

Domestic Violence Injuries During the COVID-19 Pandemic: Evidence From Medical Records*

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1 Introduction

The COVID-19 pandemic was the first time in recent memory that most people in the United States were unable to leave their homes. As a result, people spent unprecedented amounts of time at home with family and partners while also experiencing nearly unprecedented levels of economic stress and unemployment. Both of these are known risk factors for domestic violence (Aizer (2010), Anderberg et al. (2016)).

During the COVID-19 shutdown, calls to police about intimate partner violence increased in many cities in the United States (Leslie and Wilson (2020), McCrary and Sanga (2020), Hsu and Henke (2020), Bullinger et al. (2021)). It appears that abuse by current partners increased while abuse by ex-partners decreased (Ivandic et al., 2020), consistent with more time spent at home with partners. Increases in third party reporting can explain some but not all of the increases in calls, and the usual underreporting of domestic violence incidents by victims appears to have worsened during the pandemic; estimates from the National Crime Victimization Survey suggest that only about 41% of intimate partner victimizations were reported to police in 2020 compared to 58% in 2019, a 29% decrease in the reporting rate (Morgan and Thompson, 2021). However, despite the increase in calls for service, arrests and charges for domestic violence *decrease* during this period (Miller et al., 2020), (Bullinger et al., 2021). Lastly, Erten et al. (2021) find that initial increases in calls dropped off after the first rounds of CARES act stimulus payments, except in areas with lower rates of CARES payment eligibility due to immigration status. Questions remain about the overall impacts of the pandemic on domestic violence and behavioral responses to it.

In this paper, we use medical claims data to estimate the extent to which emergency department visits by women for assault and abuse injuries changed during the COVID-19 pandemic. The COVID-19 Research Database provides a dataset of claims from over 100 million patients across the country with detailed diagnostic claims that can help identify visits that may be related to domestic violence. During the pandemic, patients' willingness and ability to seek medical care

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for violence-related injuries may have changed due to perceived risk of COVID-19 infection, strain on the healthcare system resulting in a lack of emergency room capacity, or concerns about the cost of care in the face of job losses.

Like Leslie and Wilson (2020), we use an event study to compare 3-digit-ZIP-level counts of assault and abuse injuries in the year 2020 to those reported by the same insurance billing providers in the same geographic areas in the same weeks of the year in prior years. We find that seasonal patterns of domestic violence in our sample were similar in 2020 to those in 2017 and 2018 until mid-March, the onset of the COVID-19 pandemic.¹ After the onset of the pandemic, assault and abuse visits decreased by about 24% compared to the usual seasonal pattern, but gun assault visits increased by about 33%. Because most violence against women is at the hands of intimate partners (Aizer, 2010), these changes in assault and abuse visits by women are likely driven by domestic violence.

Additionally, we compare visits for accidental injuries to our measures of domestic violence visits to establish a benchmark for general decreases in emergency medical care utilization for physical injuries. We find that male accidental injury visits declined by about 35%, while female accidental injury visits, which may include some domestic violence injuries misreported as accidental, declined by only 30%. Abuse visits and female assault visits saw an even smaller decline of 24%. These results are consistent with an increase in the actual incidence of female domestic violence injuries, offset by a decrease in patients' willingness and ability to seek emergency medical care for those injuries. We also find that decreases in claims are concentrated in areas whose industry mix made them more vulnerable to the pandemic-related recession.

Our findings also suggest that, in the face of increases in domestic violence during the pandemic, victims may have been less willing and/or able to access the services they would normally seek. This may have long-term implications for patients' health after forgoing care. Additionally, domestic violence survivors who forgo medical care may also forgo other services outside their homes that carry COVID-19 infection risk. Schechter (2021), for example, finds that emergency shelter services can reduce intimate partner violence, but staying in a shelter during the pandemic may carry its own safety risks that victims are unwilling to accept. Further work may be warranted to investigate whether changes in access to services extend to non-medical support services such as emergency shelter, counseling, legal protection, or other social supports usually available to domestic violence survivors.

2 Data

2.1 Medical Claims: COVID-19 Research Database

The amount and severity of domestic violence experienced by victims is inherently difficult to measure. Victims often fear future violence should they report, feel ashamed, or may even wish to protect their abusers. While those that require medical care do seek it, many do not admit to the cause of their injuries (Rhodes et al., 2011) or hesitate to seek services for victims. The true rate of domestic assault in the United States is thus unknown, and impossible to measure precisely. However, incidents reported to police, survey measures of violence, and

¹We exclude 2019 due to a data reporting error identified by the data provider that results in an artificial dip in claims from April through July of 2019.

medical claims related to violence have entirely different sources of bias and comparisons between them can shed light on true incidence.

Much of the economic literature on domestic violence during COVID-19 (e.g. Hsu and Henke (2020), Leslie and Wilson (2020), McCrary and Sanga (2020), Miller et al. (2020)) measures incidence of domestic violence by measuring police calls for service for domestic violence offenses. However, up to a quarter of domestic violence victims report never having called police about the violence they experienced (Datner et al., 1999). Since victims may self-select into calling police based on unobserved factors such as cultural differences, fear of retaliation, or trust in police, victims who call police may be fundamentally different from those who choose not to report.

Rather than using police records, we focus on medical claims data capturing emergency department visits for assault and abuse. Patients' decisions to self-select into seeking emergency medical care are likely to be driven by different factors than those that affect self-selection into reporting to police, such as injury severity or health insurance status. However, both selection into care-seeking and selection into police reporting could be driven in part by common factors such as the level of partner control in the abusive relationship. Because the time period of the pandemic coincided with the murder of George Floyd by Minneapolis police and subsequent Black Lives Matter protests, civilian propensity to report domestic violence and police responses to domestic violence may have changed. Ang et al. (2021) find that news stories about police brutality substantially decrease citizen willingness to call for police intervention, even for serious incidents. On the other hand, May et al. (2002) find that even among patients most likely to be arrested for crime, the majority seek medical care for gunshot wounds. The data-generating process for seeking medical care should therefore be unchanged by the social justice protests of 2020.

We note that medical records are - like police records - not a panacea for the reporting of domestic violence. Medical records also fail to capture the full burden of domestic violence injury. The majority of visits for domestic violence are not recorded as such (Kothari and Rhodes, 2006). Additionally, medical visits dropped precipitously during the early months of pandemic, particularly for less severe conditions (Houshyar et al., 2020). If victims believe that their injuries are not worth the risk of possible exposure to COVID-19, they may choose not to seek medical care at all. Additionally, medical claims will be comprised only of injuries severe enough to require medical care. Injuries that do not result in physical harm requiring medical attention will not be contained in our data. We therefore cannot capture types of abuse other than physical violence, such as threats of violence or verbal or financial abuse. Finally, medical claims will only cover visits billed to an insurance provider. Pandemic-related job loss may affect patients' insurance status, so our interpretation of changes in claim counts must account for changes in sample composition based on insurance status.

In order to construct measures of emergency room claims for visits to treat severe injuries from domestic violence, we use medical claims data from the COVID-19 Research Database, a pro-bono collaboration between industry leaders and researchers to provide de-identified medical data for pandemic-related research.² While others have measured domestic violence during the pandemic in medical settings - notably in Di Franco et al. (2020) and Rhodes et al. (2020) - these papers have used data from a single hospital or treatment center. The dataset

²We considered including urgent care providers, but they comprised only 4% of billing providers who consistently reported to the database and who reported at least one assault in the data, so we elected to exclude them.

we use, provided by a large medical claims aggregator, contains tens of millions of individual visits to healthcare providers from 2017-2020.³

The sample is not nationally representative; it over-represents Medicaid patients as well as patients from certain states, particularly California and Texas. However, even after dropping geographic areas with apparent reporting issues that are difficult to resolve at the billing provider level (described below) and areas in which no emergency room billing providers report any assaults during the panel, our sample contains billing providers from emergency departments in 417 different three-digit zip codes, resulting in at least partial coverage of about 45% of the three-digit zip areas in the United States.⁴ This large coverage area should provide sufficient information to identify the general trend in emergency medical claims for domestic violence injuries at the onset of the pandemic compared to the usual seasonal pattern.

2.2 Coding Domestic Violence

We use several possible definitions of domestic violence constructed from medical billing record use of International Classification of Disease (ICD-10) coding. We use a feature of ICD coding known as external cause of morbidity codes, or "E-Codes." E-codes are a segment of ICD coding that tracks injuries by intent and mechanism of injury. Using E-codes, we construct categories of domestic violence injuries.

