

Underreporting Child Maltreatment during the Pandemic: Evidence from Colorado

Alexa Prettyman

Department of Economics · Andrew Young School of Policy Studies · Georgia State University
14 Marietta Street NW · Atlanta, GA · 30303

Email: cprettyman2@gsu.edu · Website: alexaprettyman.com

Abstract

As a result of the COVID-19 pandemic schools closed abruptly in March 2020 and Colorado issued a stay-at-home order during the month of April. Subsequently, child maltreatment reporting dropped by 31 percent. This paper documents the decline in referrals and screened-in reports during the year in Colorado and predicts counterfactual estimates using two strategies. One strategy assumes the underlying behavior for child maltreatment was unchanged from 2019 to 2020. This approach implies that about 30,000 referrals went unreported over the year as a result of the pandemic. The second strategy assumes the economic distress brought about by the pandemic altered the underlying prevalence of child maltreatment. In this case, over 38,800 cases of child maltreatment might have gone undetected. Scaling these results to the national level suggests millions of child maltreatment referrals went unreported. I find that the largest reduction in reporting comes from the stay-at-home order, followed by school closings. Moreover, there is suggestive evidence that these missed children are suffering from neglect and not abuse. These findings quantify another hardship brought about by the pandemic, underreporting, and underscore the role mandatory reporters play in detecting child maltreatment. States might want to consider additional ways to detect child maltreatment that do not rely on mandatory reporters to prepare for future events that may limit interactions between children and mandatory reporters. Lastly, states should target resources to address neglected children.

1. Introduction

At the beginning of the COVID-19 pandemic, headlines across the United States read “Child abuse hotline calls are down during COVID-19, but abuse fears are up” and “More than 60% drop in calls to child abuse hotline spark safety concerns.” State agencies across the country were reporting that child abuse and neglect reports dropped drastically, but they cautioned that the decline was not necessarily a function of reduced maltreatment, and instead a function of reduced reporting.¹ Another headline read, “Advocates express concerns about children falling through the cracks.” In Colorado, I find that reporting decreased by 15 percent in 2020 relative to 2019. The biggest drop in reports, of 31 percent, occurred between April and June, and reports remained 14 to 18 percent below 2019 counts for the remainder of the year.

Over the past year, child maltreatment research has shown that overall fewer allegations of maltreatment were reported than expected in March and April (Baron et al., 2020; Rapoport et al., 2020; Weiner et al., 2020), school closures drastically reduced the number of cases detected (Baron et al., 2020, Cabrera-Hernández & Padilla-Romo, 2020), and stay-at-home orders increased the incidence of neglect (Bullinger et al., 2020). All of these studies use different methods and data, yet come to the same conclusion in line with the concerns expressed by news articles: potential victims of child abuse and neglect are going unnoticed. Baron and colleagues (2020) estimate that a total of 212,500 allegations across the US, 40,000 of which would have been substantiated, went unreported in March and April of 2020 as a result of school closures. They come to this estimate using real-time data from Florida. In this paper, I use real-time data from Colorado to provide an updated estimate on the number of unreported allegations and victims for the entire year. I find that millions of allegations may have gone unreported, potentially impacting over 100,000 victims during the year. In addition, I estimate how child maltreatment incidences and reporting changed as a result of the COVID-19 pandemic, school closures, and the stay-at-home order. Not surprising, all three events concurrently resulted in the largest decline in reporting, followed by the pandemic-induced school closures.

There are three main contributions of this paper. First, this paper uses real-time child maltreatment data and a model, similar to Baron et al. (2020), to predict the number of calls that would have been made to the Child Protective Services’ (CPS) hotline in 2020 had the pandemic

¹ This concern is not unique to the United States. Headlines in Canada read “Child protection reports on P.E.I. climb despite fewer eyes amid COVID.”

not occurred. The counterfactual number of child maltreatment referrals is calculated two ways. The simplest way is by assuming that referrals would have followed a similar pattern in 2020 as previous years. Alternatively, the pandemic limited interactions between children and mandatory reporters through school closings and stay-at-home orders, and increased child maltreatment risk factors, such as unemployment, parental burnout, and adverse coping mechanisms, like drinking.² For this reason, a second counterfactual is estimated taking into account the rise in unemployment and alcohol consumption. Comparing the two counterfactuals and the observed number of referrals sheds insight onto the two mechanisms in which the pandemic impacted child maltreatment. The first counterfactual underscores the importance of mandatory reporters. The second counterfactual demonstrates how economic hardships and coping mechanisms brought about by the pandemic contribute to child maltreatment.

As a second contribution, this paper uses the timing differences between the COVID-19 national emergency, school closures, and stay-at-home order to determine the impact that each of these events had on the decline in child maltreatment referrals for the full year. Prior research has looked at either school closures or stay-at-home orders in isolation and only examined the effect from March to May (e.g. Baron et al, 2020; Bullinger et al., 2020). This is the first study to provide the impacts of all three events for the full year. To differentiate these three impacts, separate regression equations are estimated with an independent variable equal to the proportion of the quarter in which the event happened. I find evidence that the largest decline in reporting came when the three events were happening concurrently. Alternatively, the pandemic, without school closures and stay-at-home orders, had the smallest impact on underreporting. Understanding the difference in reported maltreatment as a result of the pandemic and policy responses to curb the spread of the virus, quantifies the effectiveness of the policy responses. In addition, understanding the difference in reported maltreatment as a result of the pandemic and school closures contributes to the emerging body of literature emphasizing teachers' roles in detecting child maltreatment.

The last contribution of this paper is to identify the impact of the pandemic and pandemic-induced policies on the *type* of child maltreatment reported and substantiated. Child welfare experts observed an increase in serious abuse (Hofmann, 2021), and doctors claimed the severity

² Brown & De Cao (2020) find that unemployment is positively correlated with child maltreatment, Griffith (2020) explains how limited availability of social supports and child care can lead to parental burnout, which in turn can result in neglect and abuse (Mikolajczak, et al., 2019), and the WHO published a [brief](#) explaining the links between alcohol abuse and neglect.

of the abuse they saw in the ER at the start of the pandemic was much worse (Schmidt & Natanson, 2020). In Colorado, I do not find evidence of these claims. Overall, the proportion of neglect, physical abuse, and sexual abuse allegations is unchanged from 2019 to 2020. In addition, I use economic and seasonal trends to predict the type of maltreatment that might be going unreported. Based on this approach, victims of neglect are most likely being missed. In order to better prepare and target interventions, it is important to understand the type of maltreatment occurring and being underreported as a result of the COVID-19 pandemic.

2. The COVID-19 Pandemic and Child Maltreatment in Colorado

The COVID-19 pandemic national emergency was announced on March 13, 2020 and continued through the end of the year. To curb the spread of the disease in the early months, schools halted in-person learning, stay-at-home orders were issued, and non-essential employees worked from home. The unemployment rate rose to an all-time high of 14.8 percent in April 2020 and remained above 6 percent for the remainder of the year (Trading Economics, nd). Frequency of alcohol consumption increased by 14 percent (Pollard et al., 2020), domestic violence calls increased by 7.5 percent (Leslie & Wilson, 2020), people's mental health deteriorated (Brodeur et al., 2020), and parental burnout probably increased (Griffith, 2020). Despite these hardships and risk factors of child maltreatment, hotline calls plummeted (Schmidt & Natanson, 2020), raising concerns that abuse and neglect are going unreported (MacFarlane et al., 2020). Research suggests that these drops in reporting come from the pandemic-induced school closures, thus limited interactions with mandatory reports (Baron et al., 2020, Cabrera-Hernández & Padilla-Romo, 2020).

Colorado is no exception to the situation described above. School closures began at the end of March and continued until September. Compared to non-pandemic years, children were out of school for three additional months, but they continued to have access to school meals (Grewe, 2020). In addition, Colorado issued a stay-at-home order from March 26 to April 26. Colorado permitted going outside during the stay-at-home order as long as social distancing was followed. In fact, the public health order specifically listed walking, hiking, skiing, snowshoeing, biking, and running as acceptable activities (Grewe, 2020). People could also go to the grocery store, liquor store, convenience store, cannabis store, banks, and pharmacies (Grewe, 2020). The

unemployment rate fluctuated from 6.8 to 11 between April to December and alcohol sales increased by 8 percent.³

Figure 1 shows the number of child maltreatment referrals received and screened-in for investigation from 2006 through 2020 in the state. From 2006 to 2020, there was a steady incline, with a steeper incline following the introduction of the statewide hotline in 2015. Between April and June of 2020, the number of referrals and screened-in reports dropped by 31 and 26 percent, respectively, relative to the same time period in 2019. In the remaining months of the year, child maltreatment seemed to rebound somewhat, but referrals and screened-in reports still remained below pre-pandemic levels. The bottom graph of Figure 1 shows the number of allegations reported by maltreatment type, indicating the biggest drop and rebound in neglect allegations, and a small uptick in sexual abuse allegations. According to the Colorado Department of Human Resources, calls from education and medical personnel decreased by 30 and 11 percent, respectively; however, calls from friends and family increased by 5 percent (CDHS, 2021).

Referrals of child maltreatment are a function of actual incidences and reporting. The current pandemic, which increased economic hardship while reducing contact with mandatory reporters, poses a particularly unique challenge for child welfare agencies to detect child maltreatment. These two opposing forces will attenuate the impact of the pandemic on child maltreatment reporting towards zero. Alternatively, school closures and the stay-at-home order limited interactions with mandatory reporters. These two events should be driving the decline in reporting, and might explain some of the rebound in reporting after they ended.

Since the stay-at-home order limited all potential interactions with mandatory reporters and occurred concurrently with the first month of school closures, we should see this event driving the decline experienced between April and June. While the stay-at-home order limited interactions, it also potentially increased household stress and parental burnout, for those who complied. Parental burnout can manifest into neglect (Mikolajczak, et al., 2019). As a result, we expect to see increases in child maltreatment for counties with higher compliance relative to counties with worse compliance. This behavior might also be able to explain the uptick in neglect and sexual abuse.

³ Author's calculations based on unemployment data from the BLS and alcohol sales data from NIAAA. These data sources are described in the next section. Additionally, the Liquor Excise Tax Reports show a similar increase and be accessed through [Colorado's Department of Revenue](#).

3. Data

The data for this study come from multiple public sources. The child maltreatment data come from Colorado's Department of Human Services (CDHS), which provides real-time quarterly counts of calls made to the child abuse and neglect hotline for each county in Colorado starting in 2006. For this time-sensitive project, the CDHS data are preferred over the National Child Abuse and Neglect Data System (NCANDS) because the national level data have a two-year time lag and only provide screened-in reports in areas with more than 1,000 records, whereas the real-time CDHS data provide the total number of hotline calls at the county level. Another advantage of the CDHS data, relative to other states' real-time data, is that they provide the type of alleged maltreatment and the finding of the allegation. These data are used to test the hypothesis that child welfare experts have posited, more severe cases of abuse will result from the pandemic. Prior research in Florida and New York did not estimate the real-time composition of child maltreatment reports (Baron et al., 2020; Rapaport et al., 2020), and research in Indiana found an increase in neglect, not physical abuse (Bullinger et al, 2020).

