Hospital Avoidance and Unintended Deaths During the COVID-19 Pandemic

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Abstract

The COVID-19 pandemic and its accompanying widespread public health interventions altered individual behaviors, including consumption of healthcare. I study utilization and mortality in the largest integrated healthcare system in the US, the Veterans Health Administration, and find that between the middle of March and the beginning of May, emergency department and hospitalization visits declined by 37% and 46%, total veteran deaths increased by 15% over historic levels, yet non-COVID mortality at VA inpatient settings declined significantly. I find suggestive evidence that hospital avoidance may have resulted in higher mortality. Counties with higher hospital avoidance were associated with more deaths, even after controlling for COVID severity, public policies, and county characteristics. Extrapolating my estimate to the US population, roughly 9,500 Americans died from hospital avoidance by the end of May, representing about 7.4% of total excess deaths. At the patient level, seniors, those with prior comorbidities, and veterans who live alone are more likely to avoid care and also die during the pandemic. Greater public efforts need to be directed at outreach and healthcare access, especially for the vulnerable.

1. Introduction

In the first quarter of 2020, a novel coronavirus (COVID-19; hereby COVID) spread across the world, infecting over 2.5 million Americans, ultimately resulting in the death of over 127,000 as of the end of June. In the middle of March, the CDC issued national guidance discouraging mass gatherings; by late March, many states had enacted mandatory public health interventions (commonly referred to social distancing, shelter-in-place, etc.) to slow

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the spread of the disease. Due to the virus itself, social distancing interventions, a sinking economy, and a general fear of public spaces, among others, consumers' consumption patterns changed dramatically (Chetty et al., 2020); personal healthcare spending dropped by 50% in April.

Changes in healthcare spending, cancellation of non-essential services such as elective surgeries, along with a fear of contracting the virus in public spaces may contribute to shifts in demand for healthcare. Such changes may also impact certain groups differentially. For instance, personal beliefs about the severity of the virus can influence shelter-in-place law abidance (Allcott et al., 2020). More dismally, those who are most fearful of getting the virus (e.g., the elderly who are immunocompromised) may also be the group that is most negatively impacted by foregone medical care. Public efforts certainly do not want to discourage heart attack patients from calling an ambulance due to fears of contracting COVID in hospitals.

In this paper, I analyze electronic health record data from the largest integrated healthcare system in the United States: the Veterans Health Administration (VHA) which has nightly updated data on healthcare utilization, hospital deaths, and regularly updated overall deaths. I begin by describing the decline in healthcare utilization in the VA. Next, I document changes to total mortality among veterans patients who have ever received VA care—whom I will refer to as "veterans"—and shifts in place of death. Finally, for the main exercise of this paper, I relate how the decline in healthcare utilization has impacted short-term, immediate mortality, beyond direct deaths from COVID, at both the county and patient level.

There are three sets of findings in this paper. First, there is a large decline in emergency department (ED) and inpatient visits across the country by 38% and 46% respectively between the middle of March to the beginning of May 2020. While virtually every non-COVID diagnosis category experienced a decline in the number of visit encounters, urgent and life-threatening conditions saw less of a decline and have almost returned to pre-COVID expected levels as of the middle to late June. Conditional on showing up at the ED with the same diagnosis, conditions during the pandemic were more severe—proxied by an index score used to triage patients, admission status, and 7-day inpatient mortality rate—than

usual (prior to COVID) times. This implies that the decline is largely driven by hospital avoidance due to fear of contracting the virus, and not merely a decline in underlying disease prevalence.

Next, I document early evidence of "excess deaths" (number of deaths during the pandemic period above predicted levels absent of COVID using historic trends) for veterans and a shift in place of death during the pandemic. Using provisional death data, I find that there is an increase in total veteran mortality by at least 14.9% over historic levels—even in counties with zero official COVID deaths—between March 18 and May 5, accounting for over 6,210 all-cause veteran deaths, consistent with national estimates by the CDC (2020).[1] However, there is no change in total deaths occurring in VA inpatient settings (hospitals, nursing homes, hospices, and residential facilities); in fact, excluding COVID deaths,[2] there is a 26% decline in VA inpatient deaths over the same period (583 fewer VA inpatient deaths). The increase in overall mortality but decrease in VA inpatient mortality together imply that thousands of veterans are dying outside of VA hospitals who normally would not have.

