Underreporting Child Maltreatment during the Pandemic: Evidence from Colorado

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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 reports during 2020 and 2021 in Colorado and predicts counterfactual estimates using two strategies. One strategy assumes the underlying behavior for child maltreatment was unchanged from 2019 to 2020 and 2021, while the second strategy assumes the economic distress and protective factors brought about by the pandemic altered the underlying prevalence of child maltreatment. Surprisingly, these two approaches yield similar results; about 60,000 referrals went unreported in 2020 and 2021 because of the pandemic. 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 child maltreatment, and underscore the role mandatory reporters play in detecting child maltreatment.

Keywords: child maltreatment, COVID-19, underreporting, Colorado, stay-at-home order

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" (Callahan & Mink, 2020; Quander, 2020). 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" (WCTV, 2020). In Colorado, I find that reporting decreased by 15 percent in 2020 relative to 2019. The biggest drop in reporting, of 31 percent, occurred between April and June, and reporting remained 14 to 18 percent below 2019 levels for the remainder of the year.

Child maltreatment research has shown that overall fewer allegations of maltreatment were reported than expected in March and April of 2020 (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., 2021). 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 were going unnoticed. Baron et al. (2020) use real-time data from Florida to 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.

In this paper, I use real-time data from Colorado to provide an updated national estimate on the number of unreported allegations and victims for the entire pandemic year (2020) and the following year (2021). I find that millions of allegations may have gone unreported, potentially impacting over 400,000 victims across the country. 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. Unsurprisingly, all three events concurrently resulted in the largest decline in reporting.

As the COVID-19 pandemic wanes, 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 update

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[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" (Desjardins, 2020).

the number of calls that would have been made to the Child Protective Services' (CPS) hotline in 2020 and 2021 had the pandemic 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 and 2021 as previous years. However, 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 alcohol abuse.[2] In addition, the pandemic may have increased *protective* factors. Lindo et al. (2018) find that stay-at-home mothers are a protective factor, and Sege and Stephens (2021) explain child abuse and neglect did not increase during the pandemic, in part due to enhanced unemployment insurance and other assistance. A second counterfactual is estimated taking into account risk and protective factors, specifically the rise in unemployment, alcohol consumption, industry-specific employment rates, and unemployment insurance claims. 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, coping mechanisms, and protective factors brought about by the pandemic contribute to child maltreatment.

As a second contribution, this paper uses the timing differences between the COVID-19 state emergency, school closures, and stay-at-home order to determine the impact that each of these events had on the decline in child maltreatment reporting for the full year and beyond. Prior research has looked at either school closures or stay-at-home orders in isolation and only examined the effect from the onset of the pandemic in March to May (e.g. Baron et al., 2020; Bullinger et al., 2021). This is the first study to provide the impacts of all three events for the full year of 2020 and beyond in 2021. 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. Moreover, there is suggestive evidence that compliance to the stay-at-home order impacts underreporting. Interestingly, child maltreatment reporting did not rebound in

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[2] Brown & De Cao (2020) find that unemployment is positively correlated with child maltreatment, Griffith (2020) explains how limited availability of social supports and childcare 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 (WHO, nd).

2021 after the state of emergency ended. This finding suggests that people altered their behaviors, i.e. increased working from home, in ways that impact child maltreatment reporting.

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 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 and 2021. In addition, I use economic and seasonal trends to predict the type of maltreatment that might have gone 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 underreported.

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 virus 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 to state agencies plummeted (Schmidt & Natanson, 2020), raising concerns that abuse and neglect are going unreported (MacFarlane et al., 2020).[3] Research suggests that these drops in reporting came from the pandemic-induced school closures which limited interactions with mandatory reports (Baron et al., 2020, Cabrera-Hernández & Padilla-Romo, 2020). As the pandemic persisted through 2020 and the following year, people adjusted their behaviors. The most notable adaptations include working from home and avoiding crowded places (Salon et al., 2021).

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[3] Alternatively, Ortiz et al. (2021) find that the volume of text messages to Childhelp, the only national hotline providing counseling services with a focus on child abuse and neglect, increased in 2020 compared to 2019.

Colorado is no exception to the situation described above. The state of emergency began March 11, 2020 and ended July 8, 2021. 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). These acceptable activities may have protected against severe abuse, despite the health crisis and dire economic situation. The unemployment rate fluctuated from 6.8 to 11 between April to December and alcohol sales increased by 6 percent.[4]

Figure 1 shows the number of child maltreatment referrals received and screened-in for investigation from 2006 through 2021 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 total referrals and reports screened-in[5] dropped by 31 and 26 percent, respectively, relative to the same period in 2019. In the remaining months of the year and the following year, child maltreatment reporting rebounded somewhat, but referrals and reports screened-in still remained below pre-pandemic levels. Panel B of Figure 1 shows the number of allegations reported by maltreatment type, indicating the largest 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 pandemic increased risk factors, like economic hardship and adverse coping strategies. However, for some families, the pandemic also increased protective factors, like fewer financial burdens via

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[4] 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.

[5] Total referrals include both the calls to the hotline that are screened out and in. Referrals that are screened-in are also referred to as reports. There is no additional follow-up for referrals that are screened-out, but reports are investigated for child maltreatment.

unemployment insurance and more stay-at-home mothers. Additionally, school closures, the stay-at-home order, and behavioral responses to reduce COVID-19 exposure limited interactions with mandatory reporters. These differing forces pose a unique challenge for child welfare agencies to detect child maltreatment and may attenuate the impact of the pandemic on child maltreatment reporting towards zero, while masking the underlying incidence of maltreatment.

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 reporting decline experienced between April and June. While the stay-at-home order limited interactions, it also may have increased household stress and parental burnout, potentially more so for those who complied. Parental burnout can manifest into neglect (Mikolajczak et al., 2019). As a result, we expect to see differential effects in child maltreatment for counties with different levels of compliance to the stay-at-home order.

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 counties 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 (i.e. neglect, physical abuse, or sexual abuse) and the finding of the allegation. These data are used to test the hypothesis that some 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; Rapoport et al., 2020), and research in Indiana found an increase in neglect, not physical abuse (Bullinger et al., 2021).

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 rate 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.

I use multiple sources of data to control for some risk and protective factors of child maltreatment. 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 2021, and the Census provides the county population size, annually from 2008 to 2021. 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,[6] to proxy for alcohol consumption at the state-level. Finally, I obtain unemployment insurance claims data from the US Department of Labor, Employment and Training Administration. The unemployment rate, alcohol sales, industry-specific employment rates, and insured unemployment rate are used to create a second counterfactual of child maltreatment that accounts for economic hardships, a potential coping strategy, and protective factors, like financial assistance. While these additional sources of data do not control for all potential confounders, risk, and protective factors, they enrich analyses that solely rely on seasonal and longitudinal trends.

Figure 1 plots the statewide trends in child maltreatment reporting for each quarter between 2006 and 2021 in Colorado. Overall, child maltreatment reporting declined by 15 percent in 2020, relative to 2019, with the biggest decline of 31 percent occurring between April and June. In 2021, child maltreatment reporting was 5 percent lower than 2019, with underreporting being spread equal across the quarters. Figure 2 plots economic conditions and alcohol sales from 2006 to 2021 in Colorado. The unemployment rate (Panel A) rose to 11.5 percent in April 2020, remained around 6 percent for the rest of 2020, and then fell to 4.3 percent by the end of 2021. The insured

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[6] These data can be found here.

unemployment rate rose to 8 percent in 2020, meaning almost 70 percent of the unemployed were receiving financial assistance. Meanwhile, alcohol purchases (Panel B) increased 6 percent between 2019 and 2020 and stayed elevated in 2021. Finally, the employment ratio (Panel C) dropped to 59 percent in April 2020 and then rebounded. Two industry-specific ratios, construction and education/health are included to proxy male and female employment, respectively. Lindo et al. (2018) find that a higher male employment rate and lower female employment rate are protective factors. Compared to April 2019, education/health employment dropped twice as much as construction employment in April 2020 (8 percent decline versus 4 percent). Appendix Table 1 provides summary statistics of child maltreatment reporting and economic conditions for all 64 counties over the 4 quarters and 14 years. The average number of referrals received in a county during a given quarter between the years 2008 and 2021 is 18, per 1,000 children. I also provide the 2019, 2020, and 2021 averages and a p-value indicating if 2020 or 2021 are statistically different from 2019. While child maltreatment reporting was lower in both 2020 and 2021, relative to 2019, neglect allegations and victims were lower in 2021, but not in 2020, relative to 2019.

The remaining data come from multiple sources and are used to supplement the main analyses. To proxy stay-at-home order compliance, I use county-level presidential election data from 2016 provided by Politico. Allcott et al. (2020) provide evidence that Republicans engaged in less social distancing. I use the Google COVID-19 Community Mobility Reports and Colorado's Outbreak Data to show that Republicans appear to be less compliant to the stay-at-home order. The Google COVID-19 Community Mobility Reports provide the percent change in mobility at the county level on a weekly basis starting in March of 2020 and is relative to mobility trends in January or February of 2020. These data are obtained from tracking movement across places, such as work, home, parks, transit, and shops. However, these data are not always available for less populated counties, so analyses using these data are exploratory, and conclusions are limited to more populated counties. Figure 3, Panel A, shows a persistent decrease in workplace mobility and an increase in staying home in Colorado through 2021. These behaviors might be able to explain why child maltreatment reporting does not rebound to pre-pandemic levels in 2021. Additionally, among the more populated counties in Colorado, Figure 3, Panels B and C, shows that counties with a higher proportion of Republican voters were less likely to be spending more time at home during the stay-at-home order. Colorado's Outbreak Data, maintained by Colorado's Department of Public Health and Environment (CDPHE), provide the county-level number of COVID-19 cases

and deaths on a weekly basis.[7] Figure 4 shows that counties with a higher proportion of Republican voters had more cases of COVID-19 during the stay-at-home order.

4. Empirical Strategy

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:

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

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,[8] $f_g(qy)$ 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.[9] 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 years 2020 and 2021. This approach assumes that the number of maltreatment referrals and reports would have followed a similar trend in 2020 and 2021 as earlier years, had the pandemic not occurred.

The hardships and stresses brought about by the pandemic might have increased child abuse and neglect. Alternatively, the pandemic may have increased protective factors. In attempt to capture the change in maltreatment due to both, risk and protective factors, I estimate equation 1 again controlling for the unemployment rate, alcohol purchases, gender-specific employment rates,[10] and unemployment insurance coverage. This approach assumes the relationship between each of these factors and child maltreatment are similar before and during the pandemic. Estimating two counterfactuals based on seasonal and longitudinal trends is useful as there is no feasible control group since the announcement of the pandemic and subsequent policy responses occurred at similar times for the entire country.

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[7] These data were downloaded March 24, 2021 from https://covid19.colorado.gov/covid19-outbreak-data.
[8] 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.
[9] See Appendix Figure 1 for a comparison of the different approaches that use a linear and quadratic polynomial.
[10] More specifically, construction employment is used as a proxy for male employment, and education/health employment is used as a proxy for female employment.

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:

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

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

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

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 state of emergency in Colorado was announced March 11, 2020 and continued through June 2021 (Raifman et al., 2021), so *covid* is assigned a value of one-sixth in quarter 1 in 2020, one for the remaining quarters in 2020, one for the first two quarters in 2021, and zero for the remaining two quarters in 2021. The state of emergency forced schools to close in March and delayed openings in the fall, so *schclo* equals one-sixth in quarter one, two-thirds in quarter two, and one-sixth in quarter three 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 two of year 2020 and zero otherwise.[11] In all equations, standard errors are clustered at the county by quarter level.[12]

These three effects cannot be estimated together because they are correlated with each other due to the overlap in timing of the events.[13] 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 on child maltreatment reporting. 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 closures, like at the end of 2020 and the first half of 2021. This setup implies $\delta_1 > \alpha_1 > \beta_1$.

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[11] See Table 1 for more details about the dates and how values are defined.
[12] Results are similar when standard errors are clustered at the county level and available upon request.
[13] See Figure 5 for a timeline of the events and how they overlap.

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

$$Y_{cqy} = \delta_0 + \delta_1 sah_{qy} + \delta_2 rep_c + \delta_3 sah_{qy} \, x \, rep_c + \varphi_q + \gamma_y + \rho_c + \varepsilon_{cqy} \qquad (5)$$

Where the majority of the terms are defined above. *rep* measures the proportion of Republican voters in 2016 for county c, so δ_2 estimates the relation between Republican voters and child maltreatment reporting, and δ_3 estimates the interaction effect between the stay-at-home order and Republican voters on child maltreatment. A positive coefficient on δ_3 means the stay-at-home order increased child maltreatment reporting for counties with a higher share of Republican voters, relative to counties with fewer Republican voters.

The validity of this approach to yield causal estimates relies on two assumptions. First, Republican and Democratic counties had similar child maltreatment reporting trends prior to the pandemic. Second, Republican and Democratic counties had different compliance to the stay-at-home order. Figure 6 plots the average child maltreatment reporting rate by political affiliation, supporting the first assumption. Regarding the second assumption, Allcott et al. (2020) provide evidence that Republicans engaged in less social distancing. In addition, I confirm this finding in Colorado by showing that Republican counties had a smaller increase in time at home during the stay-at-home order (Figure 3, Panel C) and a positive relationship between the proportion of Republican voters and COVID-19 cases during the stay-at-home order (Figure 4, Panel B).