Our most strictly defined outcome is abuse. To be classified as abuse, the doctor or treating provider must code a visit using the ICD-10 codes T74 or T76, denoting suspected or confirmed adult and child abuse, neglect and other maltreatment. This coding choice is unlikely to include false positives, where a visit is erroneously counted as domestic violence. For visits coded as abuse, medical providers must have a strong suspicion or confirmation of abuse. However, this outcome is likely to severely undercount the number of domestic violence cases, since victims often do not share with medical providers the source of their assault injuries (Rhodes et al., 2011).⁵ For this code, we include both female and male patients, as anyone can be abused by a domestic partner.

We also include an outcome variable of "female assault" to capture female victims who are not identified by their provider as abuse victims but are nonetheless victims of IPV. About 75% of assaults of women are domestic violence (Aizer, 2010). We are forced to exclude male victims of domestic violence from this particular outcome because the majority of assaults of men are not domestic violence, so we cannot make the same assumption that assault is likely intimate partner violence for men. However, we also present analogous results for male assault victims despite the fact that they likely capture other types of violence.

This outcome measure does introduce some false positives, as female assault will include non-IPV claims as well as assaults perpetrated by partners. However, it omits fewer true domestic violence cases than the more strictly defined "abuse" outcome because it includes domestic violence victims who do not tell their medical providers the source of their injuries.

³Our data use agreement does not permit us to disclose the name of the claims aggregator that provides the data to the COVID-19 Research Database. Several aggregators provide datasets to the database, but researchers are discouraged from requesting access to multiple datasets, so we use only one.

⁴In the latest version of the results, not yet approved for export, the sample includes 555 three-digit zip codes; this 60% of 3-digit zips in the United States and 67% of those that are regular residential zips in the United States (excluding territories and IRS/military zips).

⁵According to HCUPnet, the public query tool for the National Emergency Department Sample, only about 120,300 cases of T74/T76 abuse were reported in 2018 in the U.S. for the most recent available sample.

It is unlikely that changes in this outcome are driven by factors other than domestic violence. Our estimates of changes in the number of claims for abuse visits and for female assault visits are quite similar (-20% and -24%, respectively).

If there are any compositional changes, the proportion of female assaults that are domestic violence is likely to have increased because of increased time at home with partners. If this is the case, our estimated decrease in female assault visits has a few possible interpretations. Either the incidence of non-domestic assaults decreased - which is unlikely given the documented increases in violent crime generally in the year 2020 (Graham, 2021) - or an even larger proportion of women who do seek emergency medical care for assaults are victimized by their partners, and the decrease in visits is driven entirely by care utilization or insurance status and not by incidence.

2.3 Additional Outcomes

In addition to the measures of domestic violence, we also include outcome variables of non-domestic violence and accidental injury in order to more fully understand the environment of the COVID-19 pandemic. We construct an outcome for "male assault", either with or without guns. These results may also be of interest given documented increases in homicide and violent crime generally in 2020 (Graham, 2021). We also include measures of accidental injuries as a benchmark outcome for which the underlying incidence of injuries is not known to have changed. We omit injuries resulting from motor vehicle accidents to avoid measuring decreases in injury driven by decreasing vehicle use. Accidental injury are an important comparison to characterize changes in emergency department claims for physical injuries, as increases in violence, decreases in the likelihood of seeking emergency medical care due to perceived risk or strain on the healthcare system, and decreases in claims due to changes in insurance status may have offsetting effects.

We include a range of external cause of morbidity codes to create a "gun assault" outcome variable. We include all assaults using a firearm, including rifles, handguns and unknown firearm types.⁶ Despite pooling by firearm type, gun assaults are the rarest outcome in the data and analyses of gun assaults disaggregated by gender are underpowered.⁷ Nonetheless, gun assaults are a measure of extremely severe instances of assault in which patients are very unlikely to forgo medical care due to other concerns. Patients treated in emergency departments for assault by gunshot wound suffer injuries so severe that the majority are admitted for further treatment in an inpatient setting (Fowler et al., 2015), and even with inpatient treatment, about one in six gun assaults are fatal (Braga and Cook, 2018), and firearms are used in the majority of intimate partner homicides (Gold, 2020).

Because each outcome is the number of claims filed and submitted to the claims aggregator for a given injury type, it is essentially a composite of three latent variables:

$$Claims_{at} = P(SeekCare|Injury)_{at} \cdot P(Insured|Injury)_{at} \cdot (TotalInjuries)_{at} \quad (2.1)$$

For domestic violence injury claims, all three latent variables are likely to be affected by the pandemic. Total injuries likely increased given the documented increases in domestic violence

⁶BB guns, paintball guns, and air guns are the only types of firearms excluded from firearm assaults.

⁷Results not yet approved for export also include outcomes for gun accidents alone as well as gun accidents pooled with gun assaults in a total gun injury measure.

911 calls. However, many victims may have foregone or delayed emergency medical care due to COVID-19 risk, strain on the healthcare system, or increased partner control. Finally, some victims may have become uninsured due pandemic-related job loss, causing their visits to be excluded from the sample.

For accidental injury claims, total injuries are unlikely to have changed in response to the pandemic the way that domestic violence injuries did.⁸ However, care-seeking behavior and insurance status are likely to have changed in a similar manner.

Finally, for gun injuries (both gun accidents and gun assaults), actual injuries are likely to have increased and insurance coverage is likely to have decreased, but care-seeking behavior should be unchanged. As noted above, because gun injuries are usually so severe and life-threatening, victims are likely to seek emergency medical care no matter what.

By comparing results across non-gun assaults, accidental injuries, and gun injuries, especially those exploring heterogeneity by day of week and economic impact of the pandemic, we can ascertain the extent to which changes in claim counts are likely to be driven by propensity to seek care, insurance status, and actual domestic violence injuries.

2.3.1 Panel Construction

We construct a balanced panel of “good reporters” from billing provider unique identifiers to consistently track weekly emergency department visit volume without bias from idiosyncratic data reporting behavior at the provider level. We require that each billing provider - generally, a doctor or group of doctors - submit at least one claim in a given state in at least 50 weeks each of 2017, 2018, and 2020 to be included in the panel. This approach is especially important to appropriately use the COVID-19 Research Database, as billing providers vary in terms of how far back in time their records are included. Our approach avoids false zeros in the panel, or instances where a provider does not report assaults not because there were no assaults, but because it does not appear in the dataset that week.

The year 2019 is excluded from our sample due to a known data reporting issue identified by the data provider that results in an artificial dip in claims in April through July of 2019.⁹ After filtering out billing providers with irregular reporting behavior, claims are aggregated to the area-week level. An area is defined as a three-digit ZIP code, which is roughly city-sized; larger cities are often split into “main” and “metro”. This is the finest geographic designation allowed by the database.

Despite filtering out billing providers based on inconsistent reporting behavior, some reporting anomalies remain at the three-digit ZIP code level. Specifically, areas that report very few assault or accidental injury claims will infrequently report disproportionately high visit counts. To mitigate this concern, each 3-digit ZIP area a is assigned a percentile $Percentile_{ay}$ of assault

⁸Car accidents are excluded due to changes in driving behavior. Results for accidental injury visits are consistent even when splitting the sample by gender, weekend vs. weekday visits, or both, suggesting that changes are unlikely to be driven by a reduction in workplace injuries as men and women on average may work in different industries and workplace injuries would on average be more likely to occur on weekdays.

⁹Previous versions of the paper reported different results because we had not yet been notified of this error and had used 2019 as the main comparison year for the analysis. The additional reporting checks described below appear to mitigate this dip in claims in the spring and summer of 2019 but not eliminate it entirely. We are in communication with the data provider and attempting to determine the scope of the problem so that future versions of the paper can include robustness checks where 2019 is used as an additional comparison year after appropriate adjustments are made.

claims and accidental injury claims reported in the first ten weeks of each year y of the panel. Each ZIP area's percentile range $PctRange_a$ is calculated as:

$$PctRange_a = \max_z(Percentile_{ay}) - \min_z(Percentile_{ay})$$

Areas above the 95th percentile of $PctRange_a$ in either assault claims or accidental injury claims are dropped from the panel, as their extreme movement in percentiles across years in the weeks of the year prior to the onset of the pandemic is likely to be the result of changes in medical claim reporting behavior rather than a measure of true changes in injury visit rates.