Finally, I provide descriptive evidence linking hospital avoidance and excess deaths at both the county and patient level. Counties that experienced higher levels of healthcare avoidance also had more excess deaths. After controlling for COVID cases, deaths, state lockdown policies, and other economic and demographic factors, for every 10 percentage point (pp) increase in healthcare avoidance, excess deaths increased by roughly 0.40pp. Taken at face value and extrapolating this estimate to the national population, it implies that approximately 9,500 Americans died by the end of May due to hospital avoidance associated with the pandemic, representing 7.4% of total excess deaths in the country up to that point. It is important to note that my estimates only reflect the immediate short-term costs of hospital avoidance which is likely a lower bound on the overall long-term costs of avoidance and foregone care. At the patient level, I study propensity to utilize in-person healthcare and likelihood to die during the pandemic for various demographic and risk groups. I find

[1] This number is an underestimate as there is a lag, typically a couple of weeks, in when the VA is notified of a veteran death.

[2] COVID deaths are defined in subsection 2.1 as any veteran who is diagnosed with COVID in a VA inpatient setting and dies within 30 days in a VA inpatient setting.

that patient groups that were more likely to avoid hospitals and clinics also had higher death rates. This is especially pronounced for high-risk patients, seniors, and those who live alone. This suggests that greater public efforts must be directed at outreach and healthcare access for these vulnerable groups.

This paper is related to recent studies highlighting the decline in healthcare utilization during the pandemic. Solomon et al. (2020); Garcia et al. (2020); and Bhatt et al. (2020) find that ED visits for heart attacks and related cardiovascular events declined; Rosa et al. (2020) find fewer heart attacks in Italy and hypothesize it may be due to fear of hospitals. Hartnett et al. (2020) and Lange et al. (2020) look at ED encounters more broadly, with the latter briefly mentioning broader implications regarding excess deaths. In recent work with colleagues, we find that mental disorders, including drug overdoses and suicide attempts, declined significantly across all health settingsin the VA (Zhang et al., 2020). Tam et al. (2020) find that median wait time from symptom onset to first medical contact for heart attacks in Hong Kong increased from 83 to 318 minutes. This paper builds on this literature by looking across all diagnosis conditions, differentiating between urgent and life-threatening conditions versus others, and studying case severity conditional on ED presentation for the same diagnosis. This paper is also related to a strand of literature on mortality and excess deaths during the pandemic. CDC (2020) is the main source on predicted mortality and actual mortality in the US; however, they do not take an explicit stance on potential explanations. The majority of media articles and research articles do not consider hospital avoidance as a potential factor. For example, Woolf et al. (2020) propose two hypotheses for increased non-COVID deaths: delayed reporting or misreporting of COVID deaths. While both are plausible and COVID cases and deaths are almost certainly under-reported, the lack of availability in data on both utilization and place of death is a major barrier for researchers to studying the margin of avoidance. Appleby (2020) is the closest paper in this arena. He looks at changes in deaths in hospitals, home care, and home in the UK and conclude that non-COVID deaths have increased, as have deaths at home. The goal of that paper is to draw attention to non-COVID deaths and the data limitations surrounding cause

of death coding during the pandemic. My paper directly combats this issue by leveraging across-county variation in declines in healthcare utilization to look at all-cause mortality and attributes the share of excess deaths to avoidance. Finally, the findings in this paper are of immediate policy importance as some states prepare for a potential "second wave". While it is imperative that the public continue to slow the spread of the virus, non-COVID cases are still claiming the lives of many Americans daily, and this research sheds light on the costs of hospital avoidance.

The rest of the paper is organized as follows. The next section describes the data source and various definitions. Section 3 lays out the empirical strategy and Section 3 presents the set of three findings. Finally, the last section discusses and concludes.

2. Data

The data comes from the Veteran's Health Administration Corporate Data Warehouse. It includes electronic health record data for the universe of approximately 9 million healthcare utilizers per year. In this paper, I specifically study US veterans who have ever received medical care at any VA facility (approximately 6 million VA veteran patients per year) and the terms "veteran" and "VA veteran" patient are used interchangeably. I restrict attention to VA facilities in continental, mainland United States (excluding facilities in Puerto Rico, Guam, Hawaii, Alaska, and the Philippines). Graphically, I will present weekly utilization trends until June 23, 2020; however, the primary period of study will be the seven week period between March 18 and May 5. 2020. This period is chosen because it corresponds to an initial peak and recovery in COVID infection and associated changes in health care utilization. By May 5th 2020, the number of daily COVID deaths among the US population had declined steadily for 2-3 weeks, ED utilization in the VA had increased for 2-3 weeks and veteran deaths returned to pre-COVID expected counts. In-person outpatient encounters are defined as the following settings and types of care: emergency department, urgent care clinic, primary care/medicine, clinical pharmacy, mental health clinic, and general internal

medicine.