5. Results

5.1. Counterfactual number of referrals and reports

Figure 7 shows the predicted versus actual number of referrals from 2006 to 2021. In 2019, there were a total of 115,180 referrals made, 38,950 reports were screened-in, and 13,739 reports were substantiated. In contrast, in 2020, there were a total of 98,176 referrals made, 34,115 reports were screened-in, and 12,830 reports were substantiated. In 2021, there were a total of 109,928 referrals, 35,712 screened-in reports, and 12,218 substantiated reports. 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 risk and protective factors.

Comparing the actual number of referrals to counterfactual 1, an estimated 30,262 referrals went unreported in 2020 and an estimated 29,658 referrals when unreported in 2021. Alternatively, recognizing that the pandemic brought on significant hardships while providing unprecedented

support, it is unclear whether more or less children suffered from maltreatment in 2020 and 2021 relative to 2019. Comparing the actual number of referrals to counterfactual 2, an estimated 30,672 referrals went unreported in 2020 and an estimated 28,365 referrals went unreported in 2021. Surprisingly, accounting for seasonal trends alone (counterfactual 1) seems to be a good proxy of accounting for risk and protective factors (counterfactual 2).

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 7 (Panel B) shows the predicted versus actual number of screened-in reports from 2006 to 2021. Between 10,500 to 16,200 fewer reports were screened-in in 2020 compared to counterfactual estimates. In 2021, 13,800 to 12,300 fewer reports were screened in compared to counterfactual estimates. The proportion of reports that were screened-in in 2020 and 2021 was 35 and 32 percent, respectively. The proportion of reports that should have been screened-in, based on the counterfactual estimates, differ by year and specification. Between 35 to 52 percent of the referrals should have been screened in, indicating the screening process may have been compromised during the pandemic.

Lastly, I compare the actual number of substantiated reports to the predicted number of substantiated reports to determine whether the incidence of child maltreatment changed during the pandemic. Figure 7 (Panel C) shows the predicted versus actual number of substantiated reports from 2006 to 2021; 7,600 to 8,700 substantiated reports were missed during the pandemic in 2020 and 2021.

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 8 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 2 provides the estimated impact of each event on child maltreatment reporting. All else equal, an additional quarter with the COVID-19 pandemic did not have a statistically significant

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effect on child maltreatment reporting. All else equal, an additional quarter with pandemic-induced school closures reduced the number of referrals by 7.4 per 1,000 children (or 30% relative to the average 2019 referral rate in a county) and reports screened-in by 1.8 per 1,000 children (or 23% relative to the average 2019 report rate in a county). Finally, all else equal, an additional quarter with a stay-at-home order reduced the number of referrals by 14 per 1,000 children (or 56% relative to the average 2019 referral rate in a county) and reports screened-in by 3.1 per 1,000 children (or 40% relative to the average 2019 report rate in a county). None of these events had a statistically significant impact on 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 0.34, 2.5, and 4.7 referrals per 1,000 children, respectively. The effect of the stay-at-home order is much larger than the effect of the pandemic and almost twice as large as the effect of the school closings. Finally, rescaling the monthly impact to the total impact in 2020 and 2021 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 4.7, 7.4, and 4.7 referrals per 1,000 children, respectively. With a child population of 1.26 million, approximately 5,900, 9,300, and 5,900 referrals went unreported as a result of the COVID-19 pandemic, school closures, and stay-at-home order, respectively, in Colorado.

Another way to measure the pandemic's impact on child maltreatment is using the Google Mobility data, which considers how people have responded to the pandemic over the past two years. These data are only available in large counties, so this approach is exploratory. Figure 9 displays that there is a negative relationship between total referrals and increased time at home. In other words, more time at home results in fewer referrals, which could be evidence of limited interactions with mandatory reporters or increased protective factors. However, this relationship is entirely driven by county-level differences and not changes in time spent at home for screened-in reports.[14]

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

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[14] Appendix Table 2 reports the estimates from regression analyses when county fixed effects are included.

rate, but had no statistically significant impact on the substantiation rate. Next, I explore whether the type of maltreatment reported changed during the pandemic. Table 2 provides the results from estimating equations 2-4 for the neglect, physical abuse, and sexual abuse referral and substantiation 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-induced 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. Moreover, while there is a negative relationship between time spent at home and each type of maltreatment allegation, the relationship is weaker and insignificant when investigating substantiated maltreatment and controlling for county differences.[15]

5.4. Relationship between stay-at-home order compliance and child maltreatment reporting

Finally, Table 3 provides the estimates from the interaction between the stay-at-home order and Republican voters. All else equal, an additional quarter under the stay-at-home order in counties with more Republican voters is associated with a smaller decline in the number of total referrals by 0.24 per 1,000 children, relative to counties with fewer Republican voters. This interaction analysis also suggests that Republican counties experienced smaller declines, and even increases sometimes, in substantiated cases of neglect and sexual abuse during the stay-at-home order. Comparing the most Republican and most Democratic counties implies Kitt Carson County had more sexual abuse victims than Denver County as a result of the stay-at-home order.

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 4 reports the results for different measures of child maltreatment referrals 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. Panel A shows the change in the rate, per 1,000 children, Panel B uses logged values, and Panel C uses the level values.

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[15] See Figure 9 and Appendix Table 2.

Overall, the impact of the pandemic, school closures, and stay-at-home order on the referral rate (Panel A) and logged number of referrals (Panel B) 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 C), the coefficients are not sensitive to excluding the Great Recession years, but they are drastically reduced when excluding the Denver metro-area. This analysis 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 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.[16]

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 10 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.

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[16] See Appendix Table 3 and 4 for the results.

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 COVID-19 health crisis kept reporting below pre-pandemic levels for the remainder of 2020 and through 2021. Using a model that accounts for protective and risk factors brought about by the pandemic, an estimated 59,000 referrals went unreported and 8,700 victims went unnoticed in 2020 and 2021. Applying these numbers to the whole country, while taking into account Colorado's unusually high reporting rate, an estimated 2.1 million referrals and 443,000 victims may have gone unreported across the country during 2020 and 2021.[17] These estimates should be verified when NCANDS releases the national-level data.[18]

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 and school closings 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

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[17] First the 59,000 unreported referrals are multiplied by 51. Next, 3,009,000 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).

[18] If one were to scale early predictions from Baron et al. (2020) and Rapoport et al. (2020) to the full year, they would estimate that 833,000 to 1.06 million referrals went unreported in 2020. Doubling this estimate to account for two years, 2020 and 2021, implies 1.6 to 2.1 million unreported referrals.

experts disagree and claim that the pandemic is filtering out the flood of unsubstantiated reports.[19] In Colorado, I find evidence that the pandemic may have compromised the screening process, thus making it even more difficult to detect child maltreatment. 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 of the disposition, is concerning.

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. 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 method. 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.[20]

Finally, I find that the referral rate for neglect decreased by less in counties that were less likely to comply with the stay-at-home order relative to counties that were more likely to comply.[21] This result provides suggestive evidence that time spent at home might be a protective factor for some families. In addition to targeting support and services to communities with historical records of

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[19] 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.

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

[21] Bullinger et al. (2021) come to the opposite conclusion in Indiana.

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 reporters, especially since some people's behavioral responses to the pandemic include increasing time at home and remote work, which 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. For example, states may want to allocate additional funding to address the consequences of neglect. This paper can also inform policy decisions related to future pandemic responses. While school closures and stay-at-home orders reduced the spread of COVID-19 (Auger et al., 2020; Castillo et al., 2020), policymakers also must 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 child protective services data seem to be more reflective of reporting than actual incidences, so more data to measure the incidence of child maltreatment need to be readily available to researchers and child welfare communities.

References

ACF – U.S. Department of Health & Human Services, Administration for Children and Families, Administration on Children, Youth and Families, Children's Bureau. (2021). *Child Maltreatment 2019.* Available at https://www.acf.hhs.gov/cb/report/child-maltreatment-2019.

Allcott, H., Boxell, L., Conway, J., Gentzkow, M., Thaler, M., Yang, D. (2020). Polarization and public health: Partisan differences in social distancing during the coronavirus pandemic. *Journal of Public Economics,* 191, 104254.

Auger K.A., Shah S.S., Richardson T., et al. (2020). Association Between Statewide School Closure and COVID-19 Incidence and Mortality in the US. *JAMA,* 324(9):859–870. doi:10.1001/jama.2020.14348

Baron, E., Goldstein, E., & Wallace, C. (2020). Suffering in Silence: How COVID-19 school closures inhibit reporting of child maltreatment. *Journal of Public Economics, 190,* 104258.

Brodeur, A., Clark, A.E., Fleche, S., & Powdthavee, N. (2021). COVID-19, lockdowns and well-being: Evidence from Google Trends. *Journal of Public Economics*, 193, 104346. https://doi.org/10.1016/j.jpubeco.2020.104346

Brown, D., & De Cao, E. (2020). *Child Maltreatment, Unemployment, and Safety Nets* (SSRN Scholarly Paper ID 3543987). Social Science Research Network. https://doi.org/10.2139/ssrn.3543987

Buchmueller, T.C., DiNardo, J., Valletta, R.G. (2011). The effect of an employer health insurance mandate on health insurance coverage and the demand for labor: evidence from Hawaii. *American Economic Journal of Economic Policy*, 3 (4): 25–51.

Bullinger, L. R., Raissian, K. M., Feely, M., & Schneider, W. J. (2021). The neglected ones: Time at home during COVID-19 and child maltreatment. *Children and youth services review*, 131, 106287. https://doi.org/10.1016/j.childyouth.2021.106287

Cabrera-Hernández, Francisco and Padilla-Romo, María. (2020). Hidden Violence: How COVID-19 School Closures Reduced the Reporting of Child Maltreatment, No 2020-02, Working Papers, University of Tennessee, Department of Economics, https://EconPapers.repec.org/RePEc:ten:wpaper:2020-02

Callahan, K. and Mink, C. (2020, May 7). Child abuse hotline calls are down during COVID-19, but abuse fears are up. *Center for Health Journalism.* https://centerforhealthjournalism.org/2020/05/05/child-abuse-hotline-calls-are-down-during-covid-19-abuse-fears-are.

Cameron, A.C., Gelbach, J.B., Miller, D.L. (2008). Bootstrap-based improvements for inference with clustered errors. *Rev. Econ. Stat.*, 90 (3): 414–427.

Castillo, R., Staguhn, E., Weston-Farber, E. (2020). The effect of state-level stay-at-home orders on COVID-19 infection rates. *American Journal of Infection Control,* 48(8): 958-960. https://doi.org/10.1016/j.ajic.2020.05.017

CDHS. (2020). Colorado Child Abuse and Neglect Hotline 2020 Data Shows 13 Percent Drop in Calls. https://www.prnewswire.com/news-releases/colorado-child-abuse-and-neglect-hotline-2020-data-shows-13-percent-drop-in-calls-301220637.html

CDHS (nd)a. Community Performance Center. http://www.cdhsdatamatters.org/data-by-topic.html

CDHS (nd)b. What happens after you call? https://www.co4kids.org/what-happens-after-you-call

CDPHE (nd). Outbreak Data. https://covid19.colorado.gov/covid19-outbreak-data. Accessed March 24, 2021.

Chetty, R., Looney, A., Kroft, K. (2009). Salience and taxation: theory and evidence. *Am. Econ. Rev.,* 99 (4):1145–1177.

Desjardins, S. (2020, Aug. 26). Child protection reports on P.E.I. climb despite fewer eyes amid COVID. *CBC News.* https://www.cbc.ca/news/canada/prince-edward-island/pei-child-protection-reports-1.5699622

Doyle, J. & Aizer, A. (2018). Economics of child protection: maltreatment, foster care, and intimate partner violence. *Annual Review of Economics*, 10: 87-108.

Ferman, B., Pinto, C., (2019). Inference in differences-in-differences with few treated groups and heteroskedasticity. *Rev. Econ. Stat,* 101 (3): 452–467.

Grewe, L. (2020). Stay-at-home: what you can and cannot do. *KKTV11 News.* https://www.kktv.com/content/news/STAY-AT-HOME-What-you-can-and-cannot-do-569122861.html

Griffith, A. (2020). Parental Burnout and Child Maltreatment During the COVID-19 Pandemic. *Journal of Family Violence*. https://doi.org/10.1007/s10896-020-00172-2

Hofmann, M. (2021). Child welfare officials see increase in reports of serious abuse. *Herald Standard.*

Irigaray, Tatiana Quarti, Pacheco, Janaína Barbosa, Grassi-Oliveira, Rodrigo, Fonseca, Rochele Paz, Leite, José Carlos de Carvalho, & Kristensen, Christian Haag. (2013). Child maltreatment and later cognitive functioning: a systematic review. *Psicologia: Reflexão e Crítica*, 26(2): 376-387.

Kalmakis, Karen and Genevieve Chandler. (2015). Health consequences of adverse childhood experiences: a systematic review. *American Association of Nurse Practitioners*, 27: 457-465.