The final panel includes 100,672 professional claims for assault injuries, 4,457 for abuse injuries, and 654,535 for accidental injuries across 417 three-digit zip areas over three years. Many of these areas rarely report assaults in our sample, and may not report assaults every year. Results are robust to limiting the sample to areas that do report assaults every year, as these areas provide most of the variation in the panel.¹⁰

3 Research Design

To investigate whether the pandemic and associated behavioral and policy responses, changed emergency room visits for abuse and assault, we use a difference-in-differences design comparing 2020 to the usual seasonal pattern of claims in 2017 and 2018 before and after the onset of the pandemic in March. This is essential in order to capture the true effect of pandemic behavior change, as many people in non-lockdown areas nonetheless acted as if they were under a lockdown (Goolsbee and Syverson, 2021). This design is similar to that used by Leslie and Wilson (2020), the first to document the increase in domestic violence 911 calls at the beginning of the pandemic.

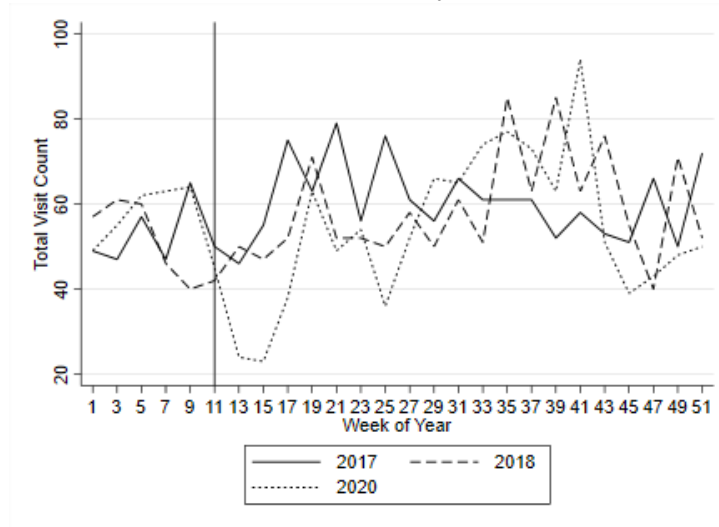
Figure 1 shows trends in abuse-related emergency room visits in 2017, 2018, and 2020, aggregated to two-week periods. Prior to the onset of the pandemic around the 11th week of the year, 2020 looks relatively similar to the usual seasonal pattern in 2017 and 2018. For several weeks after the 11th week of the year, abuse visits appear to decline in 2020.

However, according to the ICD-10-CM Official Guidelines for Coding and Reporting (2020), an abuse-related visit appears in E-codes when a medical provider denotes that a patient's injury are a result of domestic abuse, confirmed or suspected, in the patient's medical record. This is a relatively rare outcome, coded in only approximately 120,300 emergency department visits in 2018.

There are several reasons that abuse - despite being the only code specifically for domestic violence - should not be the only outcome measure we use. Not all patients share with their medical providers the source of their assault injuries. Further, not all medical providers may record this information as it is not necessary for reimbursement purposes. Finally, increased media attention to the risk of domestic violence during the pandemic may have affected medical provider willingness to report. For these reasons, we also consider overall assault visits by female patients to be a proxy for domestic violence, since most violence against women is perpetrated by partners.

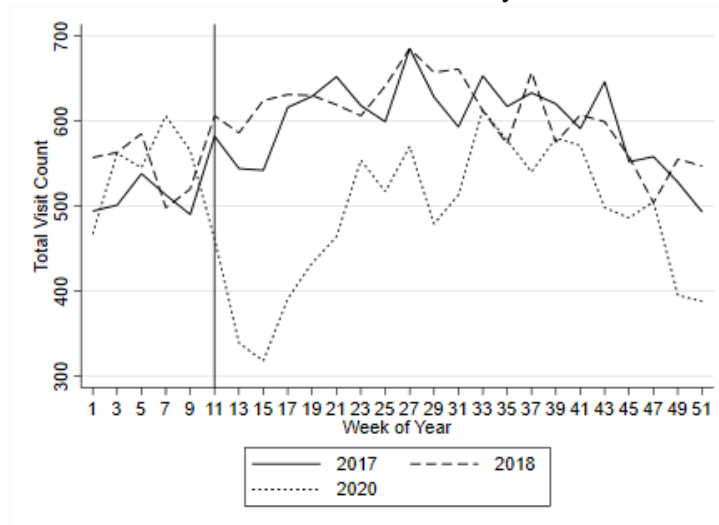
¹⁰These results have not yet been reviewed for disclosure by the database administrators but will be included in future versions of the paper.

Figure 1: Total Abuse Visit Counts by Two-Week Period of Year



Notes: Figure shows abuse emergency room visit counts for the 417 three-digit zip areas in the main sample aggregated to the two-week period of each year. Analogous figures are shown in the Appendix for abuse visit counts disaggregated by gender, and show similar patterns. Unsurprisingly, abuse visit counts are comprised primarily of female patients.

Figure 2: Total Female Assault Visit Counts by Two-Week Period of Year

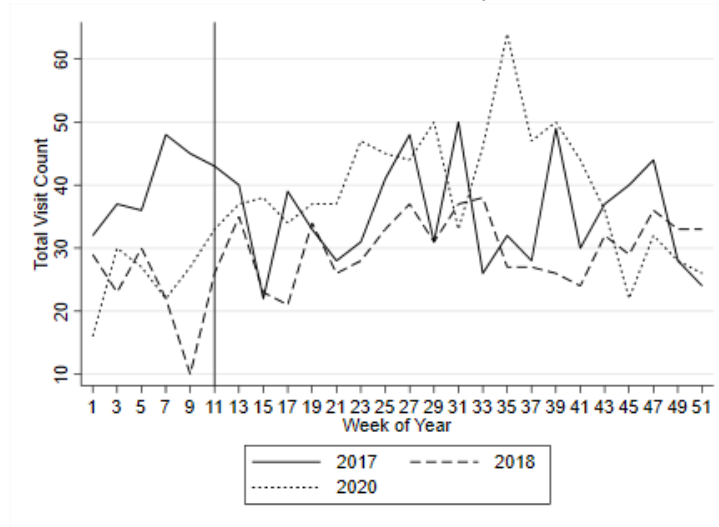


Notes: Figure shows female assault emergency room visit counts for the 417 three-digit zip areas in the main sample aggregated to the two-week period of each year.

Figure 2 shows trends in assault visits with female patients in 2017, 2018, and 2020. There is a large, pronounced dip in assault visits at the onset of the pandemic in 2020 following a similar trend to the usual seasonal pattern in the first ten weeks of the year. The similarity of the trends in the first ten weeks of the year suggests that the trend in assault visits in 2020 would have likely been similar to the usual seasonal pattern in the absence of the pandemic.

Gun assaults are an important subset of assaults to consider, as the majority of gunshot assaults treated in emergency departments are so severe they warrant inpatient hospitalization. Patients with a gunshot assault wound therefore face substantial risk if left untreated. For these patients,

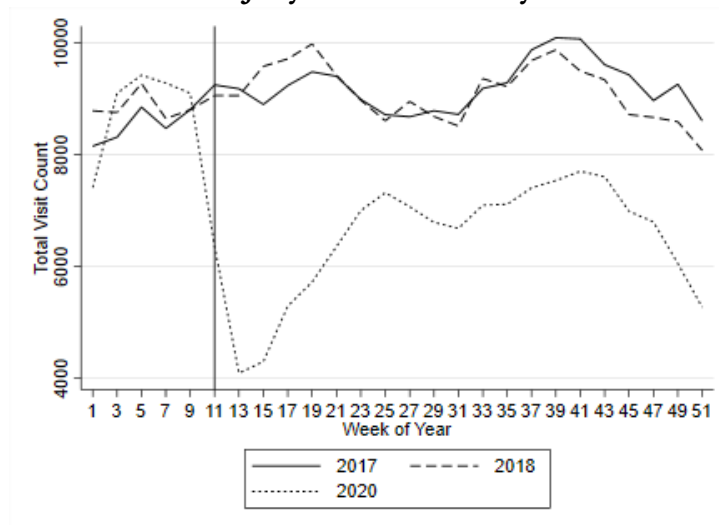
Figure 3: Total Gun Assault Visit Counts by Two-Week Period of Year



Notes: Figure shows overall gun assault emergency room visit counts for the 417 three-digit zip areas in the main sample aggregated to the two-week period of each year. Analogous figures with gun assaults disaggregated by gender are shown in the Appendix. Trends are noisy, as gun assaults are quite rare.

the severity of injury is likely to outweigh the risk of contracting COVID-19 while visiting the emergency room, and emergency rooms with limited bed space would likely prioritize space for gunshot victims. Figure 3 shows trends in gun assault visits in each year of the panel; the trends are noisy, as gun assaults are a rare outcome, but they appear similar in the first ten weeks of the year and appear to increase later in the year. This is consistent with other indicators of gun violence; as noted by Schleimer et al. (2021), gun purchases and gun injuries increased at the onset of the pandemic, with an estimated 4.3 million excess gun purchases in April 2020.