One drawback of these data, is that the analysis is limited to a single state. The extent to which these results can be generalized to the entire country is questionable. Colorado had one of the highest child maltreatment referral rates of 85.2 referrals per 1,000 children in 2019 (ACF, 2021). The average referral rate for states across the country was 59.5 (ACF, 2021). In addition, Colorado screened out more referrals than the average state. Colorado screened out 66.4 percent of their referrals in 2019, whereas the average screen-out percent was 40.7 percent (ACF, 2021). Of the calls that were screened-in, about 34 percent were substantiated in Colorado, compared to an average of 29 percent across the country (ACF, 2021). Finally, the most common types of maltreatment in both the US and Colorado are neglect, abuse, and sexual abuse (ACF, 2021); however, neglect is relatively higher and physical abuse is relatively lower in Colorado compared to the typical state. While Colorado may not be representative of the typical state in the US, these results are essential to provide more evidence of the impacts of the pandemic and pandemic-induced policies.

The remaining data come from multiple sources and are used to supplement the main analyses. First, I use employment and population data from the Bureau of Labor Statistics (BLS) and US Census to control for changes in economic conditions. The BLS provides county and state-level unemployment rates and employment counts, quarterly from 2006 through 2020, and the Census

provides the county population size, annually from 2008 to 2019. To estimate the 2020 population numbers, I use the 3-year average percent change in each county.⁴ The population size and employment counts are used to determine the employment to population ratio. In addition, I use the population to determine county-level child maltreatment rates. Next, I use alcohol sales data from the “Surveillance Report #115” and “Alcohol Sales during the COVID-19 Pandemic” files, maintained by National Institute on Alcohol Abuse and Alcoholism,⁵ to proxy for alcohol consumption at the state-level. This estimate, in combination with the unemployment rate, is used to create a second counterfactual maltreatment number that accounts for an economic hardship and potential coping strategy. Finally, to proxy for stay-at-home order compliance, I obtain county-level data on COVID-19 cases and deaths from Colorado’s Outbreak Data, maintained by Colorado’s Department of Public Health and Environment (CDPHE).⁶ These data are updated weekly and available online for transparency and evidenced-based decision-making, but may not be comparable across counties over time and should not be used to associate exposure risk with certain settings (CDPHE, nd). I use these data from the beginning of the pandemic (March 14, 2020 to May 10, 2020) to observe how caseloads changed *within* a county prior to and during the stay-at-home order to get an idea of stay-at-home order compliance. While these four additional sources of data do no control for all potential confounders, they enrich analyses that solely rely on seasonal and longitudinal trends.

Table 1 provides state-level differences in child maltreatment reporting, economic conditions, and alcohols sales for each quarter between 2019 and 2020. In addition, percent changes are provided. Overall, child maltreatment reporting declined by 15 percent, with the biggest decline of 31 percent occurring between April and June. The proportion of screened-in and substantiated reports remained similar between 2019 and 2020. Table 2 provides summary statistics of child maltreatment reporting and economic conditions for all 64 counties over the 4 quarters and 13 years. The average number of referrals received in a county during a given quarter between the years 2008 and 2020 is 18, per 1,000 children. I also provide the 2019 and 2020 averages and a p-value indicating if they are statistically different from each other.

⁴ More specifically, I first calculated the percent changes in population size from 2016 to 2017, 2017 to 2018, and 2018 to 2019. Then, I calculated the 3-year average and used this average to estimate the 2020 population size.

⁵ These data can be found [here](#).

⁶ These data were downloaded March 24, 2021 from <https://covid19.colorado.gov/covid19-outbreak-data>.

4. Empirical Approach

Similar to Baron et al. (2020), I first predict the counterfactual number of child maltreatment referrals, screened-in reports, and substantiated reports for the state of Colorado by estimating the following equation:

$$Y_{qy} = \beta_0 + \varphi_q + f_g(qy) + \varepsilon_{qy} \quad (1)$$

Where Y is the outcome of interest (i.e. number of referrals made to the hotline, number of reports screened-in, number of substantiated reports, etc.) in Colorado during quarter q of year y , φ_q is the quarter fixed effect included to capture seasonal trends,⁷ $f_g(qy)$ is a polynomial in time of order g , and ε_{qy} is the error term. In the main specification the polynomial takes a cubic form; however, the counterfactual results are similar across alternative specifications.⁸ This equation is estimated for each of the four quarters from the years 2006 to 2019. These estimates are then used to predict the outcomes for each quarter in year 2020. This approach assumes that the number of maltreatment referrals and reports would have been similar in 2020 as 2019, had the pandemic not occurred. Alternatively, the hardships and stresses brought about by the pandemic might increase child abuse and neglect. In attempt to capture the increase in maltreatment due to hardships, I estimate equation 1 again controlling for the unemployment rate and alcohol purchases. This approach assumes the relationships between unemployment and child maltreatment and alcohol purchases and child maltreatment are similar in 2020 and 2019. Estimating two counterfactuals based on seasonal and longitudinal trends is useful as there is no feasible control group since the announcement of the national emergency and subsequently policy responses occurred at the same time for the entire country.

After understanding the difference between the counterfactual and actual scenarios, the next step is to understand how much of these differences are driven by the pandemic, the pandemic-induced school closures, and the pandemic-induced stay-at-home order. I estimate the following equations to differentiate these three effects:

$$Y_{cqy} = \beta_0 + \beta_1 covid_{qy} + \varphi_q + \gamma_y + \rho_c + \varepsilon_{cqy} \quad (2)$$

$$Y_{cqy} = \alpha_0 + \alpha_1 schclo_{qy} + \varphi_q + \gamma_y + \rho_c + \varepsilon_{cqy} \quad (3)$$

⁷ Quarters one and four experience the highest call volume, whereas the quarters spanning the summer experience the lowest call volumes. This can be seen in Figure 1.

⁸ See Appendix Figure 1 for a comparison of the different approaches that use a linear and quadratic polynomial.

$$Y_{cqy} = \delta_0 + \delta_1 sah_{qy} + \varphi_q + \gamma_y + \rho_c + \varepsilon_{cqy} \quad (4)$$

Where Y is the outcome of interest in county c during quarter q of year y , φ_q , γ_y , and ρ_c are the quarter, year, and county fixed effects, respectively, and ε_{cqy} is the error term. The independent variables of interest, $covid$, $schclo$, and sah , identify the proportion of the quarter in which the condition exists in quarter q of year y . For example, the COVID-19 pandemic national emergency was announced March 13, 2020 and continued through 2020,⁹ so $covid$ is assigned a value of one-sixth in quarter 1 in 2020, and a value of one for the remaining quarters in 2020. The national emergency forced schools to close in March and delayed openings, so $schclo$ equals one-sixth in quarter 1, two-thirds in quarter 2, and one-sixth in quarter 3 during 2020. Lastly, in attempt to slow the spread of the virus, Colorado issued a stay-at-home order from March 26th to April 26th, so sah in equation 4 is assigned one-third in quarter 2 of year 2020 and zero otherwise.¹⁰ The coefficient of interest in equation 2, β_1 , estimates the impact of the COVID-19 pandemic on child maltreatment reporting. In equation 3, the coefficient of interest, α_1 , estimates the impact of school closures on child maltreatment reporting. Lastly, in equation 4, δ_1 , estimates the impact of the stay-at-home order on child maltreatment reporting. In all equations, standard errors are clustered at the county by quarter level.¹¹

These three effects cannot be estimated together because they are correlated with each other due to the timing of the events.¹² For example, when the stay-at-home order is in effect, schools are closed and the pandemic exists. After the stay-at-home order is lifted, when schools are closed, the pandemic exists. The timing overlap of these events implies that δ_1 captures the impact of the pandemic, school closures, and stay-at-home order concurrently. Similarly, α_1 captures the impact of the pandemic-induced school closures, and β_1 estimates the impact of the pandemic without stay-at-home orders or school closings, like the end of 2020. This set-up implies $\delta_1 > \alpha_1 > \beta_1$.

Finally, to determine differential effects of the stay-at-home order by compliance, I estimate the following equation:

$$Y_{cqy} = \delta_0 + \delta_1 sah_{qy} + \delta_2 cc_c + \delta_3 sah_{qy} \times cc_c + \varphi_q + \gamma_y + \rho_c + \varepsilon_{cqy} \quad (5)$$

⁹ See The White House notice on the continuation of the National Emergency found [here](#).

¹⁰ See Table 3 for the dates and values defined.

¹¹ Results are similar when standard errors are clustered at the county level and available upon request.

¹² See Figure 2 for a timeline of the events and how they overlap.

Where the majority of the terms are defined above. cc measures the pre-stay-at-home order COVID-19 cases per 100,000 residents for county c , so δ_2 estimates the relation between COVID-19 cases and child maltreatment reporting, and δ_3 estimates the interaction effect between the stay-at-home order and COVID-19 cases on child maltreatment. A positive coefficient on δ_3 means the stay-at-home order increased child maltreatment reporting for counties with higher COVID-19 cases, relative to counties with no COVID-19 cases as of March 26th.

The validity of this approach to yield causal estimates relies on two assumptions. First, counties with COVID-19 cases prior to March 26th had similar child maltreatment reporting trends as counties with no COVID-19 cases prior to March 26th. Second, counties with COVID-19 cases were more compliant to the stay-at-home order. One crude proxy for compliance is the number of COVID-19 cases during the stay-at-home order. Counties with fewer cases per 100,000 residents are considered more compliant, especially if they had cases prior to the stay-at-home order. Table 4 provides summary statistics of child maltreatment reporting by COVID-19 cases, and Figure 3 plots the relationship between COVID-19 cases prior to the stay-at-home order versus during the stay-at-home order with the regression adjusted correlation coefficient. Neither of these set of results provide convincing evidence that the two assumptions are satisfied, so this analysis is exploratory.

To understand the direction of the potential bias, I estimate the relationship between compliance on pre-pandemic child maltreatment. For this analysis, compliance is measured as the ratio between COVID-19 cases prior to and during the stay-at-home order.¹³ In this set-up, counties with ratios greater than or equal to one are considered more compliant than counties with ratios less than one. I do not find strong evidence that compliance is correlated with child maltreatment prior to the pandemic, thus I cannot sign the potential bias.

¹³ The majority of counties (45) reported zero COVID-19 cases prior to and during the stay-at-home order. For these counties the ratio is set equal to one. In the remaining 19 counties, there were COVID-19 cases before and/or during the stay-at-home order. In one county, they reported zero COVID-19 cases during the stay-at-home order, resulting in an invalid ratio (i.e. zero in the denominator). For this county, I set the ratio equal to the number of cases prior to the stay-at-home order.

5. Results

5.1. Counterfactual number of referrals and reports

Figure 4 shows the predicted versus actual number of referrals from 2006 to 2020. In 2019, there were a total of 115,178 referrals made, and substantiated reports. In contrast, in 2020, there were a total of 98,158 referrals made. Counterfactual 1 shows the predicted number of referrals assuming the pandemic had not occurred, and counterfactual 2 shows the predicted number of referrals after accounting for increases in unemployment and alcohol sales, de facto consumption.

Comparing the actual number of referrals to counterfactual 1, an estimated 30,276 referrals went unreported in 2020. Alternatively, recognizing that the pandemic has brought on significant hardships, we might expect the number of children suffering from maltreatment to be even greater in 2020 relative to 2019. Comparing the actual number of referrals to counterfactual 2, an estimated 38,794 referrals went unreported in 2020.