Leslie, E. & Wilson, R. (2020). Sheltering in place and domestic violence: Evidence from calls for service during COVID-19. *Journal of Public Economics, 189,* 104241. https://doi.org/10.1016/j.jpubeco.2020.104241

Lindo, J., Schaller, J., Hansen, B. (2018). Caution! Men *not* at work: Gender-specific labor market conditions and child maltreatment. *Journal of Public Economics,* 163: 77-98.

MacFarlane, S., Yarborough, R., & Jones, S. (2020). Child advocates concerned neglect, abuse might be going unreported during pandemic. *NBC4 Washington.*

MacKinnon, J.G., Webb, M.D. (2017). Wild bootstrap inference for wildly different cluster sizes. *J. Appl. Econ*, 32 (2): 233–254.

MacKinnon, J.G., Webb, M.D. (2018). The wild bootstrap for few (treated) clusters. *Econ. J.*, 21 (2): 114–135.

Maine DOE. (2020). Priority Notice: Spotting signs of child abuse and neglect during the COVID-19 emergency: An updated guide for educational professionals and others who care for Maine children. Available at https://mainedoenews.net/2020/04/15/priority-notice-spotting-signs-of-child-abuse-and-neglect-during-the-covid-19-emergency-an-updated-guide-for-educational-professionals-and-others-who-care-for-maine-children/

Mikolajczak, M., Gross, J. J., & Roskam, I. (2019). Parental Burnout: What Is It, and Why Does It Matter? *Clinical Psychological Science*, *7*(6), 1319-1329. https://doi.org/10.1177/2167702619858430

NGA – National Governor's Association. (2020). Addressing the decline in child abuse reports and supporting child well-being.

Ortiz R, Kishton R, Sinko L, et al. (2021). Assessing Child Abuse Hotline Inquiries in the Wake of COVID-19: Answering the Call. *JAMA Pediatr.* Doi:10.1001/jamapediatrics.2021.0525

Pollard M.S., Tucker J.S., Green H.D. (2020). Changes in Adult Alcohol Use and Consequences During the COVID-19 Pandemic in the US. *JAMA Network Open.*3(9):e2022942. Doi:10.1001/jamanetworkopen.2020.22942

Quander, M. (2020, September 2). More than 60% drop in calls to child abuse hotline spark safety concerns. *Newbreak.* https://www.newsbreak.com/news/2052707885364/more-than-60-drop-in-calls-to-child-abuse-hotline-spark-safety-concerns.

Raifman, J., Nocka, K., Jones, D., Bor, J., Lipson, S., Jay, J., … Galea, S. (2022). COVID-19 US State Policy Database. Ann Arbor, MI: Inter-university Consortium for Political and Social Research. https://doi.org/10.3886/E119446V143

Rapoport, E., Reisert, H., Schoeman, E, & Adesman, A. (2020). Reporting of child maltreatment during the SARS-CoV-2 pandemic in New York City from March to May 2020. *Child Abuse & Neglect,* 104719. https://doi.org/10.1016/j.chiabu.2020.104719

Salon, D., Conway, M., da Silva, D., Chauhan, R., Derrible, S., Mohammadian, A., Khoeni, S., Parker, N., Mirtich, L., Shamshiripour, A., Rahimi, E., Pendyala, R. (2021). The potential stickiness of pandemic-induced behavior changes in the United States. *Proceedings of the National Academy of Sciences*, 118 (27). 10.1073/pnas.2106499118

Sege, R, & Stephens A. (2022). Child Physical Abuse Did Not Increase During the Pandemic. *JAMA Pediatr*. 176(4):338–340. Doi:10.1001/jamapediatrics.2021.5476

Schmidt, S. & Natanson, H. (2020). With kids stuck at home, ER doctors see more severe cases of child abuse. *The Washington Post.*

Slade, E.P., & Wissow, L.S. (2007). The influence of childhood maltreatment on adolescents' academic performance. *Economics of education review*, 26(5), 604–614.

Stephens-Davidowitz, S. (2013). Unreported victims of an economic downturn. Retrieved from Seth Stephens-Davidowitz website: https://static. squarespace. com/static/51d894bee4 b01caf88ccb4f3

Trading Economics. (nd). United States Unemployment Rate. https://tradingeconomics.com/united-states/unemployment-rate#:~:text=Unemployment%20Rate%20in%20the%20United,percent%20in%20May%20of%201953. Accessed March 24, 2021.

WCTV. (2020, May 25). Advocates express concerns about children falling through the cracks. https://chsfl.org/blog/advocates-express-concerns-about-children-falling-through-the-cracks/.

Weiner, D., Heaton, L., Stiehl, M., Chor, B., Kim, K., Heisler, K., Foltz, R., & Farrell, A. (2020). Chapin Hall issue brief: COVID-19 and child welfare: Using data to understand trends in maltreatment and response. Chicago, IL: Chapin Hall at the University of Chicago.
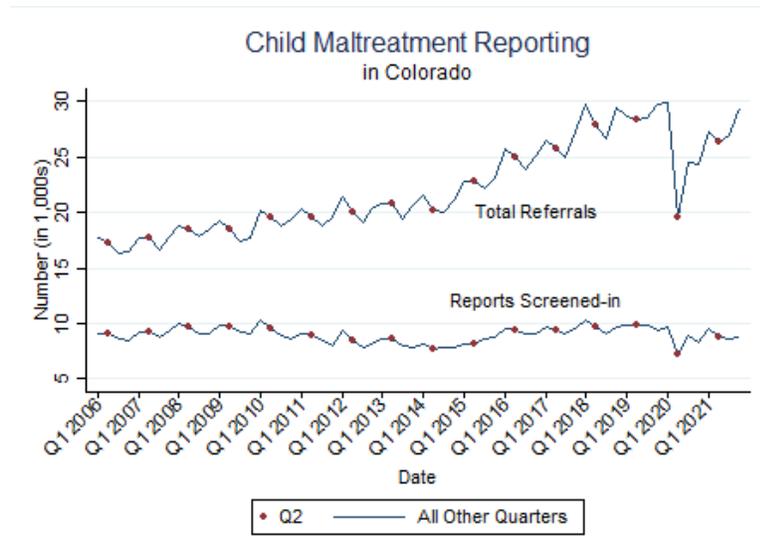
WHO – World Health Organization. (nd). Child maltreatment and alcohol abuse. https://www.who.int/violence_injury_prevention/violence/world_report/factsheets/fs_child.pdf.
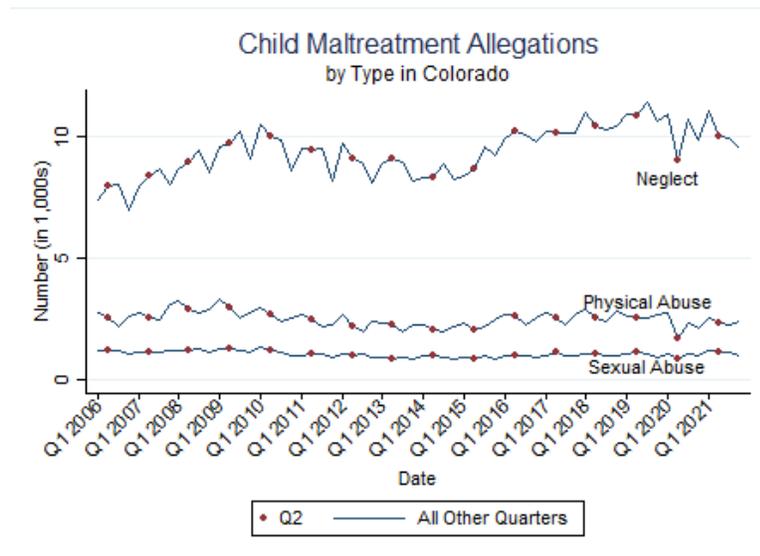
Tables and Figures

Figure 1: Child Maltreatment Referrals in Colorado from 2006 to 2021
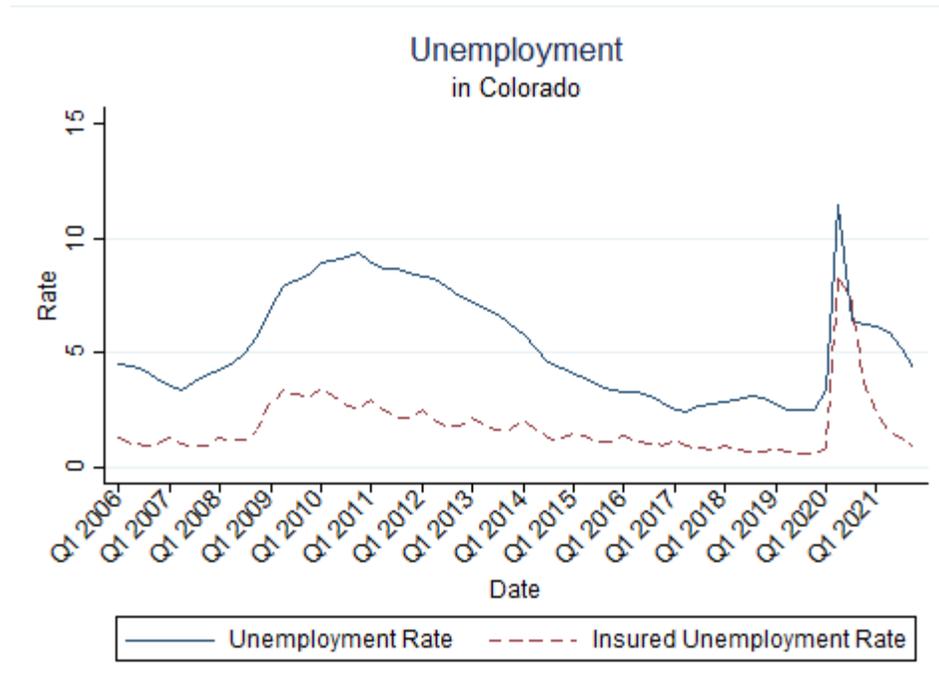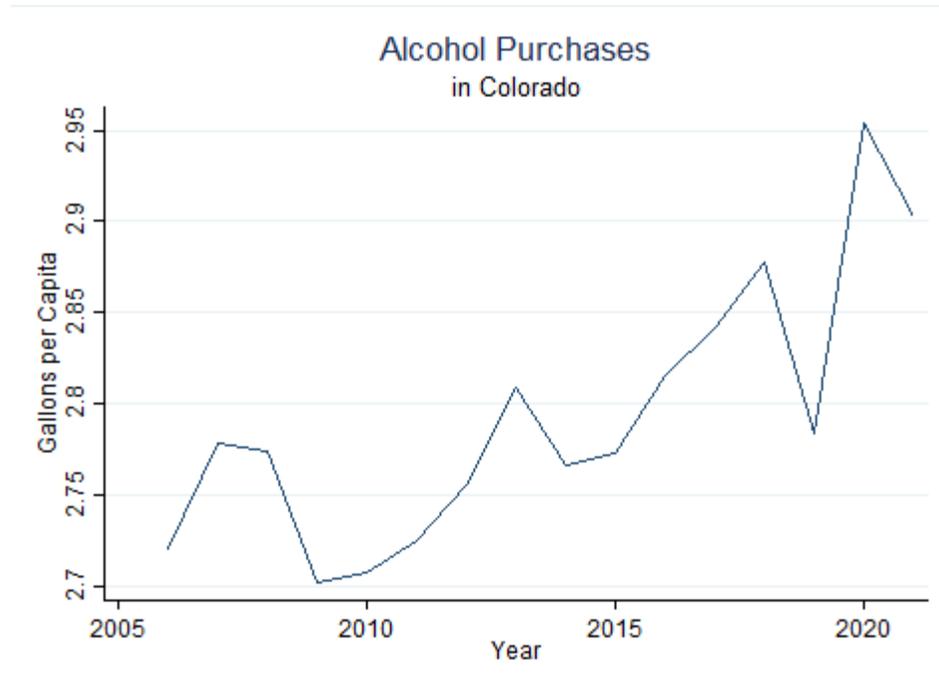*Panel A*

Panel B

Notes: This figure shows the trend in child maltreatment reporting from 2006 to 2021. Panel A 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). Panel B shows the number of allegations by maltreatment type (in thousands). The total number of maltreatment allegations in Panel B is less than the total referrals because not all referrals are screened-in and investigated. In addition, the total number of maltreatment allegations is greater than the screened-in reports because a report can be assigned multiple maltreatment types.

