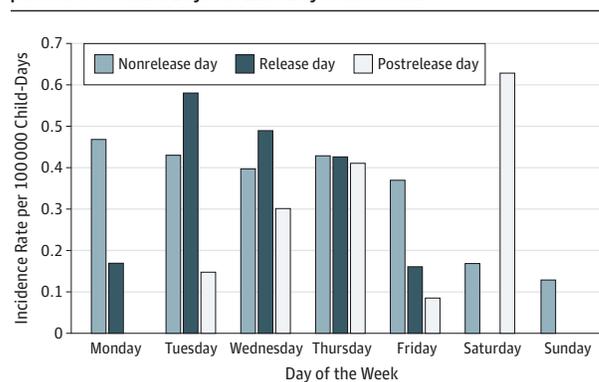
<sup>a</sup> Includes 16 960 days.

<sup>b</sup> Estimated for an average county with zero value for the county-level random effect.

<sup>c</sup> Adjusted for school holidays and all county-level covariates and offset by county child population. Saturday and Sunday release day IRRs as well as Sunday and Monday postrelease day IRRs were fixed at 1 owing to sparseness of Saturday and Sunday report card release dates in the data and zero observed physical abuse cases for Saturday and Sunday release days as well as Sunday and Monday postrelease days.

<sup>d</sup>  $P < .05$ .

**Figure 2. Model-Based Mean Incidence Rates of Physical Abuse per 100 000 Child-Days for Each Day of the Week**



Data are stratified by the 3 report card release day types (nonrelease, release, and postrelease). Means were calculated for nonholidays, adjusted for all county-level covariates, and empirically averaged over the model-estimated random effect distribution. Saturday and Sunday release day rates as well as Sunday and Monday postrelease day rates are excluded because effects could not be estimated in the model owing to sparseness of Saturday and Sunday report card release dates in the data.

distracted by other activities such as work and caring for other children. Thus, caregivers may not have the same opportunities to react negatively to a child's report card when released on a Monday through Thursday. Another possibility is that caregivers may avoid harsh punishment when children will have guaranteed exposure to mandated reporters (eg, teachers) the following day.

This study fits with others in which researchers have identified temporal variation in child abuse and neglect, including more cases in spring and summer<sup>21,22</sup> than in autumn and winter,<sup>23</sup> more physical abuse-associated visits to the hospital in the afternoon to evening hours,<sup>22</sup> and more physical abuse-associated hospital admissions during weekdays.<sup>24</sup>

One study of children in China<sup>25</sup> found peaks in physical abuse-associated hospital admissions in the 2 months preceding school examination periods. Although not discernable from their data, those researchers<sup>25</sup> speculated that parental stress and reaction to their child's school performance might explain these temporal peaks in abuse cases, as we do.

Given that this study, to our knowledge, is one of the first of its kind and that our findings do not indicate causality, ideas about the mechanisms linking report card release day and physical abuse are still largely speculative, and additional studies are needed to elucidate this possibility. Subsequent studies wherein additional, potentially influential, factors are measured (eg, days missed from school for children with verified cases of physical abuse after report card release; quality of report cards; parental beliefs about corporal punishment) would be helpful. In addition, randomization of the report card release day would create steps toward understanding pathways of causality.

### Strengths and Limitations

Strengths of this study include use of multiple data sources, a relatively large initial sample size (ie, 265 days nested within each of 64 counties, totaling 16 960 observation days), and the granularity of data (ie, day-level time points). The low overall rate of verified cases of physical abuse (the distribution of the 1943 cases in the data corresponded to 15 789 [93.1%] of the total observation days having zero cases) and small number of report card release days (206 release days and 206 postrelease days resulted in 16 278 [97.5%] of the total observation days being nonrelease days) is a potential limitation in the statistical power to detect small associations of report card release with daily IRs. However, we were able to examine these important research questions by starting with, to our knowledge, the only state-population sample of children of elementary school age that measures the calls resulting in agency-verified cases of physical abuse and the timing of report card release at county and day levels. Thus, the present data provide a unique opportunity to investigate an important

research question with significant policy implications. To the extent feasible, these analyses should be replicated with a larger sample (ie, multiple academic years and/or multiple states) to corroborate the findings. Another limitation of this study is that the data on physical abuse are limited to incidents that result in calls to a child abuse hotline. Several researchers have documented that many, if not most, incidents of abuse and neglect go unreported to state agencies.<sup>26</sup> In addition, the abuse data are based on calls, not individuals. This focus was intentional to limit the individually identifiable data regarding abuse. However, this focus precludes statements about children who experience repeated incidents. Knowing, for example, whether the same children experience abuse after multiple report card releases would add strength to the temporal association. Another limitation is that this study focused on public school data, leaving the potential link between report card release and abuse for children enrolled in private schools or homeschool programs unknown. Finally, we focused on dates when hard copy report cards were sent home or were available for parent pickup. Many schools across the states now use an online system with which teachers can update and parents can view grades daily. However, significant variation in use of this system exists, including how often grades are updated, how often—if ever—parents check the system, and the finality of grades posted online.

### Conclusions

Combined with findings from other studies regarding timing of physical abuse and studies of other policy-level precipitants of abuse,<sup>27,28</sup> the present study illustrates that child abuse incidence and prevention may be usefully considered at a more macroscopic level. To the extent that children who receive poor report cards are punished by their caregivers and that this punishment sometimes crosses the line to physical abuse, several school district-level or state-level policy changes could be made to reduce the likelihood of physical abuse.

#### ARTICLE INFORMATION

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**Concept and design:** Bright, Lynne, Alexander.

**Acquisition, analysis, or interpretation of data:** All authors.

**Drafting of the manuscript:** Bright, Lynne, Waldman, Alexander.

**Critical revision of the manuscript for important intellectual content:** All authors.

**Statistical analysis:** Lynne, Masyn, Waldman.

**Administrative, technical, or material support:**

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**Supervision:** Bright, Lynne, Masyn.

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