Colorado has a high referral rate, but a high proportion of referrals are screened-out and unsubstantiated. Next, I compare the actual screened-in reports to the predicted numbers of screened-in reports to investigate whether the screening process changed during the pandemic. If the screening process remained the same, then the proportion of the predicted screened-in reports would be the same as the proportion of the actual screened-in reports. Figure 4 shows the predicted versus actual number of screened-in reports from 2006 to 2020. Between 10,500 to 11,500 fewer reports were screened-in in 2020 compared to counterfactual estimates. The proportion of reports that were screened-in in 2020 and the proportion of reports that should have been screened-in based on the counterfactual estimates was 33 to 35 percent, indicating the screening process remained the same during the pandemic. Lastly, I compare the actual number of substantiated reports to the predicted number of substantiated reports to determine whether the nature of child maltreatment changed during the pandemic. Figure 4 shows the predicted versus actual number of substantiated reports from 2006 to 2020; 2,200 to 2,800 substantiated reports were missed. The different trends on each line and the large uptick in actual cases in quarter 3 of year 2020 make it difficult to interpret how maltreatment has changed over the year.

In addition to estimating counterfactuals for the screened-in and substantiated reports, the CDHS data also allow me to estimate counterfactuals for the composition of substantiated reports by maltreatment type. Figure 5 plots the predicted versus actual number of substantiated neglect,

physical abuse, and sexual abuse allegations. The majority of unreported victims seem to be suffering from neglect.

5.2. Impact of the COVID-19 pandemic, school closures, and the stay-at-home order on child maltreatment reporting

Table 5 provides the main results of the paper. All else equal, an additional quarter with the COVID-19 pandemic reduced the number of referrals made to the hotline by 2.5 per 1,000 children (or 10% relative to the average 2019 referral rate in a county). The screened-in report rate and substantiation rate are not statistically different as a result of the COVID-19 pandemic. All else equal, an additional quarter with pandemic-induced school closures reduced the number of referrals and screened-in reports by 7.9 (or 32% relative to the average 2019 referral rate in a county) and 1.8 per 1,000 children, respectively. Finally, all else equal, an additional quarter with a stay-at-home order reduced the number of referrals and screened-in reports by 14.8 (or 60% relative to the average 2019 referral rate in a county) and 3.3 per 1,000 children, respectively. Similar to the COVID-19 pandemic, neither school closings nor the stay-at home order had a statistically significant impact the substantiation rate.

Rescaling the quarterly effect to a monthly effect, implies that an additional month of the COVID-19 pandemic, school closures, and stay-at home order reduced child maltreatment reporting by 0.85, 2.6, and 4.9 referrals per 1,000 children, respectively. The effect of the stay-at-home order is almost six times as large as the effect of the pandemic and almost twice as large as the effect of the school closings. Finally, rescaling the monthly impact to an annual impact based on the number of months for each of the events implies the COVID-19 pandemic, school closures, and stay-at-home order reduced maltreatment reporting by 8, 7.9, and 4.9 referrals per 1,000 children, respectively. With a child population of 1.26 million, approximately 10,000, 9,900, and 6,200 referrals went unreported as a result of the COVID-19 pandemic, school closures, and stay-at-home order, respectively, in Colorado.

5.3. Changes in type of maltreatment

So far this paper has demonstrated that the COVID-19 pandemic, and subsequent school closures and stay-at-home order drastically decreased the child maltreatment referral and report rate, but had no statistically significant impact on the substantiation rate. Next, I explore whether the type of maltreatment reported changed during the pandemic. The right side of Table 5 provides the results from estimating equations 2-4 for the neglect, physical abuse, and sexual abuse referral

rates. Overall, there is no evidence that the pandemic altered the type of maltreatment reported. The direction of the coefficients implies fewer neglect and physical abuse allegations, and more sexual abuse allegations were reported as a result of the pandemic and subsequent policy responses; however, none of these estimates are statistically significant. As a result of statistically insignificant changes in the type of maltreatment referrals made, there are no statistically significant changes in the type of maltreatment substantiated.¹⁴

5.4. Impact of stay-at-home order compliance on child maltreatment reporting

Finally, Table 6 provides the estimates from the interaction between the stay-at-home order and COVID-19 cases. All else equal, an additional quarter under the stay-at-home order in counties with COVID-19 cases is associated with an increase in the number of total referrals and screened-in referrals by 0.09 and 0.05 per 1,000 children, relative to counties without COVID-19 cases. Moreover, this interaction analysis indicates that counties with COVID-19 cases experienced an increase in the neglect and sexual abuse allegation rate, as a result of the stay-at-home order, relative to counties without COVID-19 cases.

5.5. Alternative analyses and permutation tests

To determine the sensitivity of the main results, I estimate alternative analyses varying the sample size and control variables. Table 7 reports the results for different measures of the child maltreatment referral rate across different analyses. Column 1 provides the main results again. Columns 2 and 3 provide results from varying the sample size, and column 4 provides results that include county-level controls for economic conditions. The first panel of results shows the change in the rate, per 1,000 children, the second panel uses logged values, and the third panel uses the level values.

Overall, the impact of the pandemic, school closures, and stay-at-home order on the referral rate (panel 1) and logged number of referrals (panel 2) is similar across varying sample sizes. In column 2, the time period is restricted to the years 2010 to 2020, to exclude any impacts of the Great Recession. In column 3, the Denver metro-area is excluded to test whether these results are generalizable to all counties in Colorado or unique to the most populous areas. When observing total referral levels (panel 3), the coefficients are not sensitive to excluding the Great Recession years, but they are drastically reduced when excluding the Denver metro-area. This analysis

¹⁴ Results available upon request.

indicates that relatively more referrals are going unreported in the Denver metro-area relative to other parts of the state, which makes sense since there are more people and children in the Denver metro-area. This sensitivity also underscores the importance of using rates, and not levels. In all cases, including the economic conditions reduces the magnitude of the effect size, relative to the main specification. However, the change in magnitude is not statistically different from the main estimates. The same conclusions apply across analyses variations for the screened-in and substantiation rates.¹⁵

Since the pandemic started in 2020, there are only a few treated observations. Few treated observations can lead to improper inference (Cameron et al., 2008; MacKinnon & Webb, 2017, 2018; Ferman & Pinto, 2019). One way to correct for this is to perform a set of permutation tests (Chetty et al., 2009; Buchmueller et al., 2011; Baron et al., 2020). I estimate equations 2-4 with a placebo independent variable. This is done for every quarter-year combination from 2008 to 2019. This approach results in 48 placebo estimates (12 years x 4 quarters). The distribution of the 48 placebo estimates and one actual estimate from equations 2-4 represents the sampling distribution of $\hat{\beta}_1, \hat{\alpha}_1, \hat{\delta}_1$.

Figure 6 shows the cumulative distribution function of the placebo and actual estimates on *covid*, *schclo*, and *sah*, respectively for the referral rate and screened-in report rate. The actual estimate on *covid* is not statistically different from all of the placebo estimates, whereas the actual effect of the school closures and stay-at-home order are statistically different from the placebo estimates. These permutation tests indicate that the estimated impacts from school closures and the stay-at-home order are unlikely to be a result of chance.

6. Conclusion

There are three major findings of this paper. First, in Colorado, the COVID-19 pandemic and subsequent policy responses resulted in a 15 percent decline in reporting in 2020, compared to 2019. The biggest decline occurred between April and June as a result of the stay-at-home order and initial shift to virtual schooling; however, delayed school openings and continued spreading of the Coronavirus kept reporting below pre-pandemic averages for the remainder of 2020. Using a model that accounts for economic hardships and harmful coping strategies brought about by the pandemic, an estimated 38,800 referrals went unreported and 2,200 victims went unnoticed.

¹⁵ See Appendix Table 1 and 2 for the results.

Applying these numbers to the whole country while taking into account Colorado’s unusually high reporting rate, an estimated 1.38 million referrals and 112,000 victims may have gone unreported across the country during 2020.¹⁶ These estimates can (and should) be verified in two to three years when NCANDS releases the national-level data.¹⁷

There are three reasons to verify these numbers after the pandemic ends. First, for documentation purposes, it is important to correctly quantify the detrimental impacts of the pandemic. Second, these numbers can be used to predict the extent of underreporting in the event of another national emergency that alters maltreatment and reporting, simultaneously. Finally, child abuse and neglect has lasting consequences on educational attainment, employment and earnings, and health (Slade & Wissow, 2007; Irigaray et al., 2013; Kalmakis & Chandler, 2015; Doyle & Aizer, 2018), so states should be making efforts to follow-up with the children who may have been missed. Having an accurate count for how many children may have experienced abuse or neglect during the pandemic allows states to know when their follow-up efforts have reached all potential candidates.

The second key finding is that the stay-at-home order, school closings, and COVID-19 national emergency all substantially reduced child maltreatment referrals and screened-in reports. Many child welfare experts and governors understand they are missing the opportunity to protect children (NGA, 2020); however, some experts disagree and claim that the pandemic is filtering out the flood of unsubstantiated reports.¹⁸ In Colorado, I do not find evidence that the composition of substantiated and unsubstantiated reports changes. Moreover, even if the pandemic filtered out unsubstantiated reports, it is unclear whether this is a good thing for child welfare. Ultimately, the answer depends on the state and what supports are provided to children and families of unsubstantiated reports. For example, in Colorado, children and families of unsubstantiated reports can be referred to other services, so a call to the hotline may connect families with needed resources (CDHS, nd b). In this case, fewer calls, regardless the disposition, is concerning.

¹⁶ First the 38,800 unreported referrals are multiplied by 51. Next, 1,978,800 is divided by 1.43 because Colorado’s report rate is 1.43 times higher than the typical state. The number of victims is not rescaled because Colorado’s victim rate is similar to the average state (9.7 victims per 1,000 children versus 8.9 victims per 1,000 children).

¹⁷ If one were to scale early predictions from Baron et al., 2020 and Rapaport et al., 2020 to the full year, they would estimate that 833,000 to 1.06 million referrals went unreported.

¹⁸ For an example, see the [opinion piece](#), “National Opinion: COVID-19 is not leading to more child abuse, it’s cleaning the 'pollution' of false reports,” published in the Arizona Daily Star on September 4, 2020.

While child welfare experts predicted that more severe child maltreatment would arise from the pandemic (Hofmann, 2021), and some research has found that the proportion of ER visits from child abuse and neglect almost doubled, relative to 2019 proportions (Swedo et al., 2020), in Colorado, I do not find evidence of this hypothesis yet. Whether this is a limitation of the data or a glimmer of hope is unclear. Identifying victims from hotline calls is especially difficult in a state that screens out the majority of referrals and substantiates so few reports. Stephens-Davidowitz (2013) proposed two clever ways to try to identify victims of maltreatment. One method relies on using fatality counts (i.e. extreme cases of child maltreatment) and the other relies on using Google searches including terms like “child abuse and neglect.” Unfortunately, this study is not able to employ either of these methods. First, CDHS does not provide real-time data on fatalities. Second, Google searches related to child abuse and neglect in 2020 saw a substantial uptick the first week of March, prior to the pandemic. This uptick follows the release of the Netflix true crime miniseries documentary, “The Trials of Gabriel Fernandez,” which was released February 26th. This limitation is an area that future research should continue to address as different types of maltreatment victims require different interventions.¹⁹

Finally, I find that the referral rate, specifically for neglect and sexual abuse increased in counties that were more likely to comply with the stay-at-home order relative to counties that were less likely to comply.²⁰ This result provides suggestive evidence of parental burnout and is supported by early research in the medical literature. For example, childhood injuries occurring in the home or on bicycles increased relative to sport and playground injuries during the pandemic (Bram et al., 2020). In addition to targeting support and services to communities with historical records of substantiated cases, agencies need to target support and services to communities hit hard by the pandemic.