Figure 2: Risk and Protective Factors in Colorado from 2006 to 2021

Panel A

Panel B

Panel C

Employment
in Colorado
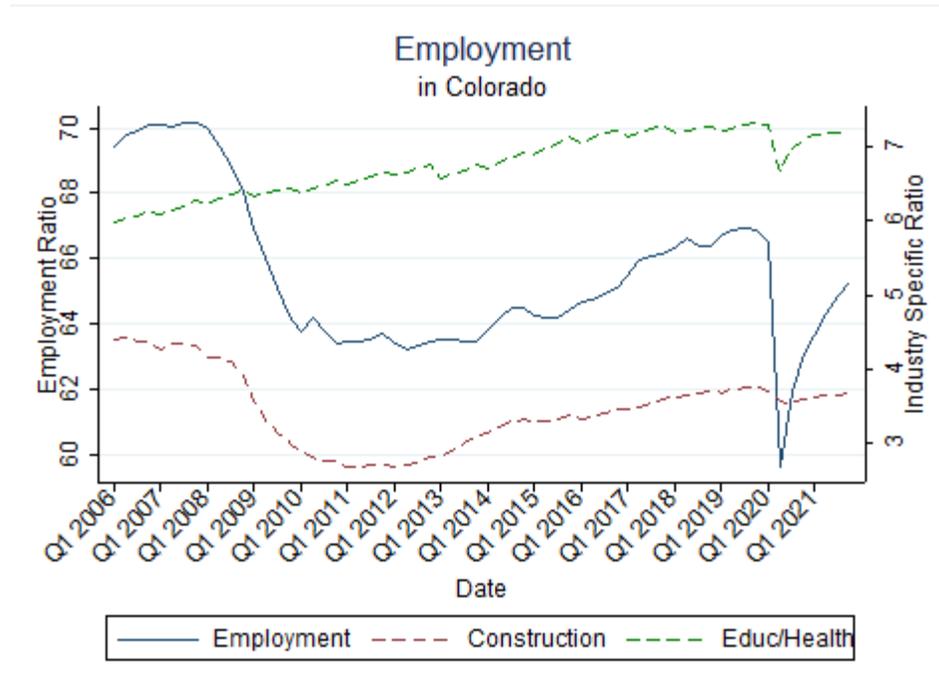
*Notes*: This figure plots select risk and protective factors overtime in Colorado. Panel A plots the unemployment rate and uninsured unemployment rate, Panel B plots yearly alcohol purchases in gallons, per capita, and Panel C plots the employment to population ratio for all industries, and then industry-specific ratios for construction and education/health. The industry-specific ratio is calculated as the proportion of the working age population employed in the industry.

Figure 3: Change in Mobility during the Pandemic in Colorado

Panel A: Average Quarterly Change Statewide
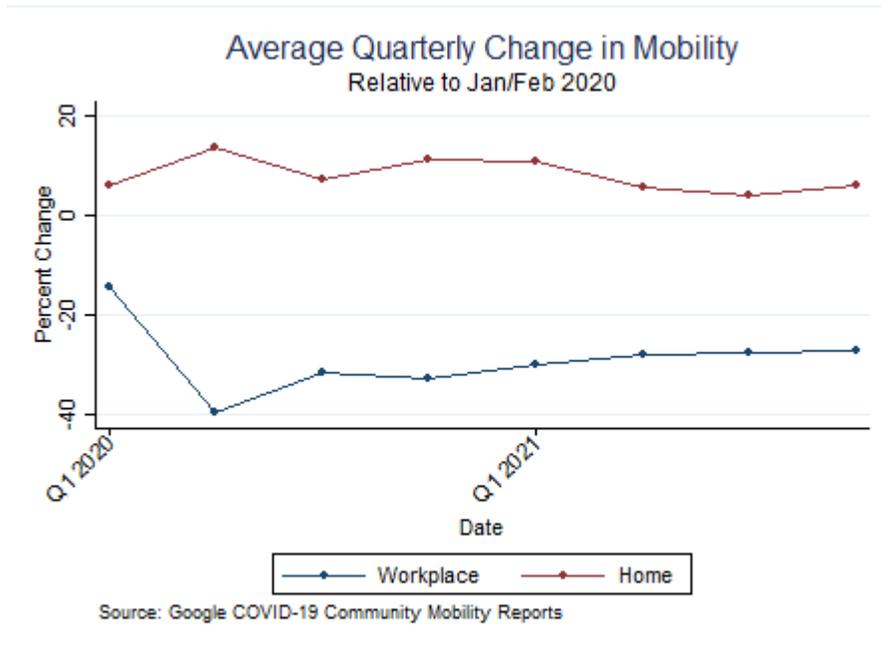
Panel B: Before Stay-at-Home Order by County and Political Affiliation
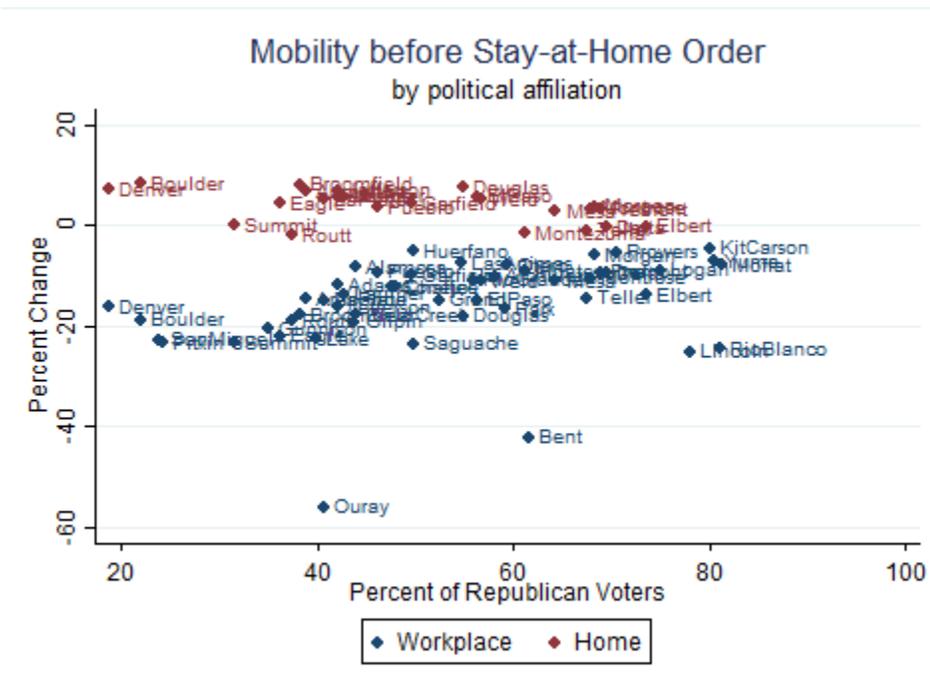
Panel C: During Stay-at-Home Order by County and Political Affiliation
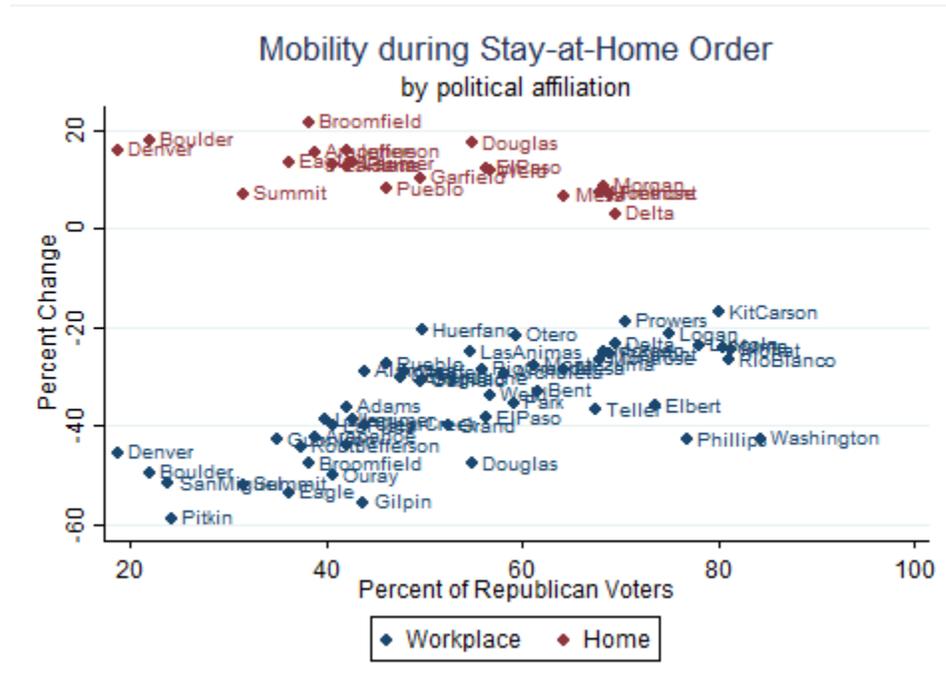

Notes: This figure uses the Google COVID-19 Community Mobility Reports to plot the percent change in workplace and home location mobility during the pandemic. Percent changes in mobility are relative to average mobility rates in January and February of 2020, prior to the onset of the pandemic. The data are available weekly, so these quarterly rates plotted are based on the average percent change during the weeks in the quarter. For more information about how Google obtains these data, refer to https://www.google.com/covid19/mobility/.

Figure 4. Relationship between COVID-19 Caseload and Political Affiliation
Panel A

COVID-19 Cases before Stay-at-Home Order
by political affiliation

Panel B

COVID-19 Cases during Stay-at-Home Order
by political affiliation
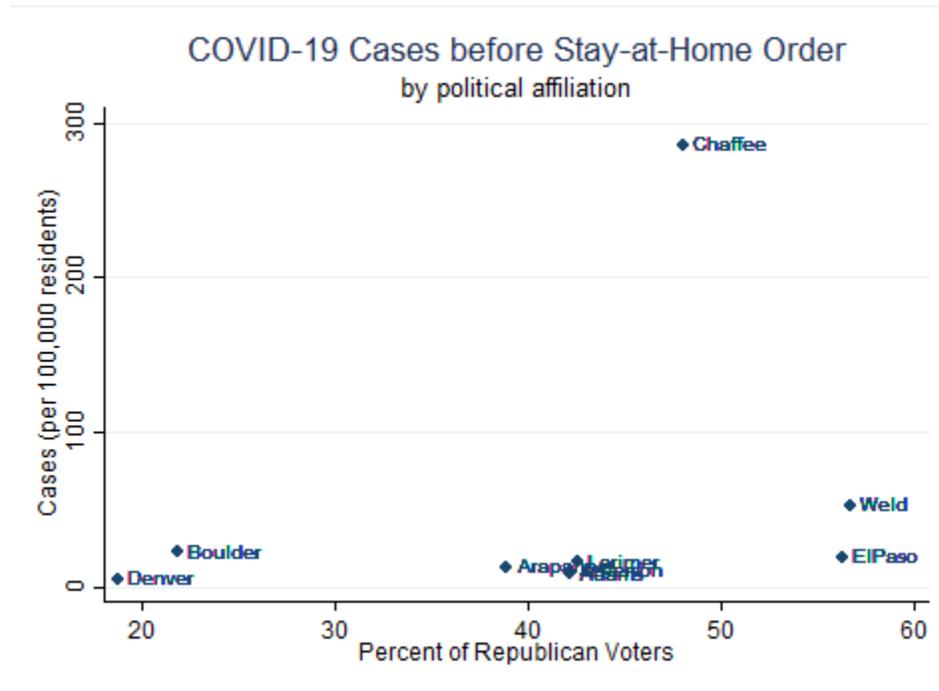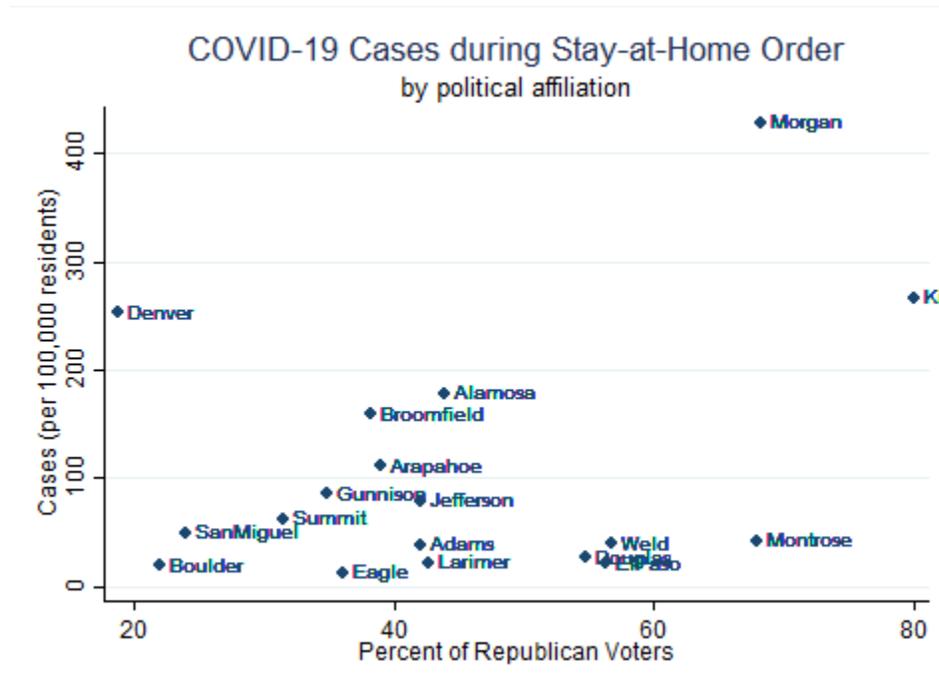
Notes: This figure plots the COVID-19 caseload by political affiliation for each county with at least one COVID-19 case. Panel A plots the caseload before the stay-at-home order and then Panel B plots the caseload during the stay-at-home order.