Figure 4: Total Accidental Injury Visit Counts by Two-Week Period of Year



Notes: Figure shows overall accidental injury emergency room visit counts for the 417 three-digit zip areas in the main sample aggregated to the two-week period of each year. Analogous figures with gun assaults disaggregated by gender are shown in the Appendix. Trends are noisy, as gun assaults are quite rare.

For comparison, we perform the same analysis for injuries resulting from accidents such as tripping and falling or running into a stationary object. Because existing work documents increases in the incidence of domestic violence and gun injuries during the pandemic, we believe the simultaneous increases in incidence of domestic violence and any decreases in health care utilization may have offsetting effects. Estimates of changes in emergency room utilization for other non-intentional injuries can provide a benchmark against which to compare changes in visits for assault injuries. Figure 3 trend shows trends in accidental injury visits in each year of the panel. In the early weeks of the year, there were more accidental injury visits in 2020 than in the other years; after the onset of the pandemic, accidental injury visits in 2020 decrease sharply relative to prior years.

Provided that trends in visits would have been similar in 2020 to 2017 and 2018 in the absence of the pandemic, comparing 2020 to the usual seasonal trends in visits before and after week 11 (the onset of the pandemic) should provide the causal effect of the pandemic on visit counts. However, even if the equal counterfactual trends assumption does not hold, the estimates are interesting in their own right. They reflect recent changes in health care utilization that may have implications for the importance of follow-up care.

3.1 Event Study

To assess how 2020 differed from the usual seasonal pattern of assault and abuse visits, we use an event study specification comparing a given two-week period τ in 2020 to the same period in 2017 and 2018. This will capture all of the changes in 2020, both the stay-at-home orders and self-imposed changes in behavior to mitigate pandemic risks. Each observation $AssaultClaims_{awy}$ is at the week level but coefficients are pooled at the two-week level (where $Period_\tau = 1$ if $w = \tau$ or $w = \tau + 1$), as assaults are a relatively rare outcome in some zips and are somewhat noisy at the weekly level.

We estimate:

$$AssaultClaims_{awy} = \sum_{\tau=1,3,5,\dots}^{51} \beta_\tau(Period_\tau \cdot Year2020_y) + Year2020_y + \theta_\tau + \theta_a + \epsilon_{awy} \quad (3.1)$$

with the two-week period τ beginning week 11 of the year as the reference period, as this is generally regarded as the beginning of the pandemic in the United States. β_τ is interpreted as the year-over-year change in assault injury visits in period τ of 2020 over the average in the same period in 2017 and 2018. θ_τ is a two-week period fixed effect, and θ_a is a three-digit zip area fixed effect. Standard errors are clustered at the three-digit zip area level. Results from a similar specification using state fixed effects and clustering standard errors at the state level have similar point estimates but are more noisily estimated.¹¹

3.2 Pooled Difference-in-Differences

We also estimate the following pooled difference-in-differences specification to obtain an overall estimate of how the number of assault and abuse claims in 2020 differed from the usual seasonal average after the onset of the pandemic:

¹¹These results have not yet been reviewed for disclosure by the database administrators but will be included in future versions of the paper.

$$\text{AssaultClaims}_{awy} = \beta_0 + \beta_1 \text{Year2020}_y + \beta_2 \text{After}_w + \beta_3 (\text{Year2020}_y \cdot \text{After}_w) + \theta_a + \epsilon_{awy} \quad (3.2)$$

where *After* is an indicator for whether $w > 11$, and the coefficient on the interaction term β_3 is interpreted as the change in claims in 2020 before and after the onset of the pandemic in week 11 compared to the usual seasonal pattern in 2017 and 2018. θ_a is a three-digit-zip fixed effect and standard errors are clustered at the three-digit-zip level. Results from a similar specification using state fixed effects and clustering standard errors at the state level are also similar but more noisily estimated.¹² It should be noted that, based on the pattern of effects in the event studies, the effect appears to be concentrated in the early months of the pandemic, so these overall estimates should be interpreted with the understanding that some patients may have delayed care to the later weeks of the year.

3.3 Labor Market Heterogeneity

To explore heterogeneity resulting from geographic differences in the severity of the recession induced by the onset of the COVID-19 pandemic, we use a triple-difference model relying on the predicted year-over-year change in the local unemployment rate from 2019 to 2020 ($\Delta Unemp_a$) based on preexisting labor market characteristics as of 2019.

We use unemployment data from the Bureau of Labor Statistics' Local Area Unemployment Statistics and industry composition data from the U.S. Census Bureau's County Business Patterns data. County Business Patterns provides total employment at the zip-code level, but industry counts are heavily censored at the 5-digit zip level and unavailable at the 3-digit zip level. For this reason, we construct estimates for the proportion of each 3-digit zip area a 's employment in each 2-digit industry group ι using the average proportion of employment in that industry in each county c of the k counties that comprise area a ,

$$\text{PropEmp}_{a\iota} = \sum_{c=1}^k \text{PropEmp}_{ac} \cdot \text{PropEmp}_{c\iota}$$

weighted by the total proportion of 3-digit zip area a 's employment contributed by county c . This is done for each two digit industry group ι of all the two-digit NAICS codes included in the County Business Patterns data.¹³

To predict each 3-digit zip area a 's vulnerability to the pandemic recession, we estimate:

$$\Delta Unemp_a = \beta_0 + \sum_{\iota=1,2,3,\dots}^{19} \beta_{\iota} \text{PropEmp}_{a\iota} + \theta_{a\iota} + \beta_2 \text{Unemp2019}_a + (\theta_{a\iota} \cdot \text{Unemp2019}_a) + \epsilon_a \quad (3.3)$$

where $\text{PropEmp}_{a\iota}$ is the proportion of 3-digit zip area a 's employment in industry ι , and $\theta_{a\iota}$ are dummies for whether each industry group ι 's share of employment in area a is above the

¹²These results have not yet been reviewed for disclosure by the database administrators but will be included in future versions of the paper.

¹³Code 99 for miscellaneous industries is omitted.

industry's average share in the sample. We then use predicted changes in the unemployment rate $\Delta \hat{Unemp}_a$ in the following triple-difference specification to determine the differential effect of the pandemic as a result of each area's specific vulnerability to the pandemic-related recession based on its industry mix:

$$\begin{aligned} \text{AssaultClaims}_{awy} = & \beta_0 + \beta_1 \text{Year2020}_y + \beta_2 \text{After}_w + \beta_3 (\text{Year2020}_y \cdot \text{After}_w) \\ & + \beta_4 (\text{Year2020}_y \cdot \text{After}_w \cdot \Delta \hat{Unemp}_a) + \theta_a + \epsilon_{awy} \quad (3.4) \end{aligned}$$

where β_3 gives the effect of the pandemic on assault claims for $\Delta \hat{Unemp}_a = 0$, and β_4 gives the differential effect for each percentage point increase in $\Delta \hat{Unemp}_a$. However, we ask the reader to exercise caution in the interpretation of β_3 , as the minimum predicted and actual changes in the unemployment rate are around one percentage point.

3.4 Future Work

Future versions of this paper may include staggered difference-in-differences estimates of the effects of the implementation and lifting of stay-at-home orders and school closures on assault and abuse visits using the estimator recently developed by Callaway and Sant'anna (2020) that corrects for biases in the traditional two-way fixed effects estimator. However, preliminary estimations not yet approved for export suggest that these results may suffer from low statistical power due to little variation in implementation timing. Furthermore, event studies show spurious pre-period placebo effects, suggesting that the equal counterfactual trends assumption may not be satisfied; states that implemented earlier social distancing policies may be fundamentally different from later adopters.