Eventually the pandemic will be a thing of the past; however, the findings of this study have implications beyond the pandemic. These findings quantify another hardship brought about by the pandemic: underreporting child maltreatment. The prevalence of underreporting highlights the role mandatory reporters play in detecting child maltreatment. These results can be used to inform policy decisions related to underreporting, mandatory reporting, and training. For example, states might want to consider additional ways to detect child maltreatment that do not rely on mandatory

¹⁹ Fatality data during 2020 will be available through NCANDS for all states in two to three years.

²⁰ Bullinger et al. (2020) come to a similar conclusion in Indiana.

reporters to prepare for future events that may limit interactions between children and mandatory reporters. These results also speak to resource allocation for intervention after a pandemic. Based on findings from this paper, states should target resources to assist neglected children. This paper can also inform policy decisions related to future pandemic responses. While school closures and stay-at-home orders reduced the spread of Coronavirus (Auger et al., 2020; Castillo et al., 2020), policymakers also have to consider the impact such policies had on child maltreatment reporting to design even better responses in the future. For example, the Department of Education in Maine provided an updated guide for teachers and others who care for children to detect maltreatment virtually (Maine DOE, 2020). Finally, this paper can be used as a reference to understand how events that alter maltreatment and reporting simultaneously impact child maltreatment referrals and substantiation rates in the data. Ultimately, fluctuations in the data seem to be more reflective of reporting than actual incidences.

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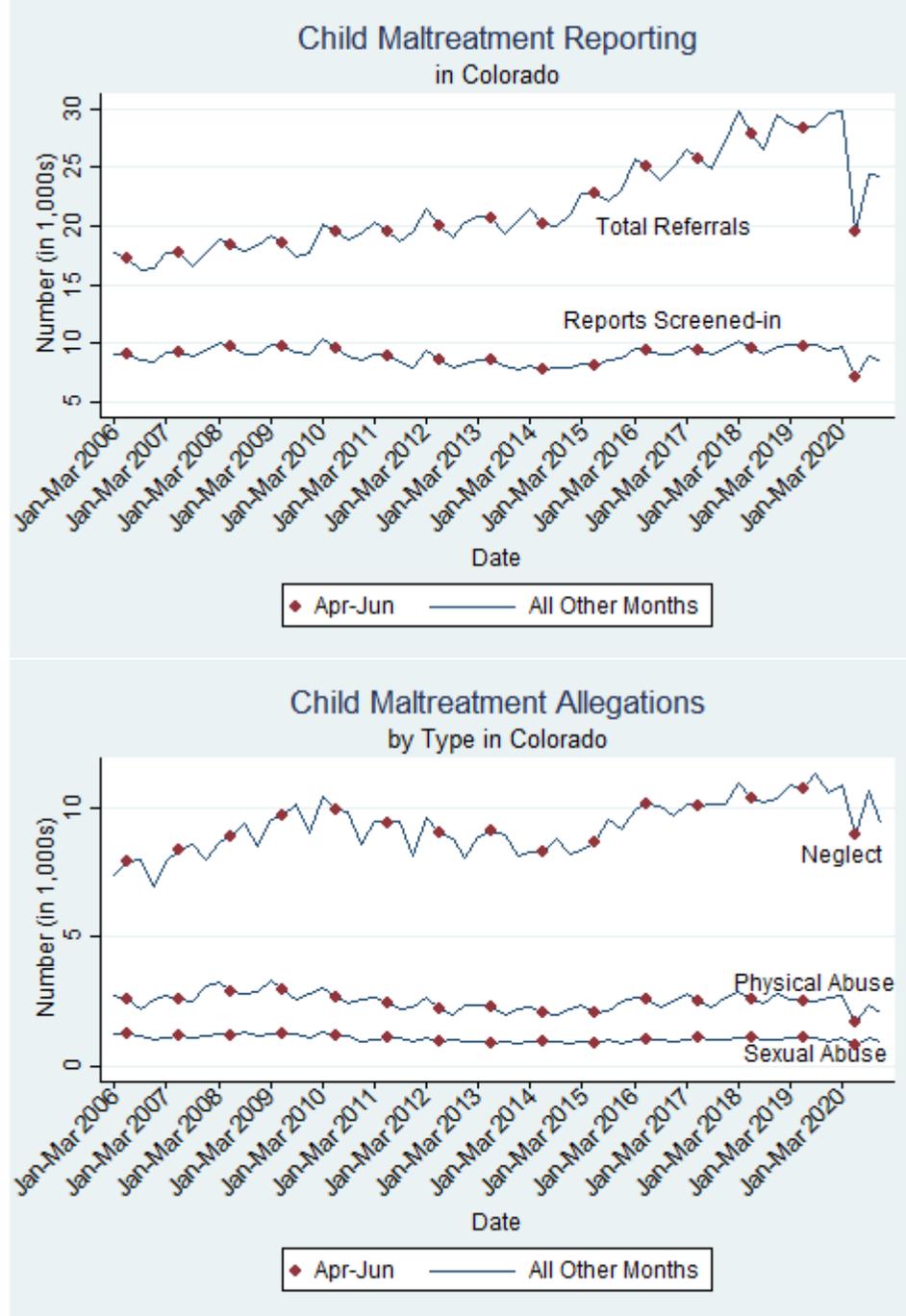
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Tables and Figures

Figure 1: Child Maltreatment Referrals in Colorado from 2006 to 2020



Notes: This figure shows the trend in child maltreatment reporting from 2006 to 2020. The top graph shows the total number of child maltreatment referrals (in thousands) reported to child welfare agencies in the state as well as the number of reports screened-in (in thousands). The bottom graph shows the number of allegations by maltreatment type (in thousands). The total number of maltreatment allegations in the bottom graph is less than the total referrals because not

all referrals are screened-in and investigated Alternatively, the total number of maltreatment allegations is greater than the screened-in reports because a report can be assigned multiple maltreatment types.

Table 1: State-Level Differences in Child Maltreatment Reporting and Economic Conditions between 2019 and 2020

Year Quarter	2019					2020				
	Jan - Mar	Apr - Jun	Jul - Sep	Oct - Dec	TOTAL	Jan - Mar	Apr - Jun	Jul - Sep	Oct - Dec	TOTAL
<i>Child Maltreatment Variables</i>										
Total Referrals Received	28626	28281	28549	29722	115178	29819	19577	24482	24280	98158
Screened-in	9896	9782	9850	9422	38950	9727	7190	8856	8348	34121
Screened-out	18730	18499	18699	20300	76228	20092	12387	15626	15932	64037
Total Allegations of Maltreatment	15333	15195	15688	14875	61091	15457	12020	14757	13019	55253
Substantiated	3487	3397	3649	3197	13730	3426	3014	3322	2922	12684
Unsubstantiated	11846	11798	12039	11678	47361	12031	9006	11435	10097	42569
Neglect Allegations	10865	10785	11349	10577	43576	10865	8955	10660	9386	39866
Physical Abuse Allegations	2623	2528	2548	2694	10393	2765	1693	2363	2045	8866
Sexual Abuse Allegations	1106	1122	1106	938	4272	1105	842	1091	935	3973
Substantiated Neglect	2786	2661	2940	2541	10928	2718	2462	2662	2335	10177
Substantiated Physical Abuse	289	336	310	295	1230	336	249	306	254	1145
Substantiated Sexual Abuse	311	299	310	270	1190	268	221	269	238	996
<i>Economic Conditions</i>										
Unemployment rate	3.10	2.80	2.63	2.50		3.40	11.00	6.83	7.07	
Employment-population ratio	66.93	67.13	67.57	67.70		66.67	59.87	62.37	63.50	
Alcohol Purchased (gallons per capita)					2.78					2.99
<i>Percent Change between 2020 and 2019</i>										
<i>Child Maltreatment Variables</i>										
Total Referrals Received	0.04	-0.31	-0.14	-0.18	-0.15					
Screened-in	-0.02	-0.26	-0.10	-0.11	-0.12					
Screened-out	0.07	-0.33	-0.16	-0.22	-0.16					
Total Allegations of Maltreatment	0.01	-0.21	-0.06	-0.12	-0.10					
Substantiated	-0.02	-0.11	-0.09	-0.09	-0.08					

Unsubstantiated	0.02	-0.24	-0.05	-0.14	-0.10
Neglect Allegations	0.00	-0.17	-0.06	-0.11	-0.09
Physical Abuse Allegations	0.05	-0.33	-0.07	-0.24	-0.15
Sexual Abuse Allegations	0.00	-0.25	-0.01	0.00	-0.07
Substantiated Neglect	-0.02	-0.07	-0.09	-0.08	-0.07
Substantiated Physical Abuse	0.16	-0.26	-0.01	-0.14	-0.07
Substantiated Sexual Abuse	-0.14	-0.26	-0.13	-0.12	-0.16
<i>Economic Conditions</i>					
Unemployment rate	0.10	2.93	1.59	1.83	
Employment-population ratio	0.00	-0.11	-0.08	-0.06	
Alcohol Purchased (gallons per capita)					0.08

Notes: This table reports the number of referrals, screened-in and screened-out reports, allegations (including disposition), and allegations by maltreatment type for the state of Colorado for each quarter and the full year in 2019 and 2020. In addition, some economic conditions (unemployment rate and employment-population ratio) and a measure of a coping technique (alcohol sales) is included. The bottom panel reports the percent change between 2020 and 2019 for quarter and the year for each variable.

Table 2: Summary Statistics of Child Maltreatment Reporting and Economic Conditions in Colorado

	Mean (N=3,328)	Std. Dev.	2019 Average (N=256)	2020 Average (N=256)	p-value
<i>Child Maltreatment Variables (per 1,000 children)</i>					
Total Referrals	18.03	9.66	24.66	20.16	0.00
Screened-in	7.97	5.00	7.83	7.03	0.05
Screened-out	10.06	7.21	16.83	13.14	0.00
Total Allegations of Maltreatment	12.81	9.23	12.53	11.70	0.27
Substantiated	3.12	3.46	2.61	2.57	0.86
Unsubstantiated	9.69	7.34	9.92	9.14	0.21
Neglect Allegations	8.45	6.73	8.72	7.80	0.09
Physical Abuse Allegations	2.37	2.04	2.20	2.08	0.48
Sexual Abuse Allegations	0.90	1.12	0.79	0.87	0.33
Substantiated Neglect	2.26	2.73	1.97	1.83	0.51
Substantiated Physical Abuse	0.36	0.67	0.25	0.25	0.85
Substantiated Sexual Abuse	0.23	0.58	0.19	0.26	0.19
<i>Economic Conditions</i>					
Unemployment Rate	5.46	2.82	2.86	6.41	0.00
Employment to Population Ratio	50.55	9.67	53.68	48.95	0.00
Child Population (0 to 17)	19471	39899	19680	19665	1.00

Notes: This table provides summary statistics for child maltreatment reporting and economic conditions across all counties in Colorado from 2008 to 2020. The mean and standard deviation are given for all 3,328 observations (13 years x 4 quarters x 64 counties) in columns 1 and 2. The 2019 and 2020 averages and corresponding p-value from a t-test are provided in columns 3-5. All averages for the child maltreatment variables are provided as rates, per 1,000 children, so the average of 18.03 means that in a typical quarter a county received 18.03 referrals, per 1,000 children.