Table 1: Timeline of Events and Independent Variable Values

Event	Dates	Independent Variable Values
COVID-19 State of Emergency	March 11, 2020 – July 8, 2021[22]	$covid_{qy} = \begin{cases} 0 \ if \ y < 2020 \\ \dfrac{0.5}{3} \ if \ y = 2020 \cap q = 1 \\ 1 \ if \ y = 2020 \ \cap q > 1 \\ 1 \ if \ y = 2021 \ \cap q < 3 \\ 0 \ if \ y = 2021 \ \cap q > 2 \end{cases}$
School Closures in Colorado	March 16, 2020 – August 24, 2020[23]	$schclo_{qy} = \begin{cases} \dfrac{0.5}{3} \ if \ y = 2020 \cap q = 1 \\ \dfrac{2}{3} \ if \ y = 2020 \cap q = 2 \\ \dfrac{0.5}{3} \ if \ y = 2020 \ \cap q = 3 \\ 0 \ otherwise \end{cases}$
Stay-at-home Order in Colorado	March 26, 2020 – April 26, 2020[24]	$sah_{qy} = \begin{cases} \dfrac{1}{3} \ if \ y = 2020 \cap q = 2 \\ 0 \ otherwise \end{cases}$

This table lists the dates of the COVID-19 State of 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 State of Emergency was announced March 11th, so about one-half of a month out of three were impacted by the pandemic. The State of Emergency existed for the rest of 2020 and through June 2021, so for the remaining three quarters and the first half of the following year, three out of three months were impacted, which equals one. 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).

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[22] Colorado State of Emergency dates come from Raifman et al. (2021). The National Emergency was declared on March 13, 2020 and continued through March 2022. See The White House notice on the continuation of the National Emergency here.

[23] 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.

[24] See Raifman et al. (2021) 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.

Lastly, the stay-at-home order primarily took place in April, so in 2020 for quarter 2, *sah* equals one-third and zero otherwise.

**Figure 5: Timeline of Events in 2020 and 2021**
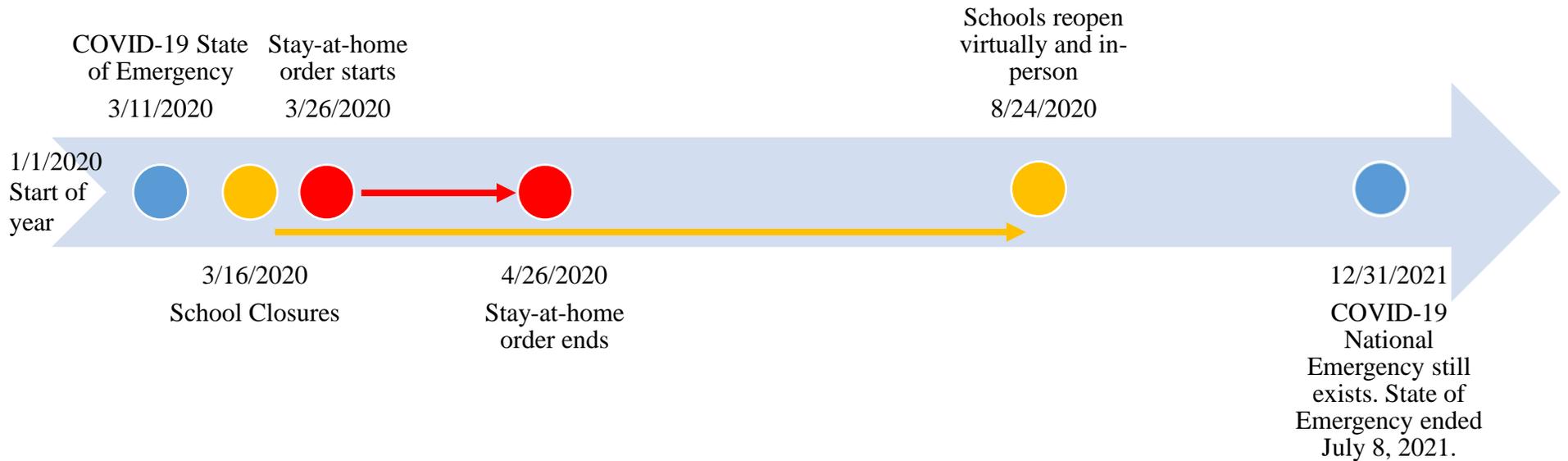
This figure plots the timeline of events during 2020 and 2021 in Colorado. The COVID-19 State of Emergency was announced on March 11, 2020 and continued through June 2021. Schools closed on March 16 and the stay-at-home order began March 26. The stay-at-home order ended a month later, and schools reopened 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 pandemic was happening.

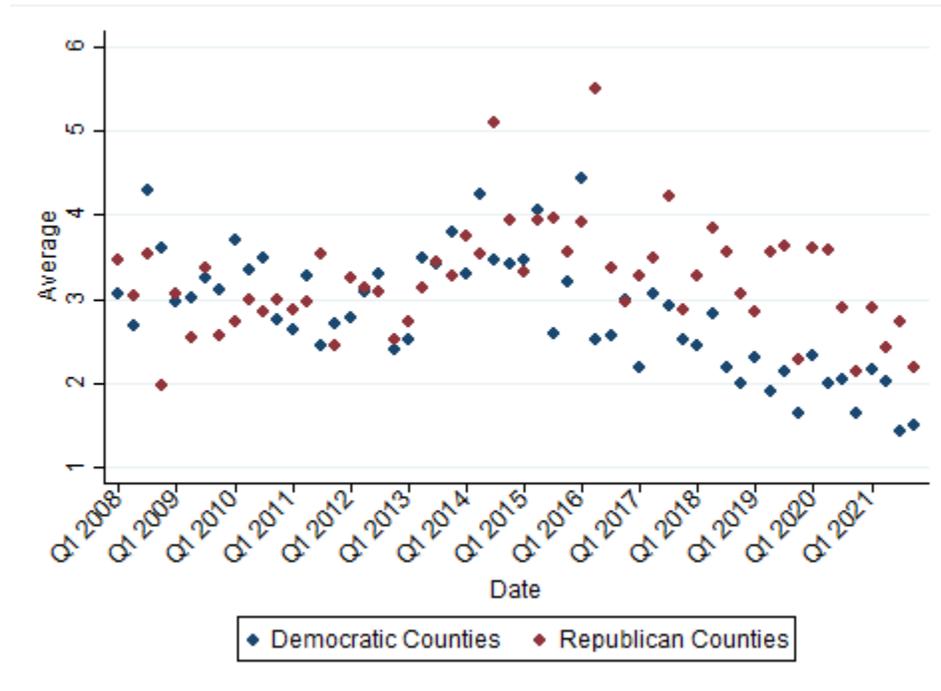**Figure 6: Child Maltreatment Reporting by Political Affiliation**

Panel A: Referral Rate
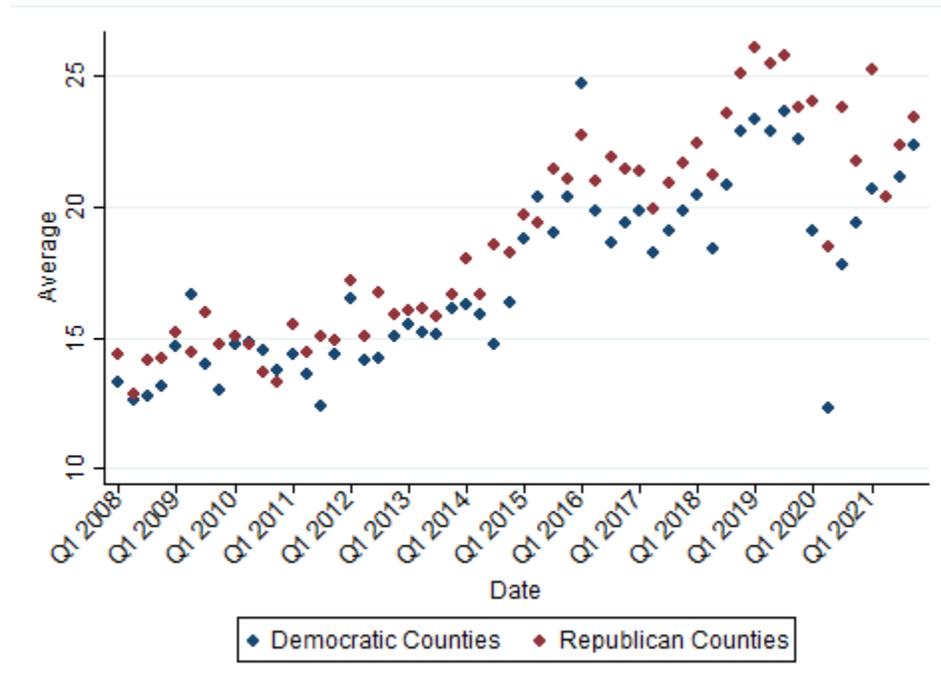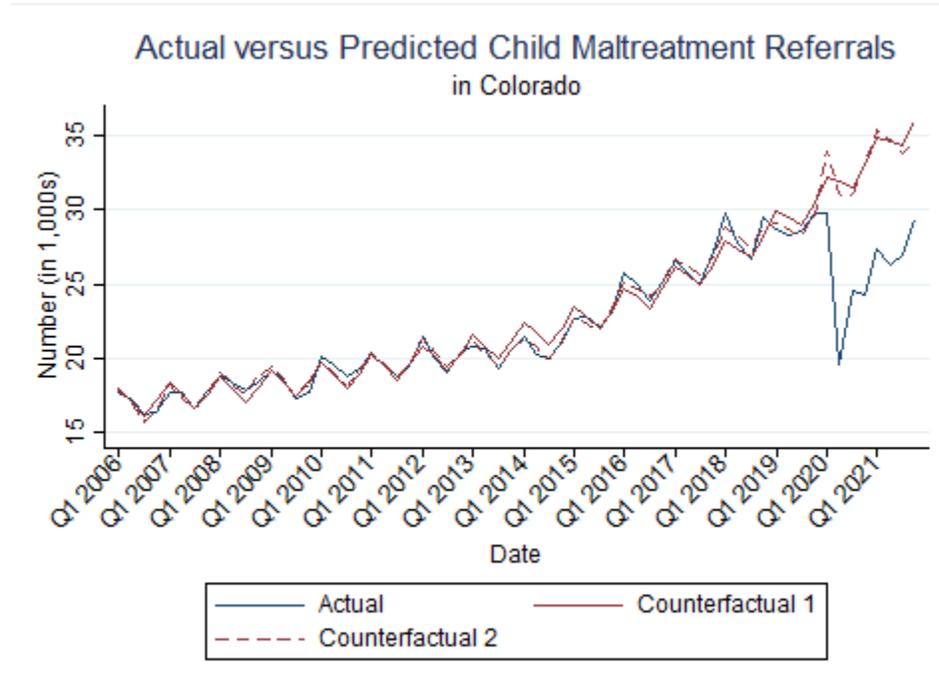

Panel B: Screened-in Report Rate
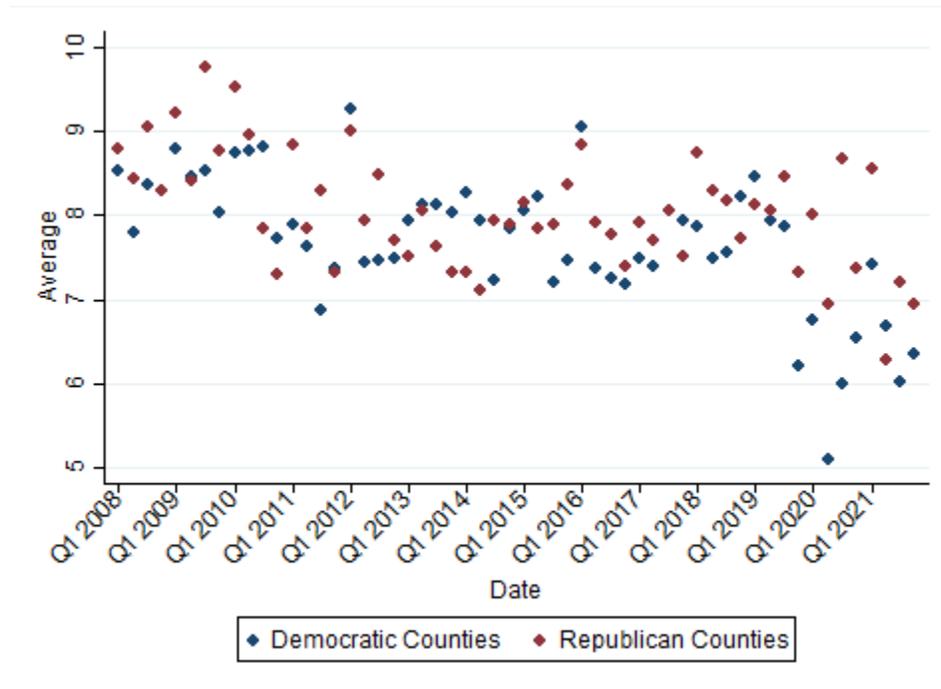
*Panel C: Substantiation Rate*

Notes: This figure plots the average child maltreatment reporting rates over time for Republican and Democratic counties. Republican counties are defined as having 50 percent or more of their voter share having voted for Trump in 2016. Panel A plots the referral rate, Panel B the screened-in report rate, and Panel C the substantiation rate. All rates are per 1,000 children.