We will also use SafeGraph data to explore heterogeneity based on COVID-19 risk mitigation behavior resulting in reductions in mobility. If effects are concentrated in areas with more reductions in mobility behavior, they are likely driven primarily by reduced willingness to seek care due to perceived infection risk. Otherwise, if they are concentrated in areas with less risk mitigation behavior, they could be primarily driven by lack of sufficient emergency room capacity for victims of assaults to receive care or could be partially offset by greater incidence of violence in areas where people spent the most time at home with partners.

Lastly, future work will include sub-samples differentiating Medicaid claims from those billed to private insurance plans. This distinction will shed light on the extent to which decreases in claims are driven by care-seeking behavior rather than insurance loss alone. Because both Medicaid eligibility and Medicaid enrollment increased at the onset of the pandemic (Dague et al., 2022; Khorrami and Sommers, 2021), this split will likely be informative regarding the role of insurance coverage changes in any estimated effects.

4 Results

Immediately after the onset of the pandemic, we find decreases in emergency department medical claims across all outcomes except gun injuries. We find an increase in gun assaults in 2020 after the onset of the pandemic. In additional results not yet approved for export, we find similar increases in gun accidents.

This exception suggests that the decrease in visits likely reflects changes in ability and willingness to access care - patients with gunshot wounds are nearly certain to go to the hospital regardless of perceived risk of COVID infection or availability of bed space. Patients with other types of injuries may be unwilling to seek care due to infection risk, unable to obtain care due to strain on the healthcare system, or may enter and exit the sample based on changes in insurance status.

We find that the decrease in abuse and female assault visits is smaller, in percentage terms, than that of the decrease in accidental injury visits. This pattern is consistent with an increase in actual domestic violence injuries accompanied by a decrease in the probability of receiving or seeking emergency medical care for a domestic violence-related injury.

Decreases in claims are concentrated in the early months of the pandemic, and for some outcomes, there appear to be modest increases in the second half of the year. Increases in visits later in the year could be a result of patients delaying care to a safer time, or a result of actual increases in violence. Regardless, this pattern in the event study estimates is important to consider when interpreting pooled difference-in-differences estimates.

4.1 Accidental Injury Claims

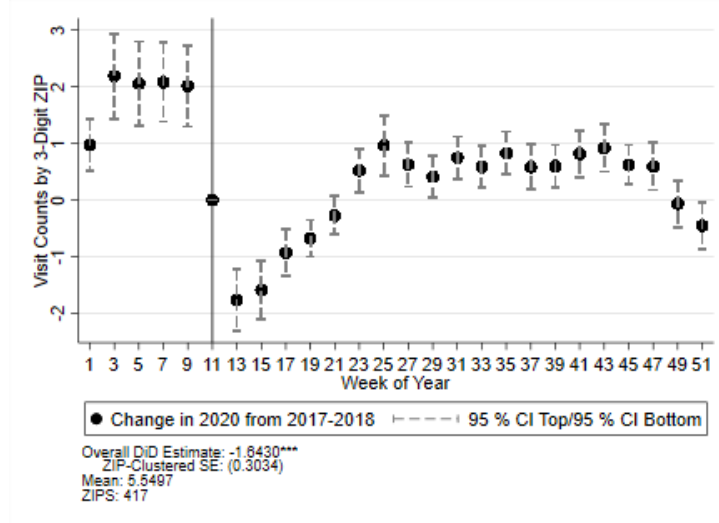
We first estimate the event study and pooled difference-in-difference specifications with accidental injuries as the outcome. We find that accidental injury visits by women in 2020 (Figure 5) decreased by about 30% compared to the 2017-2018 seasonal average after the onset of the pandemic, and those by men decreased by about 35% (Figure 6).¹⁴ These effects are statistically significant at the 0.1% level. To our knowledge, there has been no documented increase in the incidence of accidental injuries at the onset of the pandemic, so these estimates provide a benchmark for how utilization of care changed overall.

As noted above, women who seek medical care after domestic violence incidents may not tell medical providers the true source of their injuries, perhaps for fear of retaliation from their partners or social stigma. The fact that the decrease in accidental injury visits is larger for men than for women could be suggestive of domestic violence injuries misreported as accidental injuries, but disentangling this difference is beyond the scope of this paper given the available data. However, given this possibility, we will use the 35% decrease in male accidental injury visits as the benchmark against which to compare other changes in emergency room utilization. One might be concerned that this larger decrease may be affected by decreases in workplace injuries; however, results not yet approved for export show that percentage decreases in both male and female accidental injury claims are nearly identical across weekends and weekday visits, so actual workplace injuries are unlikely to be the primary driver of these gender differences.

General decreases in emergency department utilization at the onset of the pandemic are unsurprising, and could have several different potential mechanisms. If people are simply voluntarily mitigating COVID-19 infection risk, they may avoid emergency rooms because they are a high-risk location where one might have a high probability of coming into contact with a COVID-19 patient. On the other hand, people could be concerned that the emergency room will not have a bed available, and may either choose not to go or be turned away due to lack of space. Furthermore, unemployment skyrocketed during the early months of the

¹⁴Gender-pooled accidental injury visit estimates and details of ICD-10 codes used to identify accidental injuries are reported in the Appendix.

Figure 5: Event Study - Female Accidental Injury Visits, 2020 vs. 2017-2018

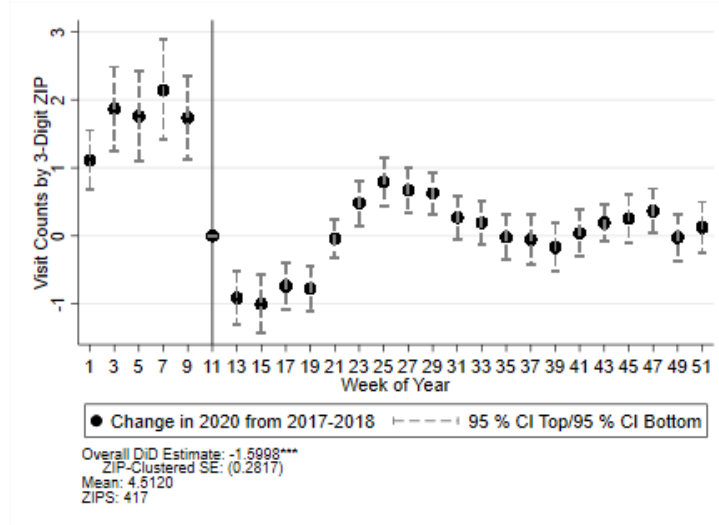


Notes: Figure shows event study comparing female accidental injury emergency room visit counts for the 417 three-digit zip areas in the main sample aggregated to the two-week period of each year to the same two-week periods in 2017-2018. Event study coefficients are estimated using the specification in Equation 3.1 and the overall difference-in-differences coefficient is estimated using the specification in Equation 3.2. The level of observation is the area-week-year, and standard errors are clustered at the three-digit zip area level.

pandemic. Those who lost their jobs may have experienced changes in insurance coverage, income, or both. Patients may delay care for less severe injuries if they are concerned about not being able to cover the cost of their care, or may exit the sample due to changes in medical providers.¹⁵

¹⁵The claims aggregator has informed us that claims are reported to the dataset by billing providers (doctors or groups of doctors) rather than payers (insurance companies), but has not given additional information about how observations come to appear in the data. Future analyses will include heterogeneity by insurance type to mitigate this concern.

Figure 6: Event Study - Male Accidental Injury Visits, 2020 vs. 2017-2018



Notes: Figure shows event study comparing male accidental injury emergency room visit counts for the 417 three-digit zip areas in the main sample aggregated to the two-week period of each year to the same two-week periods in 2017-2018. Event study coefficients are estimated using the specification in Equation 3.1 and the overall difference-in-differences coefficient is estimated using the specification in Equation 3.2. The level of observation is the area-week-year, and standard errors are clustered at the three-digit zip area level.