Table 3: Timeline of Events and Independent Variable Values

Event	Dates	Independent Variable Values
COVID-19 National Emergency	March 13, 2020 – March 2021 ²¹	$covid_{qy} = \begin{cases} 0 & \text{if } y < 2020 \\ \frac{0.5}{3} & \text{if } y = 2020 \cap q = 1 \\ 1 & \text{if } y = 2020 \cap q > 1 \end{cases}$
School Closures in Colorado	March 16, 2020 – August 24, 2020 ²²	$schclo_{qy} = \begin{cases} \frac{0.5}{3} & \text{if } y = 2020 \cap q = 1 \\ \frac{2}{3} & \text{if } y = 2020 \cap q = 2 \\ \frac{0.5}{3} & \text{if } y = 2020 \cap q = 3 \\ 0 & \text{otherwise} \end{cases}$
Stay-at-home Order in Colorado	March 26, 2020 – April 26, 2020 ²³	$sah_{qy} = \begin{cases} \frac{1}{3} & \text{if } y = 2020 \cap q = 2 \\ 0 & \text{otherwise} \end{cases}$

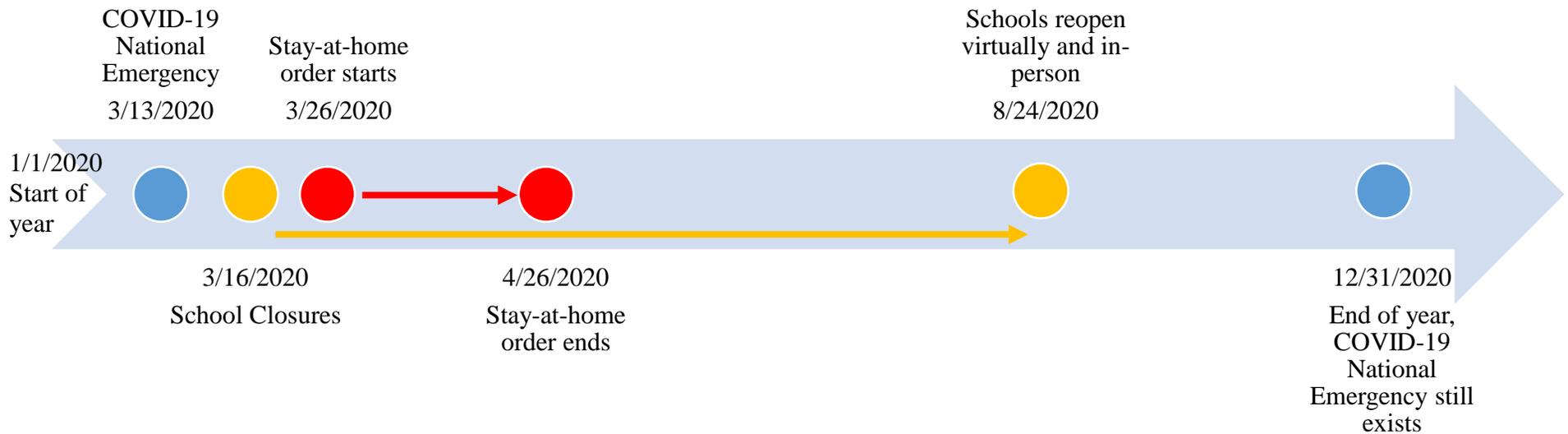
This table lists the dates of the COVID-19 national emergency, stay-at-home order, and school closures in Colorado. Using these dates, the independent variables are defined. The variable y indicates the year, and the variable q indicates the quarter. The independent variable is rounded to the nearest half month, out of 3 months. For example, the COVID-19 pandemic was announced as a national emergency March 13th, so about 0.5 months out of 3 were impacted by the pandemic. The national emergency existed for the rest of 2020, so for the remaining three quarters, three out of three months were impacted, which equals one. The stay-at-home order primarily took place in April, so in 2020 for quarter 2, sah equals one-third and zero otherwise. Lastly, school closure is defined based on the month impacted by the pandemic. For example, quarter two consists of April, May, and June, and in June, schools would have been closed regardless of the pandemic, so $schclo$ is two-thirds, and not three-thirds (i.e. one).

²¹ See The White House notice on the continuation of the National Emergency found [here](#).

²² Between the following two sources, <https://co.chalkbeat.org/2020/3/12/21178764/the-complete-list-of-coronavirus-related-colorado-school-closures> and <https://www.denverpost.com/2020/07/01/colorado-schools-reopening-coronavirus-covid/>, most school districts in Colorado closed on March 16, 2020 and most districts delayed opening in the fall by a few weeks, resulting in opening dates between August 24 and September 1. In-person and virtual learning varied by district, but since Colorado counties and school districts do not align, the school closure variable is the same for all counties, regardless of instructional mode and based on the date that impacts most of the state. As a robustness check, I allow the opening dates to vary for a few counties that are clearly defined, such as those in the Denver metro-area, but the results are similar.

²³ See <https://www.westword.com/news/covid-19-colorado-stay-at-home-order-shorter-than-most-in-america-11682795> for a list of state closing and opening dates. Some jurisdictions, like Denver, extended their stay-at-home order, and Colorado issued a “safer-at-home” order following the stay-at-home order. See <https://www.kktv.com/content/news/Gov-Polis-issues-Executive-Order-on-Safer-at-Home-569966341.html> for more details. These variations are not accounted for in this analysis.

Figure 2: Timeline of Events in 2020



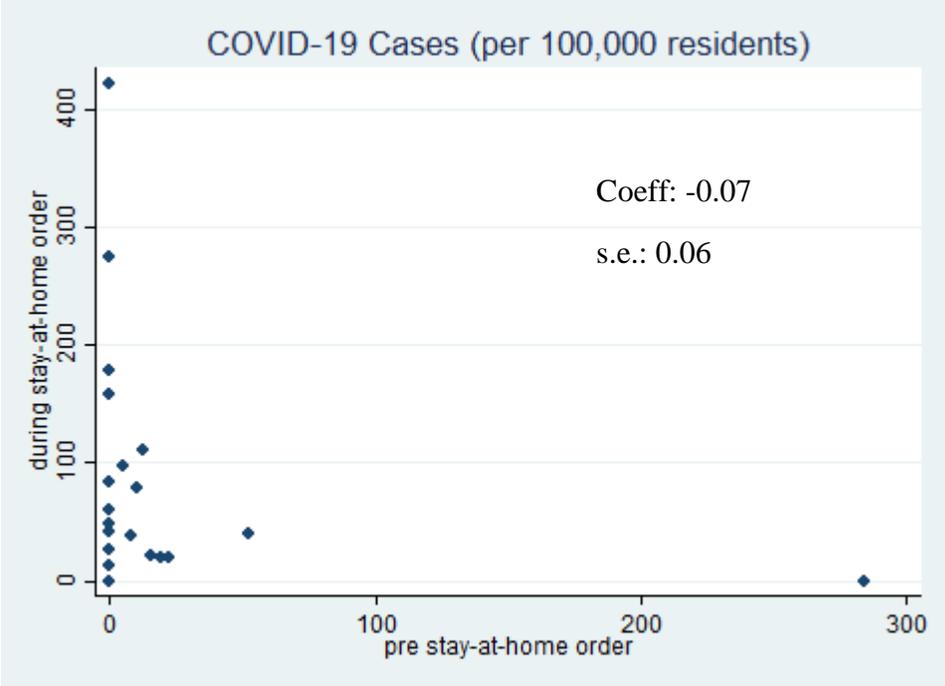
This figure plots the timeline of events during 2020 in Colorado. The COVID-19 National Emergency was announced on March 13, 2020 and continued through the year. Schools closed on March 16 and the stay-at-home order began March 26. The stay-at-home order ended a month later, and schools reopened for in-person and virtual learning at the end of August. The red arrow shows when the stay-at-home order happened, the yellow arrow shows when schools were closed for in-person learning, and the blue arrow shows when the pandemic existed. All three events happened concurrently from March 26 to April 26, and two of the events happened concurrently from April 26 to August 24. After August 24, only the COVID-19 national emergency was happening.

Table 4: Summary Statistics of Child Maltreatment Reporting by COVID-19 Cases

	2019			2020			Unconditional DD Estimate (4-2-(3-1))
	(1) Non- COVID-19 Counties	(2) COVID-19 Counties	p-value	(3) Non- COVID-19 Counties	(4) COVID-19 Counties	p-value	
<i>Child Maltreatment Variables (per 1,000 children)</i>							
Total Referrals	24.83	23.62	0.17	20.23	19.77	0.61	0.76
Screened-in	7.81	7.96	0.71	7.03	6.99	0.90	-0.20
Substantiated Reports	2.66	2.34	0.31	2.62	2.24	0.25	-0.06
Neglect Allegations	8.73	8.62	0.84	7.76	8.05	0.57	0.40
Physical Abuse Allegations	2.22	2.06	0.36	2.13	1.72	0.02	-0.26
Sexual Abuse Allegations	0.78	0.80	0.79	0.89	0.78	0.26	-0.13
<i>Economic Conditions</i>							
Unemployment Rate	2.89	2.64	0.02	6.33	6.93	0.24	0.85
Employment to Population Ratio	53.75	53.24	0.62	48.79	49.97	0.26	1.70
Child Population	6009	103223	0.00	5988	103247	0.00	45.36
<i>COVID-19 Cases (per 100,000 residents)</i>							
pre stay-at-home order				0.00	47.61	0.15	
during stay-at-home order				23.75	47.04	0.17	
post stay-at-home order				59.23	26.84	0.31	
Number of Counties	55	9		55	9		