Figure 7: Actual versus Predicted Child Maltreatment Referrals and Reports in Colorado from 2006 to 2021
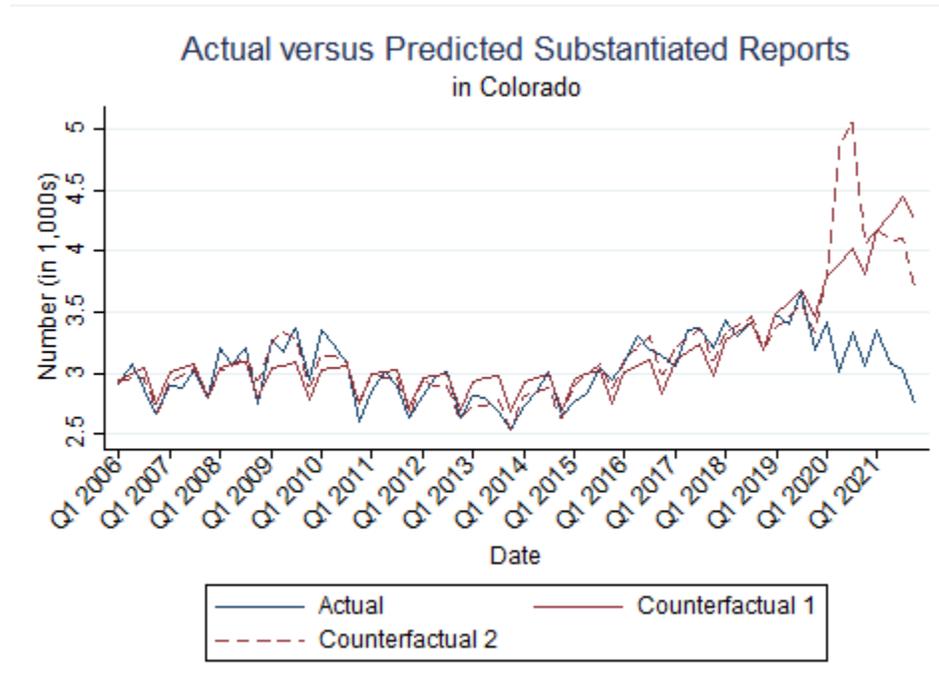
Panel A

Panel B

Panel C

Actual versus Predicted Substantiated Reports in Colorado
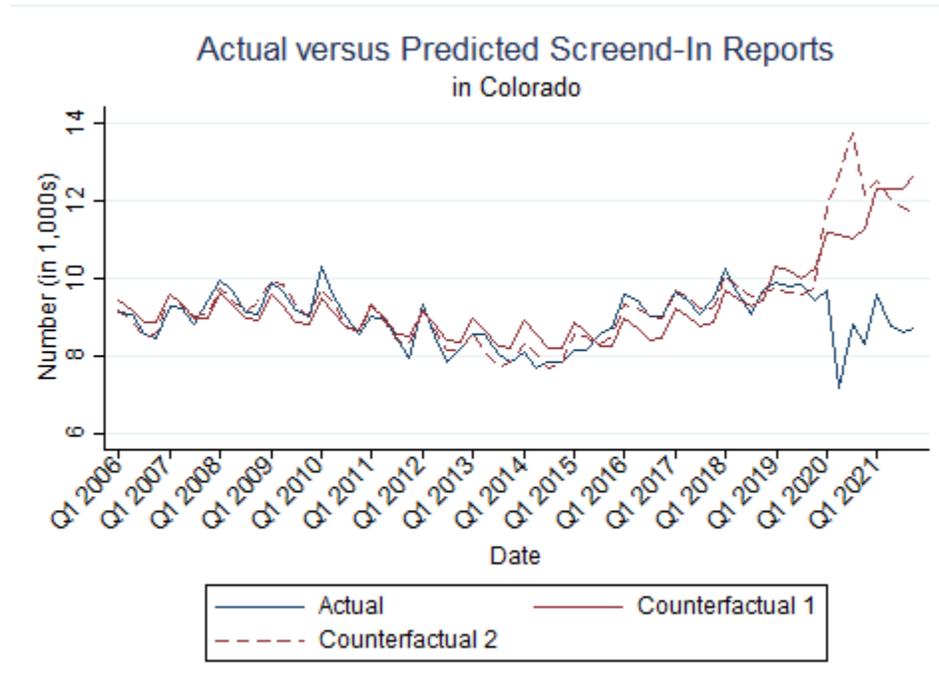
Notes: These figures plot the actual versus predicted counts of child maltreatment referrals (Panel A), screened-in reports (Panel B), and substantiated reports (Panel C). Two counterfactuals are estimated: counterfactual one assumes child maltreatment would have been the same in 2020 and 2021 as 2019 had the pandemic not occurred, and counterfactual two accounts for changes in maltreatment as a result of changes in risk and protective factors, including unemployment, alcohol purchases, industry-specific employment in construction and education/health, and unemployment insurance.

Figure 8: Actual versus Predicted Substantiated Allegations by Child Maltreatment Type in Colorado from 2006 to 2021

Panel A

Panel B

Panel C

Actual v. Predicted Substantiated Sexual Abuse Allegations in Colorado
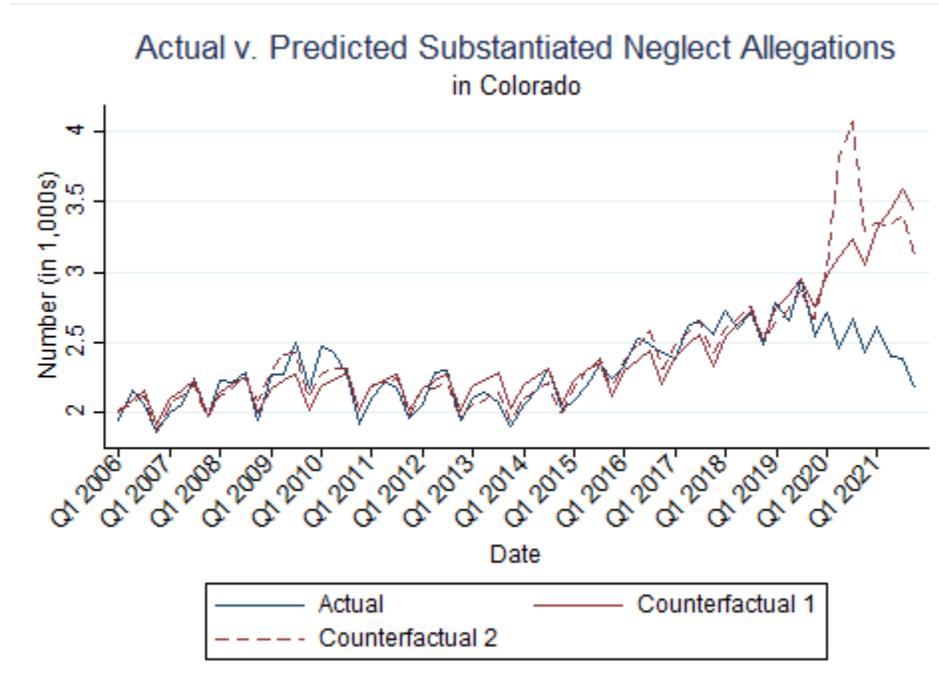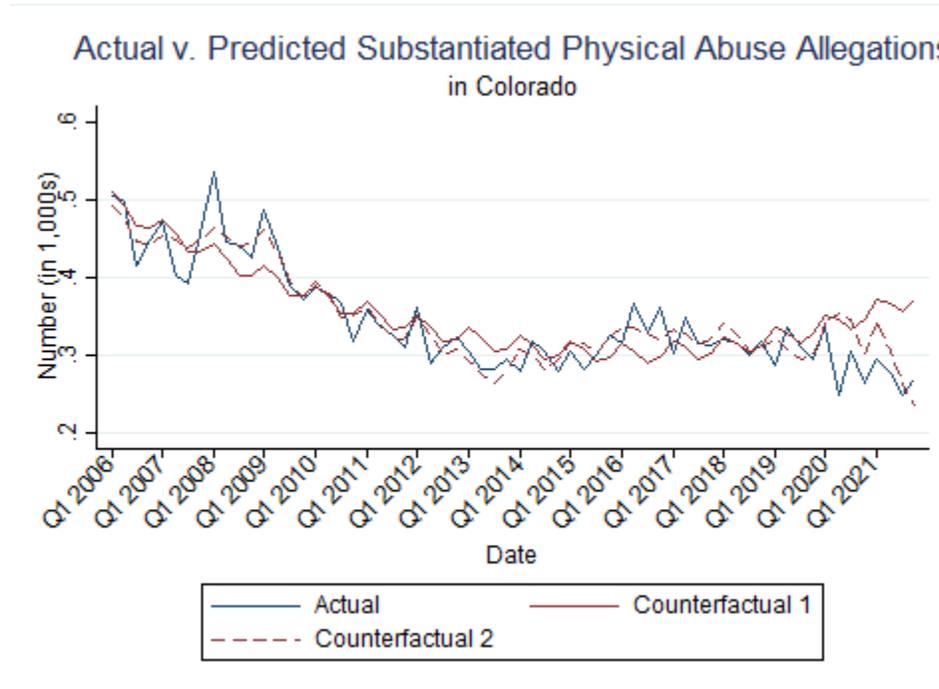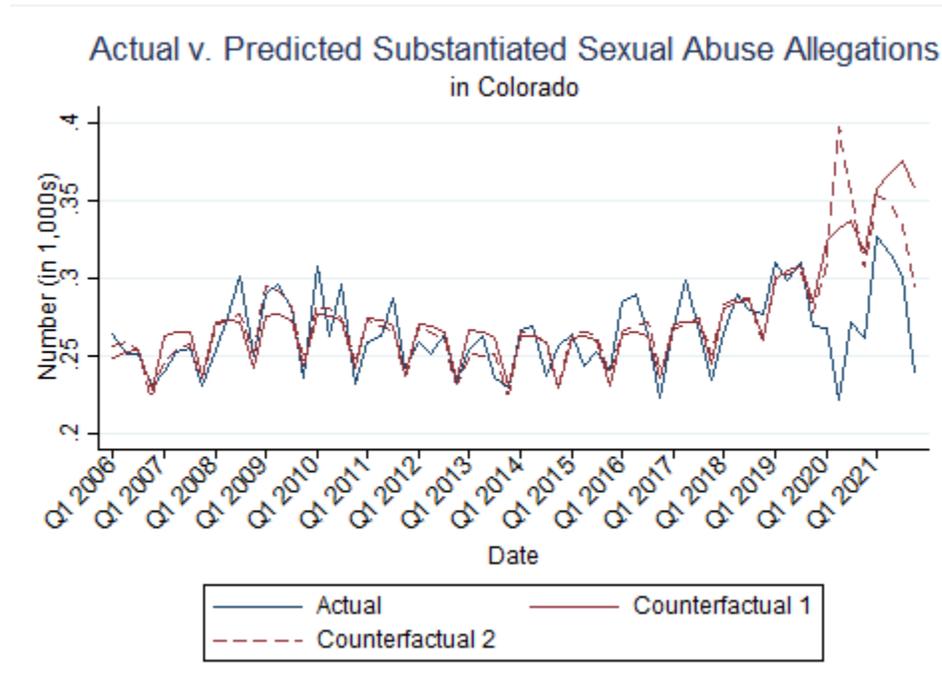
Notes: These figures plot the actual versus predicted counts of substantiated neglect (Panel A), physical abuse (Panel B), and sexual abuse (Panel C) allegations. Two counterfactuals are estimated: counterfactual one assumes child maltreatment would have been the same in 2020 and 2021 as 2019 had the pandemic not occurred, and counterfactual two accounts for changes in maltreatment as a result of changes in risk and protective factors, including unemployment, alcohol purchases, industry-specific employment in construction and education/health, and unemployment insurance rate.

Table 2: Estimated Impacts of COVID-19 Pandemic, School Closures, and Stay-at-home Order on Child Maltreatment Reporting in Colorado

|	Main Outcomes			Allegation Type			Substantiated Maltreatment		
	Total Referrals	Reports Screened-in	Substantiated Reports	Neglect	Physical Abuse	Sexual Abuse	Neglect	Physical Abuse	Sexual Abuse
Ind. Var.: COVID-19	-1.011	0.192	-0.107	0.348	0.174	0.089	-0.091	-0.001	0.041
	(0.639)	(0.310)	(0.275)	(0.451)	(0.150)	(0.085)	(0.218)	(0.057)	(0.051)
Ind. Var.: School Closure	-7.424***	-1.753**	0.543	-1.187	-0.283	0.107	0.124	-0.032	0.282
	(1.735)	(0.808)	(0.965)	(1.215)	(0.497)	(0.347)	(0.644)	(0.119)	(0.253)
Ind. Var.: Stay-at-home Order	-13.997***	-3.112**	0.595	-2.563	-0.715	0.247	-0.047	-0.064	0.490
	(2.959)	(1.418)	(1.762)	(2.211)	(0.882)	(0.620)	(1.175)	(0.213)	(0.459)
2019 Average	24.66	7.83	2.61	8.72	2.2	0.79	1.97	0.25	0.19
Observations	3,584	3,584	3,584	3,584	3,584	3,584	3,584	3,584	3,584

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.