4.2 Abuse Claims

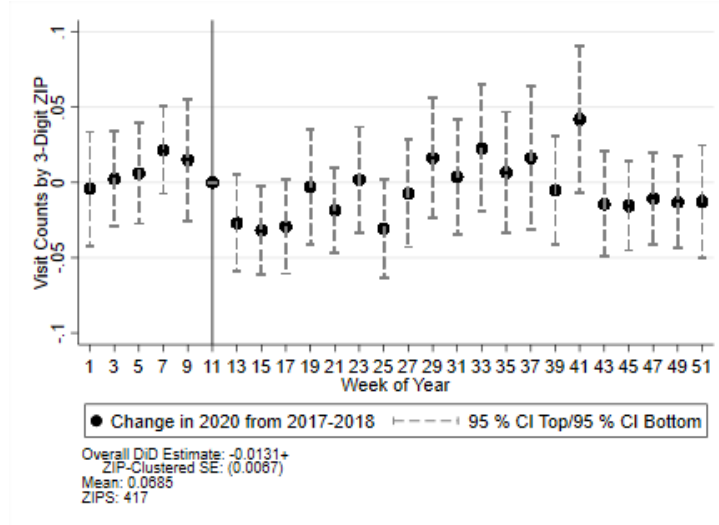
Figure 7 shows an event study comparing abuse-related emergency room visit claims in 2020 to the usual seasonal pattern in 2017 and 2018. Abuse claims decreased in the first several weeks following the onset of the pandemic. The overall difference-in-differences estimate suggests an overall 20% decrease, driven mostly by these early weeks. This decrease is statistically significant at the 10% level; the marginal significance is unsurprising given that abuse is a rare outcome.

The fact that abuse visits decreased only 20% compared to the 35% reduction in male accidental injury visits is consistent with increases in the incidence of abuse injuries potentially being offset by decreased willingness and ability to seek emergency medical care.

Analogous event studies for gender-disaggregated female and male abuse visits are presented in the Appendix. The effect is too noisy to detect for male abuse visits because they are exceedingly rare, but the time patterns of the event study coefficients for women and for men are similar to those in the pooled event study presented here.

Results not yet approved for export suggest that, unlike those for accidental injury visits, decreases in abuse claims are larger for weekend visits than for weekday visits. This pattern would be consistent with increased partner control as a potential mechanism for decreased care-seeking among patients whose partners kept their jobs during the pandemic and continued going to work during the week, and who either have a documented medical history of domestic abuse or are willing to disclose their abuse to their medical provider. These victims may be more able to seek care during the week when their partner is at work.

Figure 7: Event Study - All Abuse Visits, 2020 vs. 2017-2018



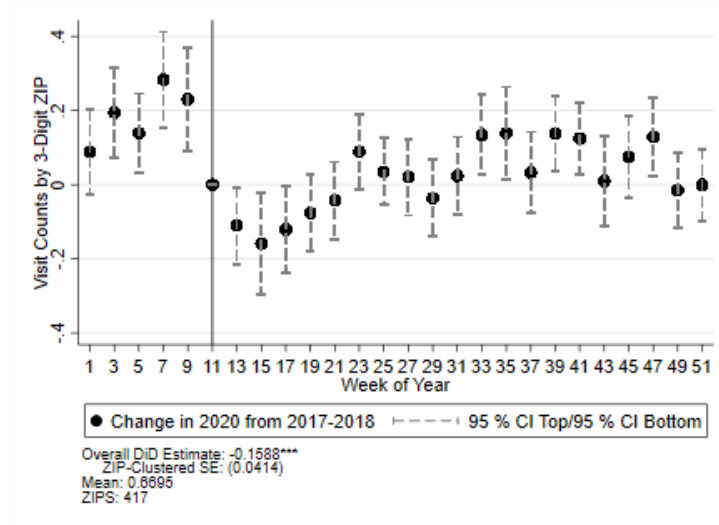
Notes: Figure shows event study comparing abuse-related emergency room visit counts for the 417 three-digit zip areas in the main sample aggregated to the two-week period of each year to the same two-week periods in 2017-2018. Event study coefficients are estimated using the specification in Equation 3.1 and the overall difference-in-differences coefficient is estimated using the specification in Equation 3.2. The level of observation is the area-week-year, and standard errors are clustered at the three-digit zip area level.

4.3 Assault Claims

Figure 8 shows an event study comparing counts of emergency room visits by women for assault injuries in 2020 vs. the usual seasonal pattern in 2017 and 2018. The overall difference-in-differences estimate suggests a statistically significant decrease of about 24%, driven entirely by the early weeks of the pandemic. In fact, the second half of the year shows modest increases over the seasonal average in 2017 and 2018, although these increases are smaller than the preexisting difference between 2020 and the prior years in the first ten weeks of the year.

As documented by Aizer (2010) and noted above, about 75% of assaults against women are perpetrated by intimate partners. Women who were assaulted by their partners during the early weeks of the pandemic appear not to have sought medical care for their injuries at the same rate as they otherwise would have.

Figure 8: Event Study - Female Assault Visits, 2020 vs. 2018



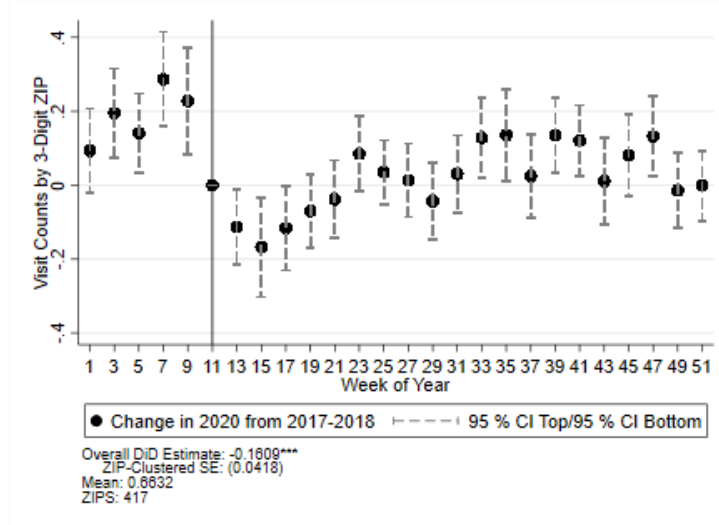
Notes: Figure shows event study comparing counts of emergency room visits by women for assault injuries for the 417 three-digit zip areas in the main sample aggregated to the two-week period of each year to the same two-week periods in 2017-2018. Event study coefficients are estimated using the specification in Equation 3.1 and the overall difference-in-differences coefficient is estimated using the specification in Equation 3.2. The level of observation is the area-week-year, and standard errors are clustered at the three-digit zip area level.

As shown by the nearly identical estimates in Figure 9, the decrease in female assault claims is driven entirely by assaults that did not involve a firearm.

Results not yet approved for export show that, unlike visits specifically designated as abuse, overall claims for female assault injuries declined more for weekday visits than for weekend visits, although the difference is much smaller than that for abuse visits. The role of partner control in domestic violence patients' ability to seek care may vary based on whether or not their partner perceives that they are likely to tell their medical provider the source of their injuries.

Event studies for all assaults and non-gun assaults for male patients and for men and women combined are presented in the Appendix, and show a similar pattern. Male assault claims decreased by about 21%. This is substantially less than the 35% decrease in male accidental injury visits, and is consistent with a general increase in violence during the pandemic being offset by reduced likelihood of accessing emergency medical care.

Figure 9: Event Study - Female Non-gun Assault Visits, 2020 vs. 2017-2018



Notes: Figure shows event study comparing counts of emergency room visits by women for non-gun assault injuries for the 417 three-digit zip areas in the main sample aggregated to the two-week period of each year to the same two-week periods in 2017-2018. Event study coefficients are estimated using the specification in Equation 3.1 and the overall difference-in-differences coefficient is estimated using the specification in Equation 3.2. The level of observation is the area-week-year, and standard errors are clustered at the three-digit zip area level.

4.4 Gun Assault Claims

Gun assault visits are the exception to the across-the-board decrease in assault-related emergency room visits. Figure 10 shows an event study of gun assault visits in 2020 compared to prior years, and estimates that gun assaults increased by about 41% after the onset of the pandemic. Importantly, this increase appears to have begun gradually over the course of the pandemic.