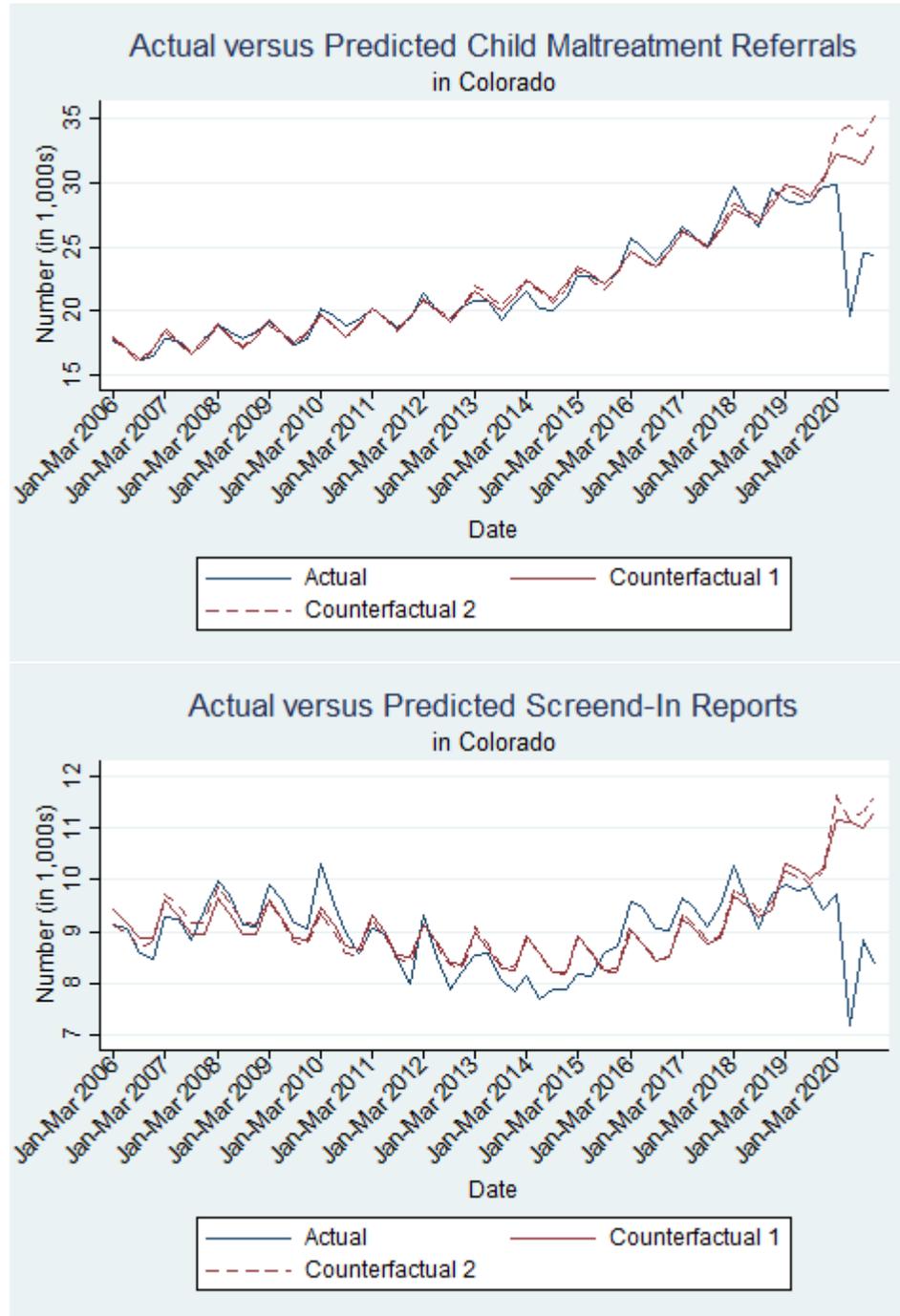
Notes: This table reports the average child maltreatment referral, screened-in, and substantiated report rate, and economic conditions across all counties and quarters in 2019 and 2020 based on the counties' COVID-19 caseload. Nine counties ("treated") reported COVID-19 cases prior to the stay-at-home order, whereas 55 counties ("control") reported no cases prior to the stay-at-home order. The p-value for t-tests between the COVID-19 and non-COVID-19 counties are reported for each year, and a crude DD is provided.

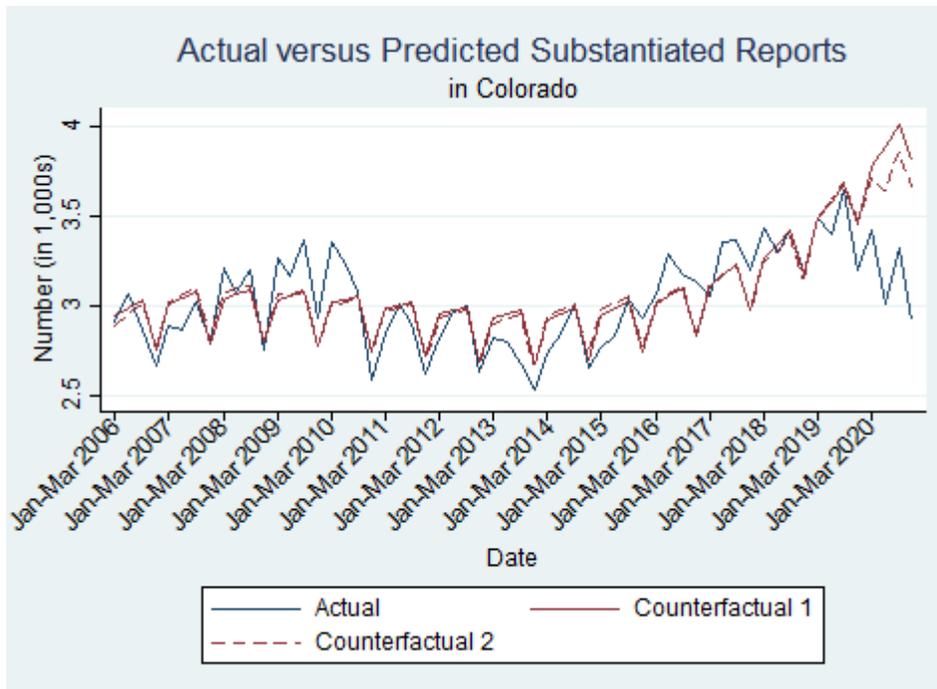
Figure 3: Relationship between COVID-19 Cases Before and During the Stay-at-home Order



Notes: This figure plots the number of COVID-19 cases (per 100,000 residents) before the stay-at-home order against the number of cases during the month of the stay-at-home order. The negative regression adjusted coefficient (-0.07) suggests places with higher pre-stay-at-home order COVID-19 cases might have been more compliant to the stay-at-home order.

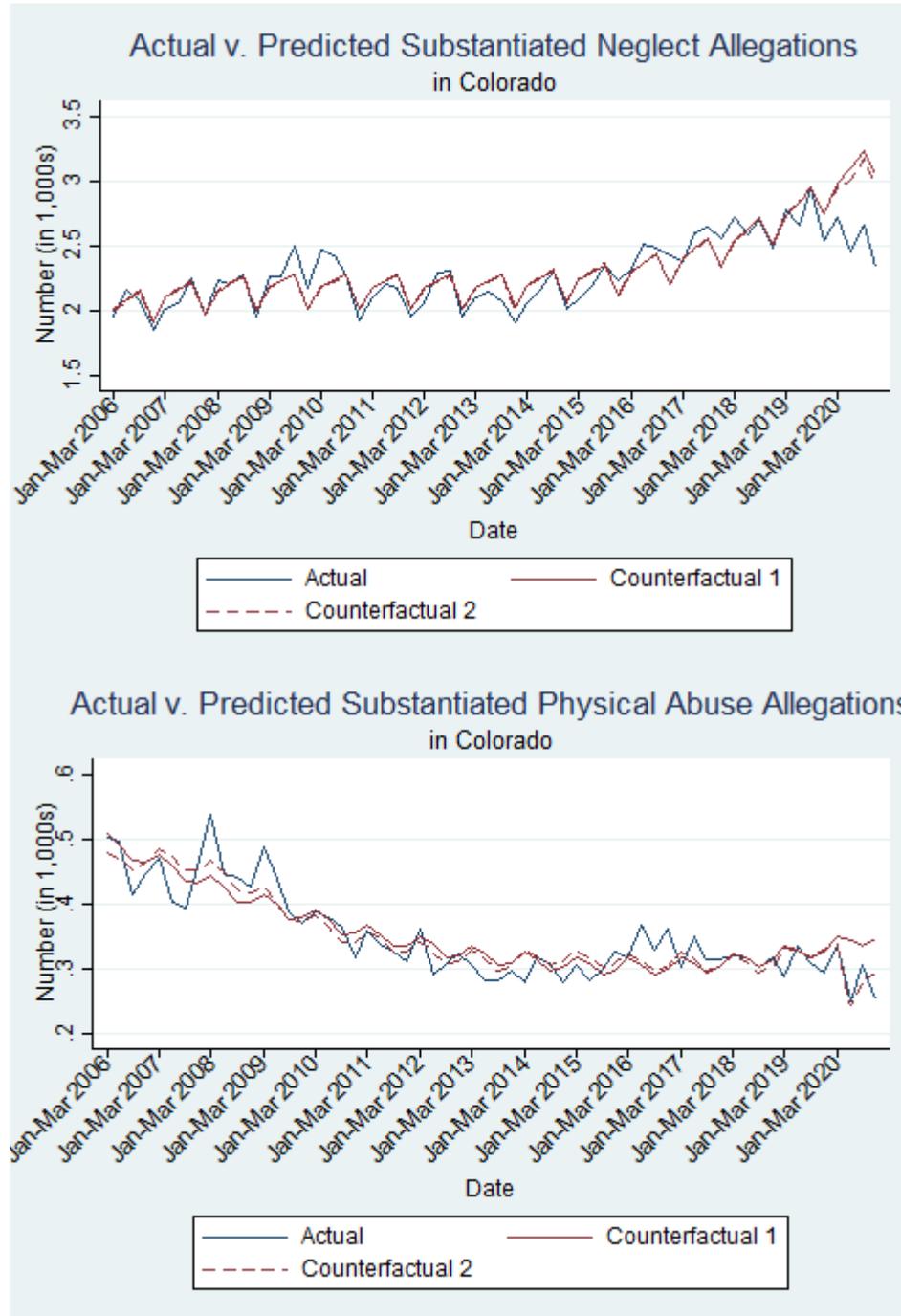
Figure 4: Actual versus Predicted Child Maltreatment Referrals and Reports in Colorado from 2006 to 2020

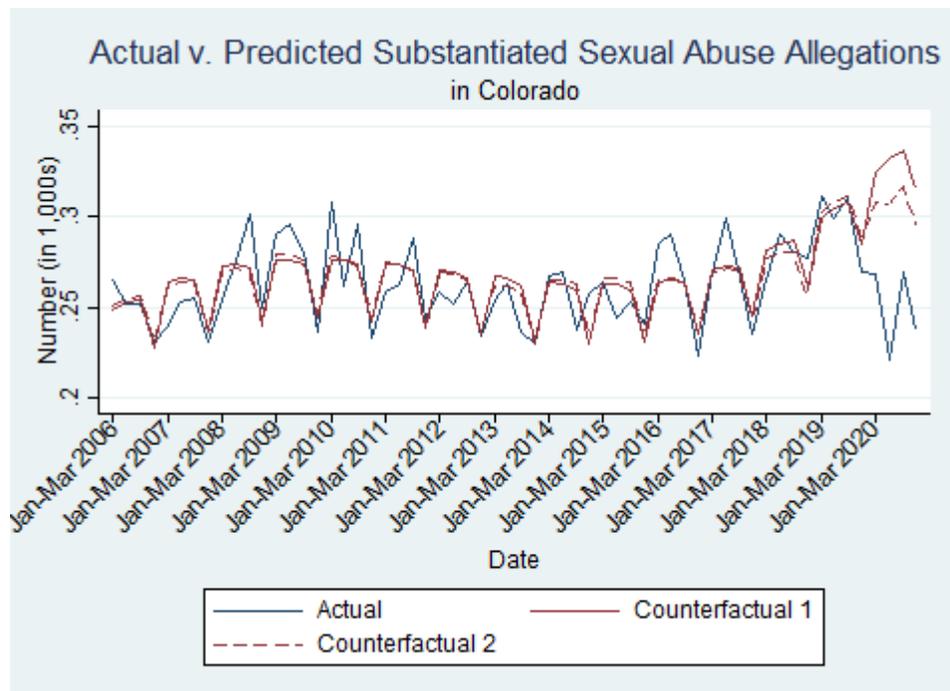




Notes: These figures plot the actual versus predicted counts of child maltreatment referrals (top graph), screened-in reports (middle graph), and substantiated reports (bottom graph). Two counterfactuals are estimated: counterfactual one assumes child maltreatment would have been the same in 2020 as 2019 had the pandemic not occurred, and counterfactual two accounts for changes in maltreatment as a result of changes in the unemployment rate and alcohol purchases.