Figure 9: Relationship between Time Spent at Home and Child Maltreatment in Colorado during the Pandemic

Panel A
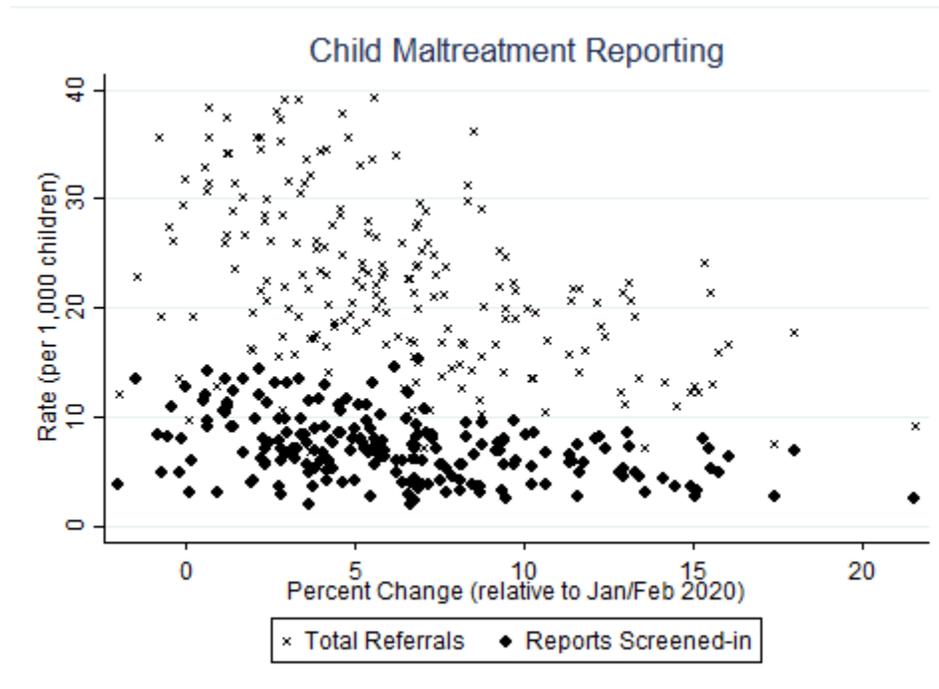
Panel B

Panel C

Notes: This figure plots the relationship between time spent at home and child maltreatment for 27 large counties in Colorado in 2020 and 2021.

Table 3: Estimated Impact of Stay-at-home Order Interacted with Republican Voter Share on Child Maltreatment Reporting

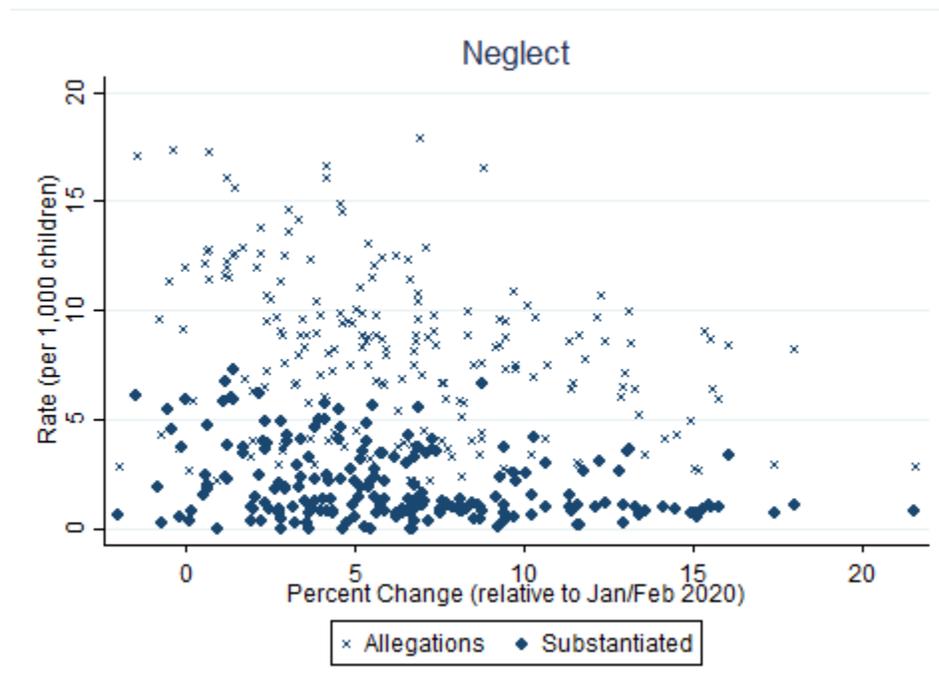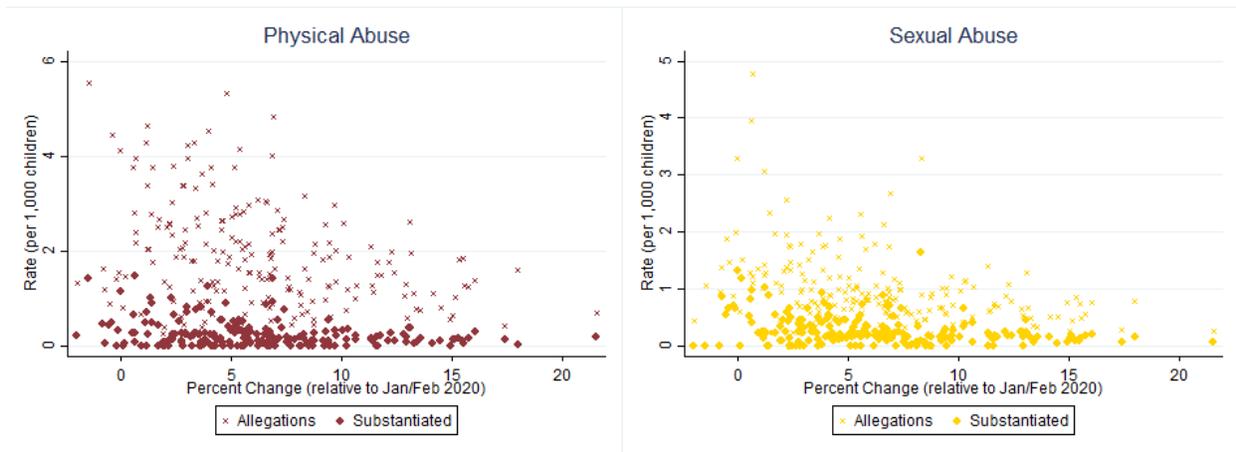|	Main Outcomes			Allegation Type			Substantiated Maltreatment		
	Total Referrals	Reports Screened-in	Substantiated Reports	Neglect	Physical Abuse	Sexual Abuse	Neglect	Physical Abuse	Sexual Abuse
Stay-at-home	-27.361***	-8.356**	-5.707	-7.604	-1.194	-2.976*	-4.367	-0.134	-0.906
	(6.167)	(3.428)	(5.411)	(6.143)	(3.400)	(1.535)	(3.547)	(0.430)	(1.093)
Share Republican	-0.009	0.018***	-0.015***	0.001	0.004	0.001	-0.024***	0.000	0.003***
	(0.013)	(0.006)	(0.003)	(0.010)	(0.004)	(0.002)	(0.003)	(0.003)	(0.001)
Stay-at-home x Share Republican	0.238**	0.093	0.112	0.090	0.009	0.057*	0.077	0.001	0.025
	(0.099)	(0.065)	(0.119)	(0.126)	(0.059)	(0.034)	(0.075)	(0.008)	(0.026)
Observations	3,584	3,584	3,584	3,584	3,584	3,584	3,584	3,584	3,584

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 proportion of Republican voters, and row 3 reports the coefficient on the interaction term between the stay-at-home order and Republican voters. Each regression includes year, county, and quarter fixed effects.

Table 4: Robustness Analyses for Child Maltreatment Referrals

|		(1)	(2)	(3)	(4)
				Exclude	Include
		Main Results	Post 2010	Denver	Economic
				Metro-area	Controls
Panel A: Rate (per 1,000 children)	COVID-19	-1.011	-0.854	-0.686	-0.309
		(0.639)	(0.644)	(0.728)	(0.682)
	School Closure	-7.424***	-6.889***	-7.273***	-5.430***
		(1.735)	(1.697)	(1.998)	(1.788)
	Stay-at-home	-13.997***	-13.187***	-13.674***	-10.594***
		(2.959)	(2.926)	(3.405)	(3.097)
Panel B: Log	COVID-19	-0.066**	-0.059*	-0.051	-0.036
		(0.032)	(0.031)	(0.037)	(0.034)
	School Closure	-0.404***	-0.376***	-0.383***	-0.319***
		(0.110)	(0.106)	(0.126)	(0.114)
	Stay-at-home	-0.747***	-0.710***	-0.704***	-0.613***
		(0.186)	(0.181)	(0.213)	(0.196)
Panel C: Levels	COVID-19	-55.900***	-54.485***	-20.334**	-42.340***
		(13.066)	(11.655)	(8.441)	(13.290)
	School Closure	-142.865***	-137.576***	-71.103***	-95.217***
		(33.026)	(37.791)	(24.481)	(29.838)
	Stay-at-home	-296.649***	-290.042***	-145.478***	-217.136***
		(62.402)	(69.212)	(46.063)	(56.841)
	Observations	3,584	2,816	3,080	3,584

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 A reports the effect on the total referral rate, per 1,000 children. Panel B reports the effect on the log total referrals, and Panel C reports the effect on the total referrals (level). Each regression includes year, county, and quarter fixed effects.

Figure 10: Cumulative Distribution Function of Estimates from Permutation Tests
Panel A
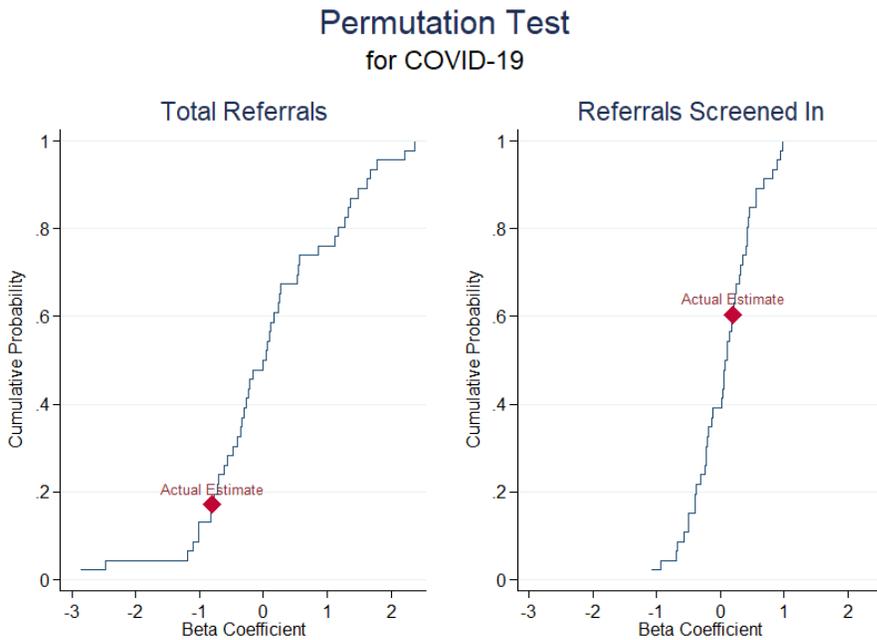
Panel B
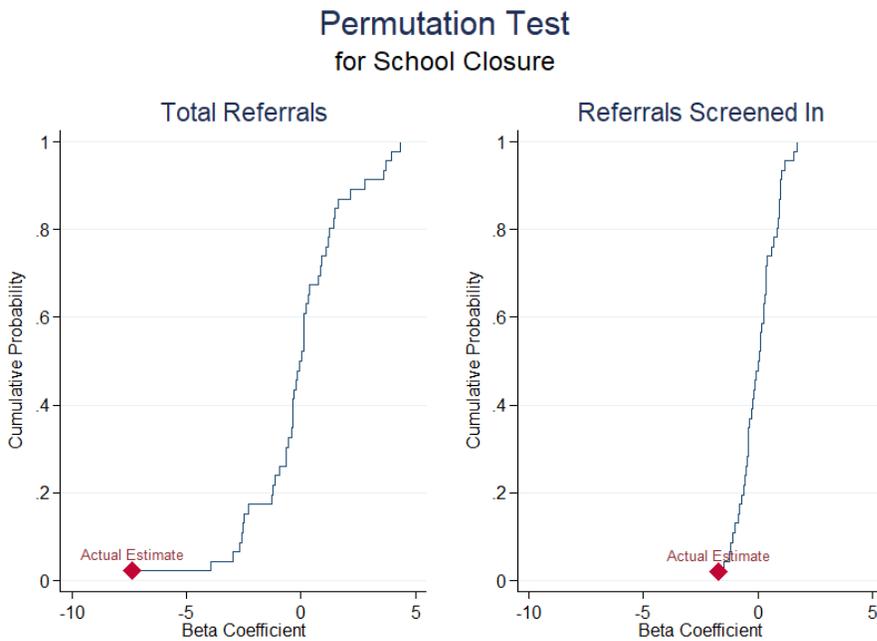
Panel C
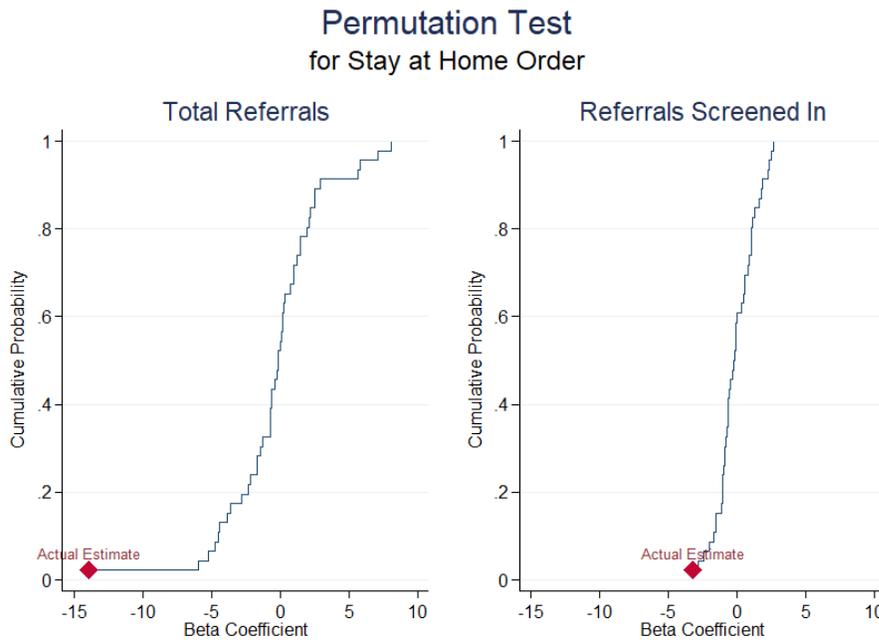
Notes: These figures plot the cumulative distribution function of the beta coefficient for the 48 placebo and one actual estimate. Panel A plots the coefficients on *covid* from equation 2, the Panel B plots the coefficients on *schclo* from equation 3, and Panel C plots the coefficient on *sah* from 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