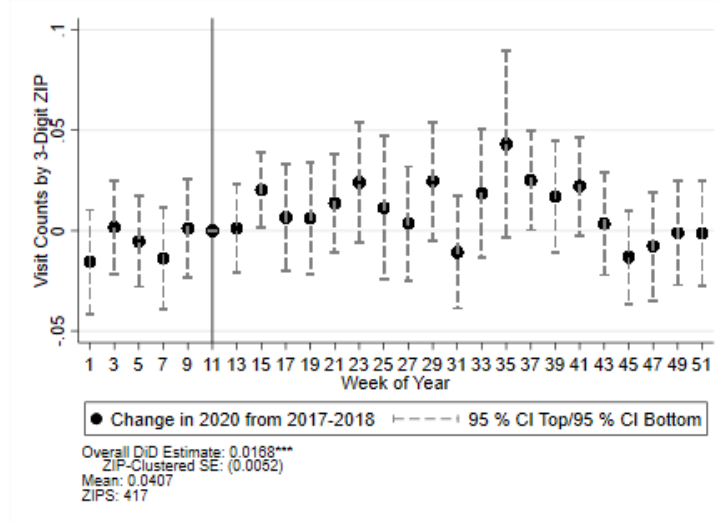
The fact that all other assault visits decreased but gun assault visits increased suggests that when injuries are severe enough, victims of violence are still willing and able to receive emergency medical care, even during a pandemic. Future versions of the paper will include additional analyses exploring effect heterogeneity driven by injury severity.

Results for gun assault visits disaggregated by gender are reported in the Appendix. The effects for women are quite noisily estimated, because female gun assaults are extremely rare. Because of this, we are unable to precisely estimate the impact of the pandemic on female gun assaults, which are among the most severe domestic violence injuries. However, the time series of event study coefficients is similar for men and women.¹⁶

Additional results not yet approved for export suggest that claims for accidental gun injuries follow a similar pattern to those for gun assaults. We also aggregate gun assaults and gun accidents to a total gun injury measure and find that increases in total gun injuries are similar in percentage terms across male and female patients.

¹⁶A new version of these results not yet approved for export does find a statistically significant increase for female gun assaults as well.

Figure 10: Event Study - All Gun Assault Visits, 2020 vs. 2017-2018



Notes: Figure shows event study comparing counts of emergency room visits for gun assault injuries for the 417 three-digit zip areas in the main sample aggregated to the two-week period of each year to the same two-week periods in 2017-2018. Event study coefficients are estimated using the specification in Equation 3.1 and the overall difference-in-differences coefficient is estimated using the specification in Equation 3.2. The level of observation is the area-week-year, and standard errors are clustered at the three-digit zip area level.

4.5 Labor Market Heterogeneity

We estimate differential effects of the pandemic by predicted local severity of pandemic-related job losses on accidental injury claims, female assault and abuse claims, and gun injury claims. These results are not yet approved for export.

For assault, abuse, and accidental injury claims, areas with greater predicted job losses experience greater reductions in claims at the onset of the pandemic. The percentage decrease in accidental injury claims is similar for weekday and weekend visits among both men and women, again showing little evidence of actual changes in accidental injuries from workplace accidents. This is suggestive evidence that the number of underlying accidental injuries is unlikely to have changed substantially as a result of the pandemic and changes are likely driven by care seeking behavior and/or insurance loss. Much like the main results, decreases in female assault visits are driven by weekday visits, and this decrease is driven by areas with higher predicted increases in the unemployment rate. For both accidental injury claims and female assault claims, β_3 (the main effect of the pandemic) is positive and β_4 (the differential effect per predicted percentage point increase in the unemployment rate) is negative.

Gun injury claims show a different pattern. For this outcome, β_3 (the main effect of the pandemic) is negative, and β_4 (the differential effect per predicted percentage point increase in the unemployment rate) is positive. For gun injuries, care seeking is likely to have remained unchanged since gun injuries tend to be so severe. Because crime statistics show increases in gun injuries overall, the negative coefficient on β_3 likely reflects claims not showing up in the sample due to insurance loss, and the positive coefficient β_4 suggests that increases in gun violence were larger in areas hit harder by the pandemic recession.

Overall, the totality of these results reflect the need for further analysis by insurance type. The

next version of the paper will include a set of results that limits the sample to states or zip areas that have both private insurance and Medicaid claims, and estimates both the main effects and the heterogeneous labor market effects separately for Medicaid and private insurance claims.

5 Conclusion

Overall, the results in this paper suggest that, despite previously documented increases in the incidence of domestic violence at the onset of the pandemic, emergency department medical claims for assault and abuse decreased unless the assault involved a gun. Decreases in assault and abuse claims were smaller than decreases in accidental injury claims, which is consistent with offsetting effects of the pandemic: we believe it is likely that domestic violence increased during the pandemic, but that this effect was outweighed by the overall decrease in both medical care sought and in insurance coverage during 2020.

Particularly, decreases in claims appear to be concentrated in the early weeks of the pandemic when many jurisdictions were under stay-at-home orders and mobility was restricted. We also find that decreases in assault, abuse and accidental injury claims as well as increases in gun injury claims are concentrated in areas whose industry mix made them more vulnerable to pandemic-related increases in the unemployment rate. Future versions of the paper will explore additional potential mechanisms that may have induced people to delay or forgo medical care for their injuries, as well as heterogeneity based on voluntary changes in mobility, injury severity, and economic conditions. These additional analyses will disentangle whether reduced health care utilization is driven by infection risk aversion, emergency department capacity constraints, changes in income and insurance coverage, or some combination of the above.