HCUP Clinical Classification Software (CCS) is used to categorize diagnoses. For the broad categorizations, I use multi-level 1 (18 diagnosis categories), and for more fine categorizations, I use single-level CCS diagnosis (285 diagnosis categories). Urgent conditions are classified using single-level CCS diagnoses and following Card et al. (2009), Cabral and Mahoney (2019), and Ryan et al. (2010).[3]

Emergency severity index (ESI) are obtained from electronic records when patients are triaged in the ED. They range from a level 1 (Resuscitation: "Immediate, life-saving intervention required without delay") to level 5 (Nonurgent: "Stable, with no resources anticipated except oral or topical medications, or prescriptions").

2.1 Provisional Death Data

As with the other VHA data, date of death data is updated nightly in the Corporate Data Warehouse. Inpatient deaths that occur in VA inpatient settings are updated almost immediately and are therefore fairly accurate. Inpatient deaths include deaths that occur at VA hospitals, nursing homes, hospices, and residential or domiciliary facilities. Inpatient deaths also have the advantage of being able to observe the history of diagnoses, care, and transfers prior to death. All other veteran deaths (that occur at home or in non-VA facilities) are considered non-VA deaths. In 2019, 17,115 veterans died in a VA inpatient setting (5.1% of all veteran deaths), which includes hospital deaths, nursing home (short-term, acute, or long-term care), hospice, and residential deaths. Of these 17,115 deaths, around 20% occurred in nursing homes and hospices, 9% in residential or domiciliary facilities (many of which are co-located with a VA medical center) and the remaining are in hospitals

Deaths are also updated regularly in the Corporate Data Warehouse from other sources including the SSA Death Master File (SSA DMF), notification from spouse or family member,

[3]Card et al. (2009) and Cabral and Mahoney (2019) classify procedures as urgent based on the relative distribution of case counts occurring on weekdays versus weekends. The idea being that non-urgent conditions can be delayed until weekends. Ryan et al. (2010) classify procedures based on ED wait times, with more urgent conditions being triaged and attended to quicker. See Appendix B for the full list of diagnoses.

or Department of Defense, or National Cemetery Administration, among others. For these sources, there is a lag between actual date of death and the date the VA is notified of the death. The lag can vary from a couple days to many weeks, again meaning the number of total deaths will likely be an underestimate. If the source is from SSA Death Master File (SSA DMF), the median length between date of death and date of notification is 11 days (IQR: 9-17); 6 days for spouse or family member (IQR: 2-17); the distribution of the lag in reporting is right-skewed.[4]

2.2 COVID Cases and Deaths

National-level COVID case and death count are obtained from the New York Times, 2020a. VA-level COVID cases come from the VA COVID-19 Shared Data Resource from the National Surveillance Tool, the authoritative data source for positive and negative COVID cases. The data, which is updated hourly, includes VA lab test information, as well as information from tests performed outside of the VA. Positive COVID cases are defined using "data from the Corporate Data Warehouse and leverage experiences and data knowledge from across the VA research community (e.g., medication and laboratory mappings, complex algorithsm for phenotypes). Natural language processing is also used to supplement data elements that are not completely or consistently captured with structured data including duration of mechanical ventilation, symptoms, and some conditions." (VINCI, 2020)

For analyses involving mortality, sometimes I consider non-COVID deaths, which requires a precise definition of a COVID-related death. Currently, the CDC is classifying deaths as COVID deaths based on cause of death codes (CDC 2020). Since I do not have access to cause of death, I count a veteran death as a COVID death if and only if they are hospitalized at a VA hospital for COVID (based on an inpatient diagnosis[5][6]) and die within 30 days at

[4]These lag estimates are an upperbound because they reflect the difference between the last time the date of death field was *modified* and the actual date of death for the veteran.

[5]This is to avoid patients who test positive for COVID but get admitted for a completely different reason.

[6]COVID diagnoses are identified off a medical diagnosis with ICD-10 diagnosis code of U07.1, and prior to April 1, 2020, ICD-10 codes B97.29 or J12.89. The latter two codes were provisionary codes created prior to U07.1.

a VA hospital. This definition will likely undercount COVID deaths relative to the CDC's definition; for example, it excludes COVID patients who die in non-VA hospitals or outside of a hospital all together. It also implies that any discussion of non-COVID deaths may be an *overestimate* of true non-COVID deaths, again, relative to the CDC's definition.

3. Empirical Strategy

In this section I describe the empirical strategy to compute relative changes in healthcare utilization and mortality, association between changes in healthcare utilization and mortality, and patient-level propensity to avoid care and propensity to die during COVID regressions.