Panel A

Actual versus Predicted Child Maltreatment Referrals in Colorado

Panel B

Actual versus Predicted Screend-In Reports in Colorado
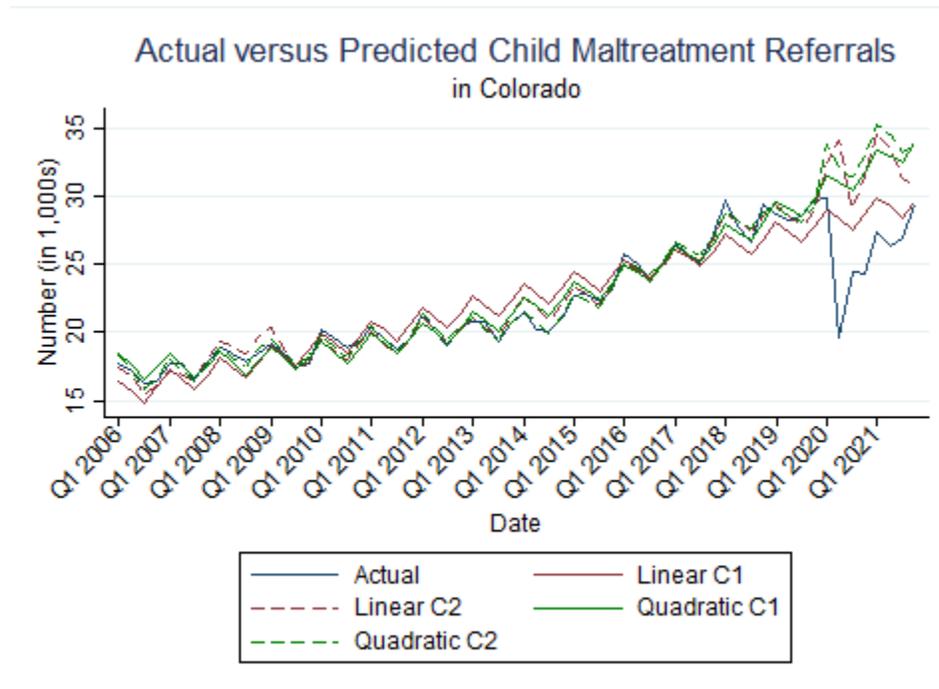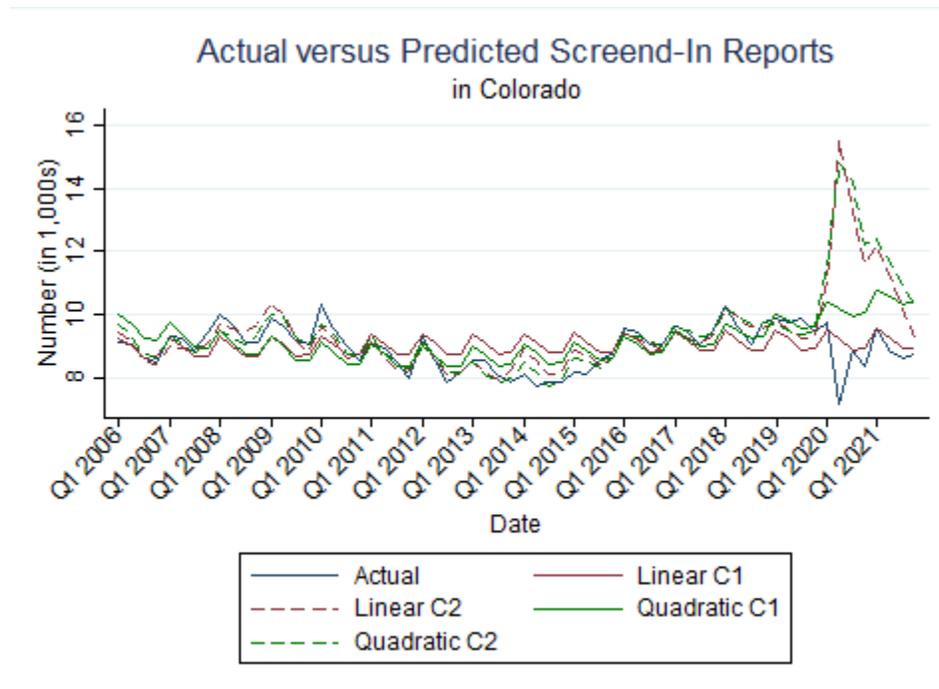
Notes: This figure plots the counterfactual estimates from equation 1 using a linear and quadratic polynomial, as opposed to the preferred cubic specification. For counterfactual 2, the linear and quadratic model are similar to the cubic model.

Appendix Table 1: Summary Statistics of Child Maltreatment Reporting and Economic Conditions in Colorado

	Mean (N=3,584)	Std. Dev.	2019 Average (N=256)	2020 Average (N=256)	p-value	2021 Average (N=256)	p-value
Child Maltreatment Variables (per 1,000 children)							
Total Referrals	18.27	9.66	24.38	19.96	0.00	22.12	0.01
Screened-in	7.90	4.94	7.83	7.05	0.06	6.98	0.03
Screened-out	10.37	7.29	16.55	12.91	0.00	15.15	0.05
Total Allegations of Maltreatment	13.60	9.48	13.42	12.52	0.26	12.02	0.07
Substantiated	3.06	3.41	2.62	2.61	0.96	2.23	0.10
Unsubstantiated	10.54	7.64	10.79	9.91	0.18	9.79	0.12
Neglect Allegations	8.38	6.63	8.74	7.94	0.15	7.46	0.01
Physical Abuse Allegations	2.35	2.03	2.20	2.12	0.62	2.06	0.41
Sexual Abuse Allegations	0.90	1.10	0.79	0.89	0.27	0.84	0.53
Substantiated Neglect	2.21	2.69	1.98	1.87	0.60	1.56	0.02
Substantiated Physical Abuse	0.36	0.67	0.25	0.25	0.90	0.28	0.57
Substantiated Sexual Abuse	0.23	0.57	0.19	0.26	0.18	0.23	0.28
Economic Conditions							
Unemployment Rate	5.47	2.92	2.75	6.46	0.00	5.05	0.00
Employment to Population Ratio	50.67	9.53	53.17	50.16	0.00	52.19	0.23
Child Population (0 to 17)	19472	39911	19636	19568	0.99	19532	0.98

Notes: This table provides summary statistics for child maltreatment reporting and economic conditions across all counties in Colorado from 2008 to 2021. The mean and standard deviation are given for all 3,584 observations (14 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. In columns 6-7, the 2021 average and corresponding p-value from a t-test compared to the 2019 average are provided. All averages for the child maltreatment variables are provided as rates, per 1,000 children, so the average of 18.03 means that a typical county received 18.03 referrals, per 1,000 children in a quarter.

Appendix Table 2: Estimated Impact of Increased Time at Home during the Pandemic on Child Maltreatment Reporting

	Main Outcomes			Allegation Type			Substantiated Maltreatment		
	Total Referrals	Reports Screened-in	Substantiated Reports	Neglect	Physical Abuse	Sexual Abuse	Neglect	Physical Abuse	Sexual Abuse
Time at Home	-0.396***	-0.038	-0.000	0.002	-0.037***	-0.002	-0.002	-0.000	-0.001
	(0.078)	(0.025)	(0.016)	(0.043)	(0.013)	(0.010)	(0.015)	(0.004)	(0.006)
Observations	206	206	206	206	206	206	206	206	206

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. The independent variable of interest is the percent change in time at home, which increased by 6.3 percent on average (Std. Dev. of 4.3). 27 out of 64 counties have 6 to 8 quarters of data (N=206) Each regression includes year, county, and quarter fixed effects.

Appendix Table 3: Robustness Analyses for Screened-in Reports

		(1) Main Results	(2) Post 2010	(3) Exclude Denver Metro-area	(4) Include Economic Controls
Panel A: Rate (per 1,000 children)	COVID-19	0.192	0.207	0.212	0.236
		(0.310)	(0.309)	(0.351)	(0.346)
	School Closure	-1.753**	-1.709**	-1.608*	-1.844**
		(0.808)	(0.788)	(0.921)	(0.929)
	Stay-at-home	-3.112**	-3.086**	-2.953*	-3.446**
		(1.418)	(1.395)	(1.610)	(1.702)
Panel B: Log	COVID-19	0.039	0.042	0.050	0.055
		(0.039)	(0.038)	(0.044)	(0.043)
	School Closure	-0.196*	-0.189*	-0.147	-0.176
		(0.118)	(0.114)	(0.134)	(0.132)
	Stay-at-home	-0.372*	-0.362*	-0.298	-0.345
		(0.206)	(0.200)	(0.232)	(0.238)
Panel C: Levels	COVID-19	-5.698	-4.970	-0.351	-3.391
		(4.271)	(4.048)	(2.583)	(4.407)
	School Closure	-44.946***	-42.802***	-21.710**	-42.245***
		(16.054)	(14.623)	(9.627)	(15.463)
	Stay-at-home	-88.284***	-85.686***	-43.829**	-86.090***
		(28.757)	(26.390)	(18.161)	(28.113)
	Observations	3,584	2,816	3,080	3,584

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 A reports the effect on the screened-in report rate, per 1,000 children. Panel B reports the effect on the log screened-in reports, and Panel C reports the effect on the total screened-in reports (level). Each regression includes year, county, and quarter fixed effects.

Appendix Table 4: Robustness Analyses for Substantiated Reports

		(1) Main Results	(2) Post 2010	(3) Exclude Denver Metro-area	(4) Include Economic Controls
Panel A: Rate (per 1,000 children)	COVID-19	-0.107	-0.163	-0.171	-0.036
		(0.275)	(0.270)	(0.313)	(0.303)
	School Closure	0.543	0.362	0.795	0.922
		(0.965)	(0.954)	(1.107)	(1.154)
	Stay-at-home	0.595	0.240	0.905	1.328
		(1.762)	(1.741)	(2.028)	(2.178)
Panel B: Log	COVID-19	-0.012	-0.019	-0.017	0.012
		(0.065)	(0.063)	(0.073)	(0.072)
	School Closure	0.179	0.159	0.254	0.300
		(0.193)	(0.183)	(0.216)	(0.219)
	Stay-at-home	0.298	0.255	0.410	0.555
		(0.344)	(0.325)	(0.387)	(0.406)
Panel C: Levels	COVID-19	0.930	1.054	-0.093	1.641
		(2.633)	(2.517)	(1.957)	(2.413)
	School Closure	-8.153	-7.669	-0.719	-7.501
		(8.093)	(6.262)	(6.229)	(8.158)
	Stay-at-home	-15.340	-15.294	-2.490	-14.062
		(14.736)	(11.529)	(11.832)	(15.077)
	Observations	3,584	2,816	3,080	3,584

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 A reports the effect on the substantiated report rate, per 1,000 children. Panel B reports the effect on the log substantiated reports, and Panel C reports the effect on the total substantiated reports (level). Each regression includes year, county, and quarter fixed effects.