6 Appendix

Figure 11: Event Study - All Accidental Injury Visits, 2020 vs. 2017-2018

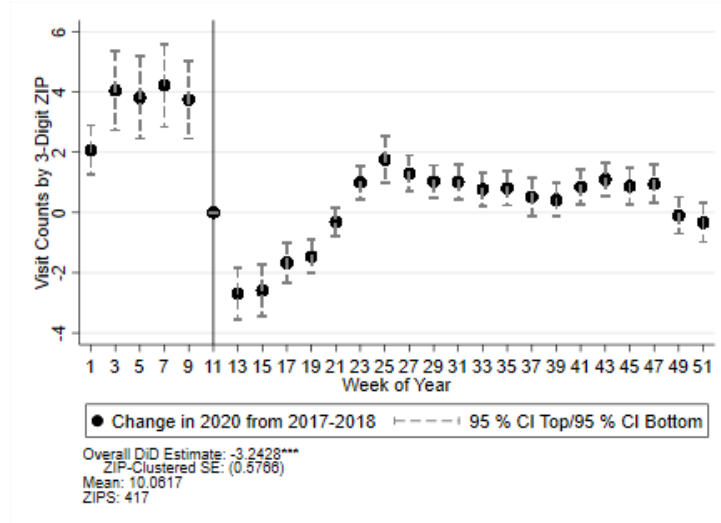


Figure 12: Event Study - Female Abuse Visits, 2020 vs. 2017-2018

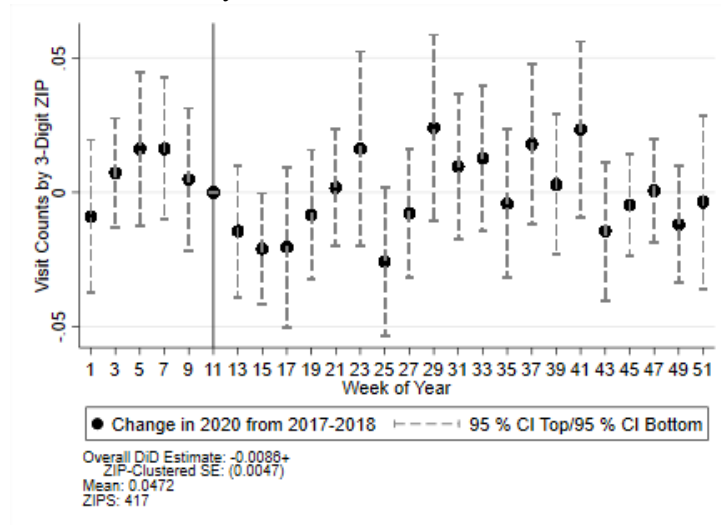


Figure 13: Event Study - Male Abuse Visits, 2020 vs. 2017-2018

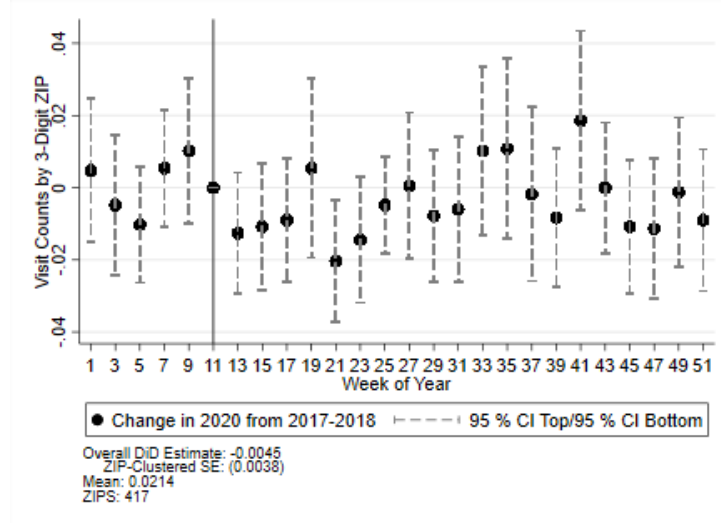


Figure 14: Event Study - All Assault Visits, 2020 vs. 2017-2018

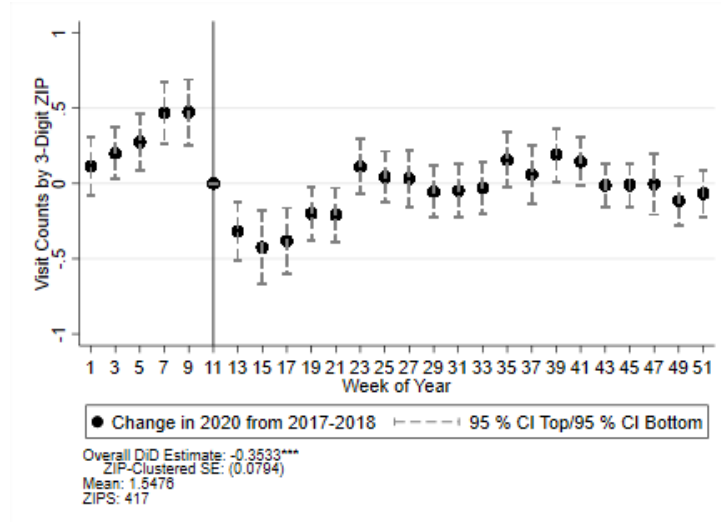


Figure 15: Event Study - All Non-gun Assault Visits, 2020 vs. 2017-2018

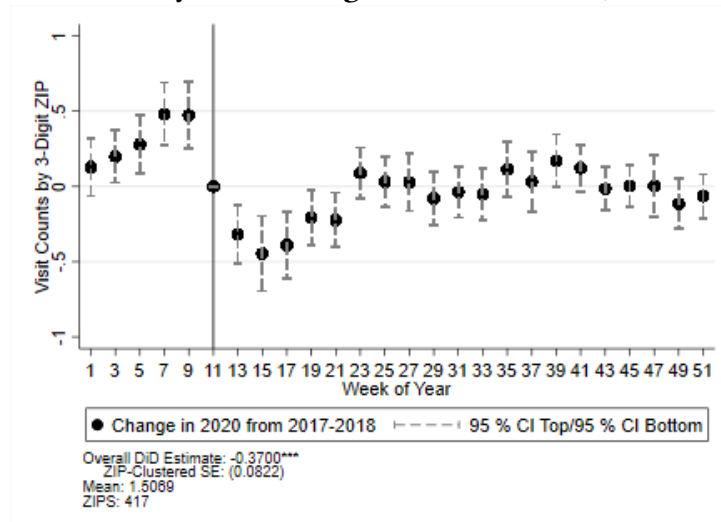


Figure 16: Event Study - All Male Assault Visits, 2020 vs. 2017-2018

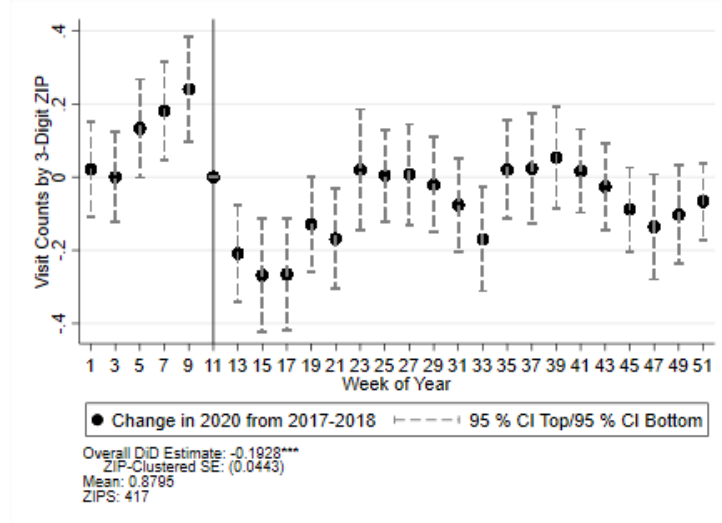


Figure 17: Event Study - Male Non-gun Assault Visits, 2020 vs. 2017-2018

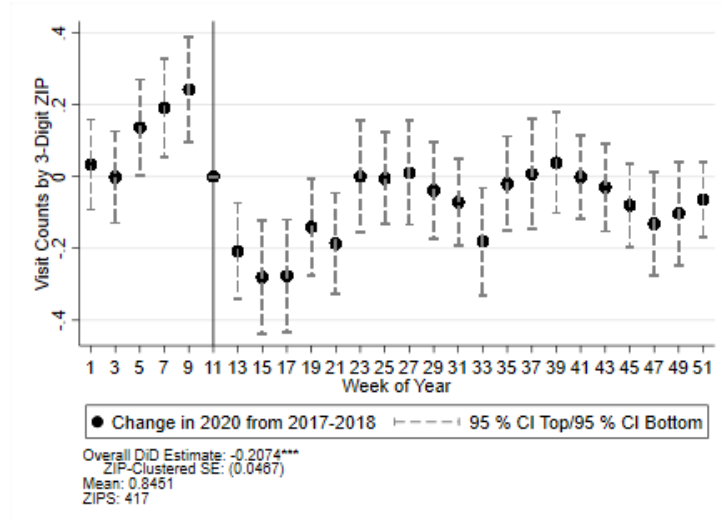


Figure 18: Event Study - Male Gun Assault Visits, 2020 vs. 2017-2018

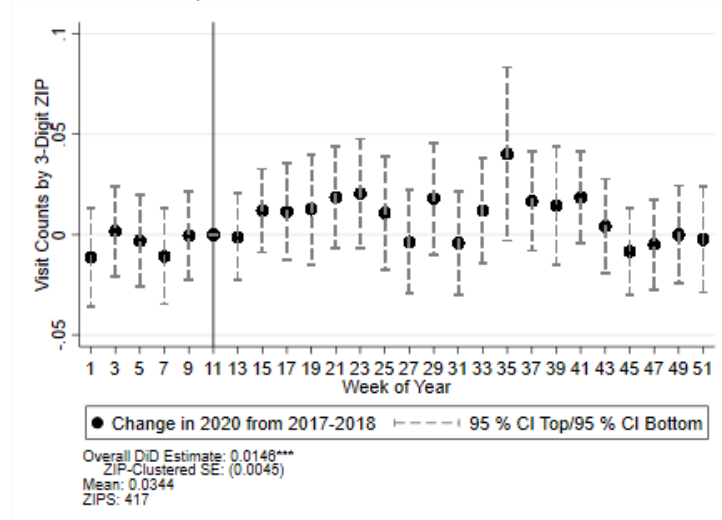
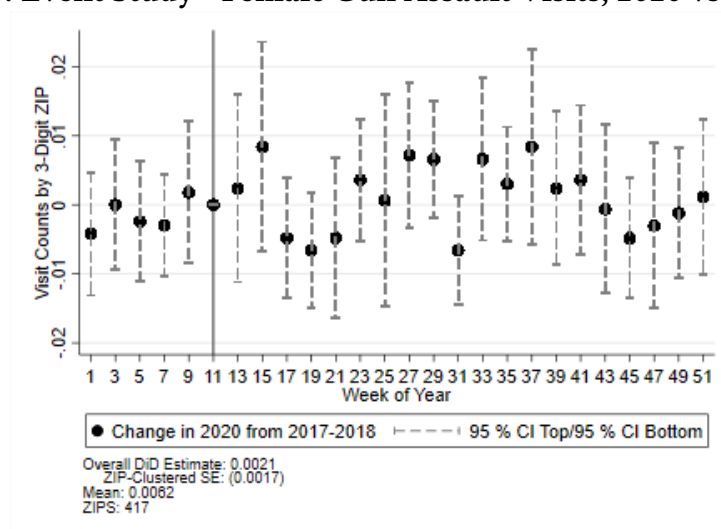


Figure 19: Event Study - Female Gun Assault Visits, 2020 vs. 2017-2018



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