3.1 Relative changes during the pandemic

Historic trend lines and confidence bands are fit for outcome Z in week w of year y with the following regression

$$Z_{wy} = \alpha_y + \alpha_w + \epsilon_{wy} \tag{1}$$

for weeks starting from the first week of 2010 (for mortality trends, and 2016 for encounter trends[7]) to the end of February 2020. Then, all 2020 weekly values $\hat{Z}_{w,2020}$ are projected along with corresponding confidence intervals. For the majority of this paper, I will display graphically the most up-to-date data, while focusing on the period from the middle of March to the beginning of May (specifically, the seven week period from March 18-May 5). Percent change during these seven weeks is then computed as the ratio of observed 2020 values relative to the predicted: $\sum_{w=Mar18}^{May5} Z_{wy} / \sum_{w=Mar18}^{May5} \hat{Z}_{wy}$

[7]Due to changes from ICD-9 to ICD-10 in the VHA at the end of 2015, trends in utilization cannot be perfectly traced back.

3.2 County-level change in utilization and mortality

To investigate the impact of healthcare avoidance (or lack of avoidance) on total veteran deaths (in both VA inpatient settings and total veteran deaths) in county (that the veteran resides in) c and week w (starting in January 1, 2020), the empirical specification is

$$\log(1 + Deaths_{cw}) = \sum_{w} \beta_w log(1 + InPersonVisits_{cw}) \times \alpha_w + \lambda X_{cw} + \epsilon_{cw}, \tag{2}$$

where α_w are week fixed effects, and X_{cw} include county, week, and state by month fixed effects, COVID severity (case and death counts for in the nation and the VA), and time-varying county-level controls for White and Black population shares, median income, share below federal poverty level, share with a bachelor degree, median age, and population density. I allow the county characteristics to vary by week to allow for differential trends in death based on county characteristics; for instance, population density may impact changes in mortality differently earlier versus later into the pandemic. By including state by month fixed effects that broadly control for state shelter-in-place policies, $InPersonVisits_{cw}$ can be interpreted as propensity to utilize in-person healthcare, net of government orders; there is still substantial variation in this propensity, driven by differences in beliefs and fear about the virus (Allcott et al., 2020; Goolsbee and Syverson, 2020). The parameters of interest β_w isolates the impact of healthcare utilization on deaths (both in percent changes) under the assumption that after controlling for COVID severity, public policies, and time-varying county characteristics, changes in healthcare utilization represent exogeneously determined changes to underlying propensities to shelter-in-place.

3.3 Patient-level change in utilization and mortality

Finally, to study heterogeneity in both utilization and mortality with respect to veteran characteristics, I run the following specification for utilization for patient i in quarter q (starting in January 1, 2019) for all patients who utilized any outpatient VA services since January 2019, excluding those who were ever diagnosed with COVID or die prior to April 1,

2020:

$$InPersonVisit_{iq} = \beta^{Visit} PostCovid_q \times W_i + \theta X_{iq} + \epsilon_{iq}, \tag{3}$$

where W_i is an indicator variable for whether the patient has a particular characteristic or belongs to a particular group. $PostCovid_q$ is an indicator for the second quarter of 2020 (April 1 to May 19, 2020 to account for a few weeks lag in death notification) and X_{iq} include patient, quarter, and state by quarter fixed effects, and Elixhauser and age bins interacted with $PostCovid_q$ (except when studying heterogeneity with respect to patient risk or age). I include only patients who were alive and not COVID-positive by April 1, 2020.

For mortality, I run the following cross-section regression for death between April 1 to May 19, 2020:

$$Death_i = \beta^{Death} W_i + \theta X_i + \epsilon_{iq}, \tag{4}$$

with controls for county fixed effect, Elixhauser and age bins. I run both regressions of Equation 3 and Equation 4 for six margins of heterogeneity (splitting the sample into two mutually exhaustive sets for each margin): i) Black; ii) female; iii) senior (above age 65); iv) those who live alone;[8] v) high risk;[9] and vi) healthcare proactive (proxied by whether the veteran received a flu shot between September 2018 and February 2019[10]). The demographic margins are motivated by Williamson et al., 2020, who find that men, seniors, Blacks and ethnic minorities, and those with pre-existing conditions are more likely to die from COVID.

[8]Patients sometimes delay calling an ambulance for a variety of reasons and often a spouse will call on their behalf (Meyer et al., 2019). Live alone status is proxied by the following conditions using the most recent enrollment/patient record data: i) Not married/partnered, ii) emergency contact on file is not a spouse, partner, or significant other, iii) never received housebound or aid and attendance benefits, and iv) no reported dependents.