Figure 5: Actual versus Predicted Substantiated Allegations by Child Maltreatment Type in Colorado from 2006 to 2020





Notes: These figures plot the actual versus predicted counts of substantiated neglect (top graph), physical abuse (middle graph), and sexual abuse (bottom graph) allegations. Two counterfactuals are estimated: counterfactual one assumes child maltreatment would have been the same in 2020 as 2019 had the pandemic not occurred, and counterfactual two accounts for changes in maltreatment as a result of changes in the unemployment rate and alcohol purchases.

Table 5: Estimated Impacts of COVID-19 Pandemic, School Closures, and Stay-at-home Order on Child Maltreatment Reporting in Colorado

	<u>Main Outcomes</u>			<u>Type of Maltreatment</u>		
	Total Referrals (per 1,000 children)	Reports Screened-in (per 1,000 children)	Substantiated Reports (per 1,000 children)	Neglect Allegations (per 1,000 children)	Physical Abuse Allegations (per 1,000 children)	Sexual Abuse Allegations (per 1,000 children)
Ind. Var.: COVID-19	-2.541* (1.415)	-0.079 (0.710)	-0.876 (0.715)	-0.445 (1.078)	-0.084 (0.279)	0.251 (0.178)
Ind. Var.: School Closure	-7.874*** (1.829)	-1.838** (0.846)	0.615 (0.966)	-0.961 (1.239)	-0.229 (0.512)	0.115 (0.350)
Ind. Var.: Stay-at-home Order	-14.787*** (3.070)	-3.273** (1.479)	0.628 (1.764)	-2.430 (2.260)	-0.638 (0.909)	0.265 (0.625)
2019 Average	24.66	7.83	2.61	8.72	2.2	0.79
Observations	3,328	3,328	3,328	3,328	3,328	3,328

Notes: *** p<0.01, ** p<0.05, * p<0.1. Robust standard errors, clustered at the county-by-quarter level, in parentheses. Each column indicates an outcome of interest, provided as a rate per 1,000 children. Each row represents a separate regression analysis, so row 1 reports the coefficient from equation 2 where *covid* is the independent variable of interest. Row 2 reports the coefficient from equation 3 where *schclo* is the independent variable of interest, and row 3 reports the coefficient from equation 4 where *sah* is the independent variable of interest. Each regression includes year, county, and quarter fixed effects.

Table 6: Estimated Impact of Stay-at-home Order Interacted with COVID-19 Cases on Child Maltreatment Reporting

	<u>Main Outcomes</u>			<u>Type of Maltreatment</u>		
	Total Referrals (per 1,000 children)	Reports Screened-in (per 1,000 children)	Substantiated Reports (per 1,000 children)	Neglect Allegations (per 1,000 children)	Physical Abuse Allegations (per 1,000 children)	Sexual Abuse Allegations (per 1,000 children)
Stay-at-home	-15.413*** (3.104)	-3.607** (1.491)	0.664 (1.812)	-2.879 (2.293)	-0.619 (0.935)	0.220 (0.642)
COVID-19 Cases	0.024 (0.077)	-0.123*** (0.030)	0.045*** (0.015)	-0.030 (0.051)	-0.037 (0.023)	-0.014 (0.012)
Stay-at-home x COVID-19 Cases	0.094*** (0.015)	0.050*** (0.006)	-0.005 (0.008)	0.067*** (0.011)	-0.003 (0.005)	0.007** (0.003)
Observations	3,328	3,328	3,328	3,328	3,328	3,328

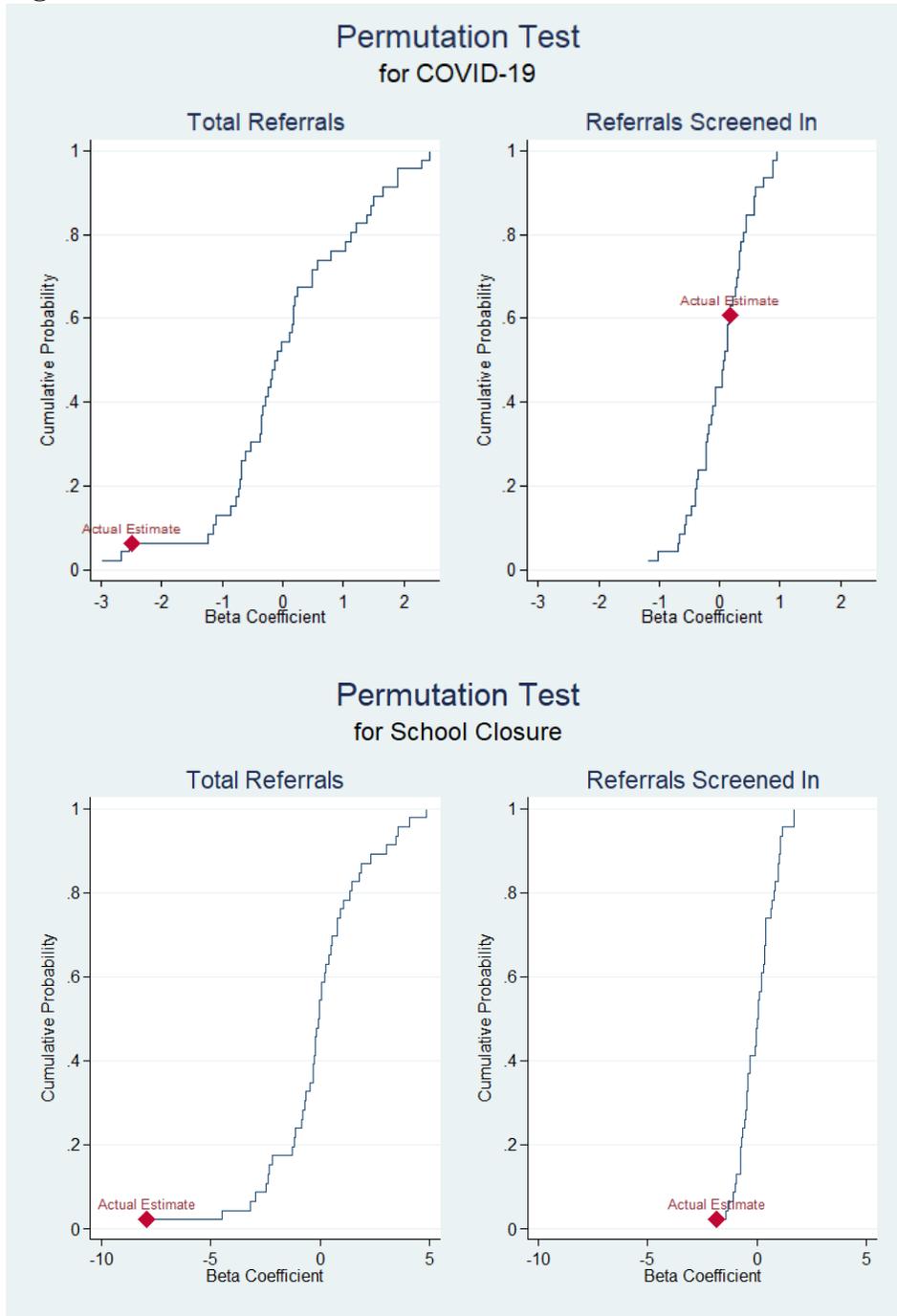
Notes: *** p<0.01, ** p<0.05, * p<0.1. Robust standard errors, clustered at the county-by-quarter level, in parentheses. Each column indicates an outcome of interest, provided as a rate per 1,000 children. Row 1 reports the coefficient on the stay-at-home order, row 2 reports the coefficient on the number of pre-stay-at-home order COVID-19 cases, and row 3 reports the coefficient on the interaction term between the stay-at-home order and pre-stay-at-home COVID-19 cases. Each regression includes year, county, and quarter fixed effects.

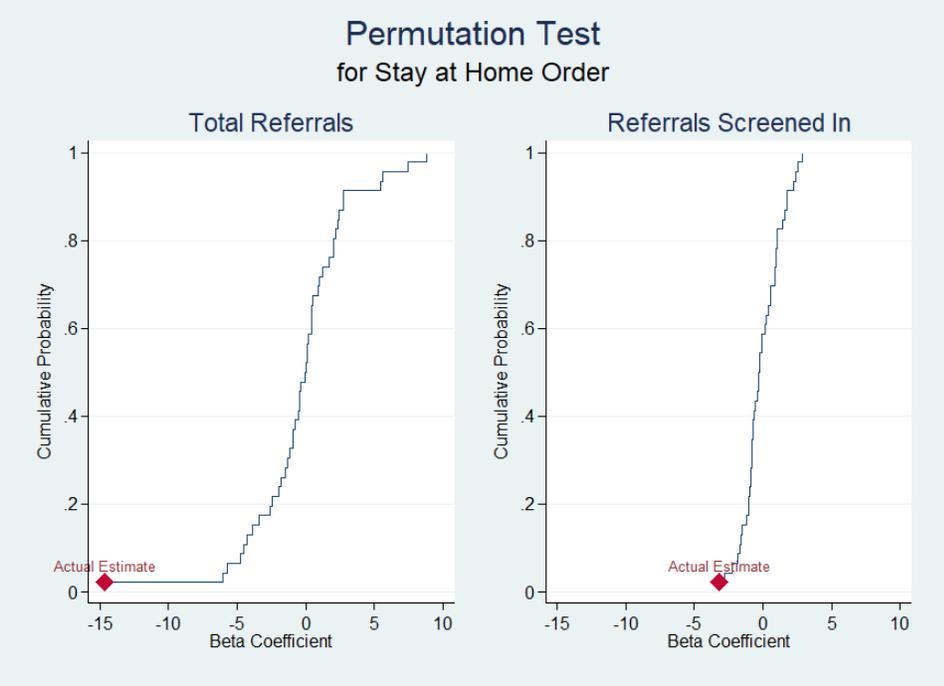
Table 7: Robustness Analyses for Child Maltreatment Referrals

		(1)	(2)	(3)	(4)
		Main Results	Post 2010	Exclude Denver Metro-area	Include Economic Controls
Panel A: Rate (per 1,000 children)	COVID-19	-2.541* (1.415)	-2.514* (1.418)	-1.868 (1.632)	-1.053 (1.547)
	School Closure	-7.874*** (1.829)	-7.358*** (1.799)	-7.684*** (2.107)	-6.402*** (1.917)
	Stay-at-home	-14.787*** (3.070)	-14.019*** (3.056)	-14.396*** (3.538)	-12.415*** (3.274)
Panel B: Log	COVID-19	-0.133* (0.074)	-0.131* (0.072)	-0.096 (0.085)	-0.056 (0.080)
	School Closure	-0.420*** (0.114)	-0.392*** (0.111)	-0.397*** (0.131)	-0.353*** (0.120)
	Stay-at-home	-0.780*** (0.192)	-0.744*** (0.188)	-0.733*** (0.221)	-0.681*** (0.206)
Panel C: Levels	COVID-19	-110.255*** (34.192)	-110.765*** (29.319)	-42.456* (24.229)	-73.236** (32.786)
	School Closure	-146.414*** (32.469)	-141.809*** (36.791)	-72.856*** (25.657)	-89.796*** (28.643)
	Stay-at-home	-301.492*** (61.579)	-295.858*** (67.786)	-148.273*** (48.256)	-201.033*** (53.836)
	Observations	3,328	2,560	2,860	3,328

Notes: *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$. Robust standard errors, clustered at the county-by-quarter level, in parentheses. Each column indicates a separate regression analysis. The first column provides the main results. The second column is post-2010. The third column excludes the Denver metro-area, and the fourth column includes controls for economic conditions (i.e. the unemployment rate and employment-to-population ratio). Each row represents a separate regression analysis for the three independent variables of interest, so row 1 reports the coefficient from equation 2 where *covid* is the independent variable of interest. Row 2 reports the coefficient from equation 3 where *schclo* is the independent variable of interest, and row 3 reports the coefficient from equation 4 where *sah* is the independent variable of interest. There are 3 separate panels as well. Panel one reports the effect on the total referral rate, per 1,000 children. The second panel reports the effect on the log total referrals, and the third panel reports the effect on the total referrals (level). Each regression includes year, county, and quarter fixed effects.

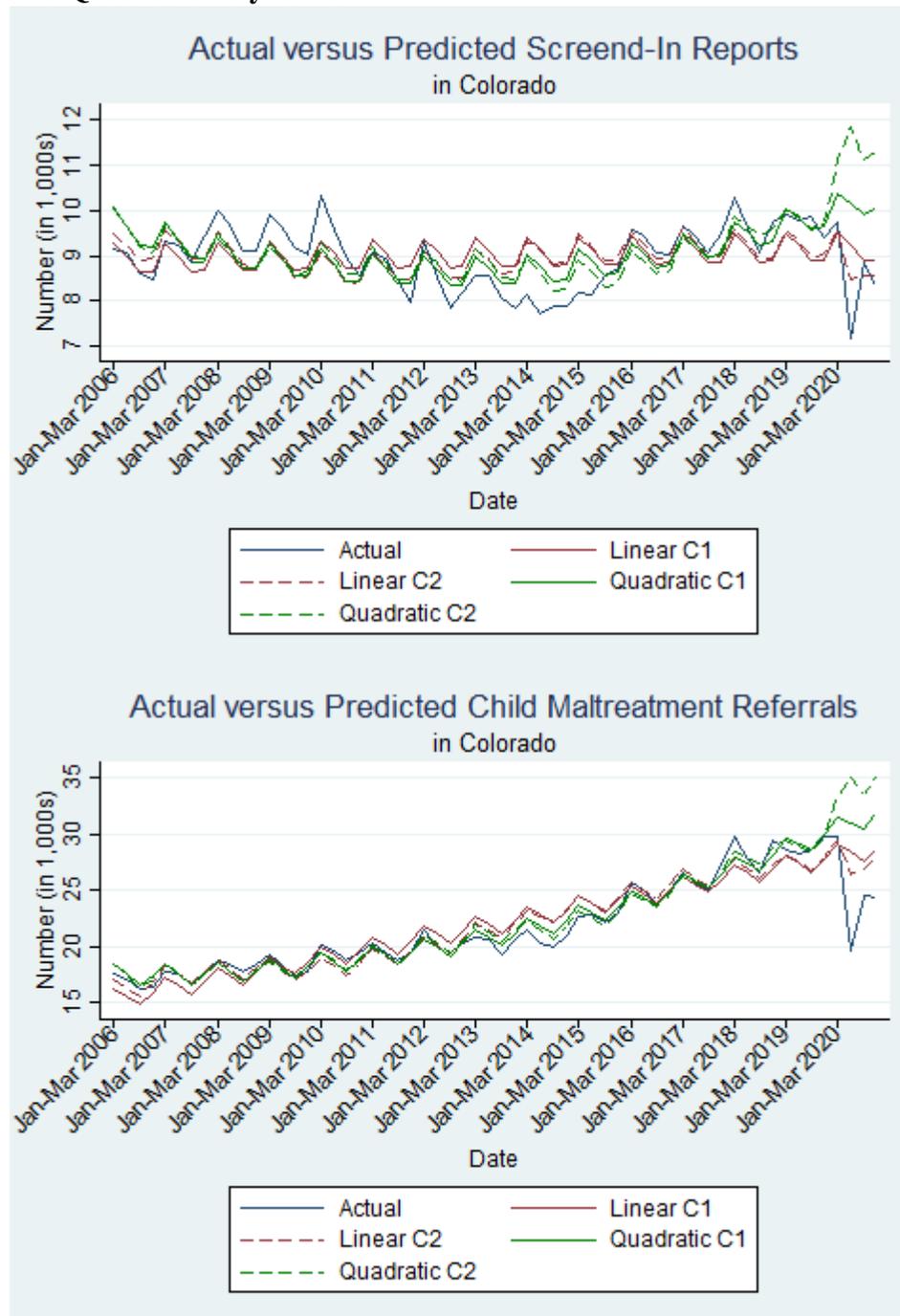
Figure 6: Cumulative Distribution Function of Estimates from Permutation Tests





Notes: These figures plot the cumulative distribution function of the beta coefficient for the 48 placebo and one actual estimate. The top graph plots the coefficients on *covid* from equation 2, the middle graph plots the coefficients on *schclo* from equation 3, and the bottom graph plots the coefficient on *sah* from equation 4. The left-hand graphs plot the coefficient for the total referral rate (per 1,000 children) and the right-hand graphs plot the coefficient for the screened-in report rate.

Appendix Figure 1: Actual versus Predicted Child Maltreatment Reporting using Linear and Quadratic Polynomial



Notes: This figure plots the counterfactual estimates from equation 1 using a linear and quadratic polynomial, as opposed to the preferred cubic specification. The linear model is less predictive than the quadratic, and the quadratic model is similar to the cubic model.

Appendix Table 1: Robustness Analyses for Screened-in Reports

		(1)	(2)	(3)	(4)
		Main Results	Post 2010	Exclude Denver Metro-area	Include Economic Controls
Panel A: Rate (per 1,000 children)	COVID-19	-0.079 (0.710)	-0.079 (0.708)	-0.024 (0.801)	0.118 (0.795)
	School Closure	-1.838** (0.846)	-1.814** (0.831)	-1.711* (0.966)	-1.883* (0.961)
	Stay-at-home	-3.273** (1.479)	-3.291** (1.466)	-3.146* (1.681)	-3.514** (1.759)
Panel B: Log	COVID-19	-0.004 (0.095)	0.003 (0.094)	0.012 (0.106)	0.031 (0.104)
	School Closure	-0.201* (0.121)	-0.195* (0.117)	-0.152 (0.137)	-0.176 (0.134)
	Stay-at-home	-0.382* (0.211)	-0.375* (0.205)	-0.309 (0.238)	-0.347 (0.242)
Panel C: Levels	COVID-19	-19.531* (11.504)	-21.527* (11.230)	-8.392 (9.196)	-15.955 (11.007)
	School Closure	-45.600*** (16.603)	-43.433*** (15.174)	-21.899** (10.072)	-41.476** (16.030)
	Stay-at-home	-89.454*** (29.659)	-86.960*** (27.306)	-44.373** (18.952)	-84.199*** (28.668)
	Observations	3,328	2,560	2,860	3,328

Notes: *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$. Robust standard errors, clustered at the county-by-quarter level, in parentheses. Each column indicates a separate regression analysis. The first column provides the main results. The second column is post-2010. The third column excludes the Denver metro-area, and the fourth column includes controls for economic conditions (i.e. the unemployment rate and employment-to-population ratio). Each row represents a separate regression analysis for the three independent variables of interest, so row 1 reports the coefficient from equation 2 where *covid* is the independent variable of interest. Row 2 reports the coefficient from equation 3 where *schclo* is the independent variable of interest, and row 3 reports the coefficient from equation 4 where *sah* is the independent variable of interest. There are 3 separate panels as well. Panel one reports the effect on the screened-in report rate, per 1,000 children. The second panel reports the effect on the log screened-in reports, and the third panel reports the effect on the total screened-in reports (level). Each regression includes year, county, and quarter fixed effects.

Appendix Table 2: Robustness Analyses for Substantiated Reports

		(1)	(2)	(3)	(4)
		Main Results	Post 2010	Exclude Denver Metro-area	Include Economic Controls
Panel A: Rate (per 1,000 children)	COVID-19	-0.876 (0.715)	-0.947 (0.701)	-1.077 (0.817)	-0.855 (0.749)
	School Closure	0.615 (0.966)	0.412 (0.961)	0.870 (1.106)	0.933 (1.150)
	Stay-at-home	0.628 (1.764)	0.227 (1.748)	0.939 (2.028)	1.236 (2.166)
	COVID-19	-0.046 (0.154)	-0.063 (0.146)	-0.079 (0.171)	-0.016 (0.161)
Panel B: Log	School Closure	0.206 (0.201)	0.179 (0.191)	0.281 (0.225)	0.300 (0.227)
	Stay-at-home	0.315 (0.356)	0.261 (0.338)	0.428 (0.401)	0.516 (0.416)
	COVID-19	-5.794 (8.598)	-7.053 (7.548)	-5.118 (7.281)	-5.196 (8.558)
Panel C: Levels	School Closure	-5.966 (8.473)	-5.429 (6.771)	0.329 (6.232)	-3.918 (8.431)
	Stay-at-home	-13.249 (15.645)	-13.255 (12.636)	-1.623 (12.047)	-9.381 (15.559)
	Observations	3,328	2,560	2,860	3,328

Notes: *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$. Robust standard errors, clustered at the county-by-quarter level, in parentheses. Each column indicates a separate regression analysis. The first column provides the main results. The second column is post-2010. The third column excludes the Denver metro-area, and the fourth column includes controls for economic conditions (i.e. the unemployment rate and employment-to-population ratio). Each row represents a separate regression analysis for the three independent variables of interest, so row 1 reports the coefficient from equation 2 where *covid* is the independent variable of interest. Row 2 reports the coefficient from equation 3 where *schclo* is the independent variable of interest, and row 3 reports the coefficient from equation 4 where *sah* is the independent variable of interest. There are 3 separate panels as well. Panel one reports the effect on the substantiated report rate, per 1,000 children. The second panel reports the effect on the log substantiated reports, and the third panel reports the effect on the total substantiated reports (level). Each regression includes year, county, and quarter fixed effects.