[9]Patient risk is proxied by January 2017-January 2020 Elixhauser comorbidity scores. High risk is classified as one standard deviation above the median, approximately 9.48

[10]The 2019 flu season is chosen to avoid regression towards the mean.

4. Results

4.1 Declines in Healthcare Utilization

Figure 1 displays the changes to weekly emergency department and inpatient hospital encounters (all cases, including COVID) in 2020 relative to predicted levels based on historic trends. In the seven week period between March 18 and May 5, 2020, ED and hospital visit counts were down 37% and 46% respectively. While ED and hospital usage has begun to climb since the first week of May, utilization is still down 17% and 25% as of the week of June 17-23. This is despite the fact that the all states have begun to slowly reopen. Although some of this is due to the cancellation of elective surgeries, these estimates include COVID cases and hospitals that are overwhelmed due to COVID. In fact, this decline is present across all major diagnosis categories (see Figure A.1 for the top major diagnosis categories and Table A.1 for top single-level CCS diagnoses with the biggest changes), with musculoskeletal and connective tissue conditions experiencing the largest drop and mental illness conditions at the opposite end; all major categories have started to return to pre-pandemic expected levels.

Non-urgent conditions and low-mortality conditions declined more than urgent and high-mortality (defined as a 7-day VA inpatient mortality of over 1%)[11][12] conditions as displayed in Figure A.2. COVID cases are excluded from both classifications. In both cases, the decline for non-urgent and low-mortality conditions is about one and a half times the size of the urgent and high-mortality conditions. As of the week of June 17 to June 23, both urgent and high mortality ED conditions have nearly returned to pre-pandemic expected levels, whereas non-urgent and low death rate conditions have plateaued.

Moreover, even conditional on showing up for the same diagnosis, conditions that do end up in the ED during the pandemic are more severe. Controlling for county, facility, and diagnosis fixed effects, patient conditions in EDs—excluding COVID conditions and all patients who were COVID-positive prior to the ED visit, to avoid complications associated

[11] Both urgent and high-mortality conditions are fixed definitions defined using non-COVID data.
[12] See Appendix B for the list of urgent and high-mortality conditions.

with COVID—are more severe (measured by emergency severity index), more likely to be admitted, and die at higher rates. Figure 2 displays the trends in severity since the start of 2020, conditioning on diagnosis codes. Between March 18 and May 5, 2020, conditions were 0.035pp more severe, 0.75pp more likely to be admitted,[13] and 0.10pp more likely to die in their hospital within 7 days (pre-COVID averages for ESI, admission likelihood, and 7-day inpatient mortality are 3.2, 26% and 0.31%, respectively). As of the week of June 17, 7-day inpatient mortality has returned to pre-COVID levels, but severity and admission likelihood are still elevated. Together, these findings indicate that the decline in healthcare utilization is largely due to hospital avoidance, and not an overall decline in disease prevalence. This is consistent with Goolsbee and Syverson (2020) and Cronin and Evans (2020), who find that fear and precaution (and not necessarily state policies) explain a large share of the decline in economic activity.

4.2 Mortality: Total and VA Inpatient

Since the start of the COVID pandemic, mortality counts have significantly exceeded expected levels based on historic trends (CDC, 2020). The same is true among the VA veteran patient population. The top panel in Figure 3 displays that in that seven week period from March 18 to May 5, observed veteran deaths—recall provisional deaths are an underestimate, especially for the most recent few weeks—were above the 95% confidence interval for predicted deaths. During this period, there were approximately 6,210 "excess deaths" above the expected counts (a 14.9% increase with the peak at 22.4% the second week of April).

Veterans can either die in VA inpatient settings, community (non-VA) hospitals, or in non-healthcare settings ("at home"). Figure 3 shows that while overall veteran mortality has *increased*, deaths in VA inpatient settings have actually remained *constant or decreased*. Recall that VHA inpatient deaths are observed almost with almost no lag. With a conservative definition of inpatient COVID deaths, inpatient non-COVID deaths declined by 26%, roughly

[13] Admission likelihood actually declined for emergency cases at the start of the pandemic (prior to April), presumably due to hospital bed capacity constraints or precautionary measures to avoid reaching hospital bed capacity.

583 veterans. While I don't have access to community hospital death data or ambulance dispatch data, in Figure A.3 I restrict the sample to veterans who have not utilized non-VA and non-CMS services in the prior 365 days and find similar patterns of overall excess death and VA hospital deaths.

Finally, I concentrate on the roughly 1,700 counties in the United States with zero official COVID deaths by the end of May and study their excess deaths. Even in these counties, mortality increased by around 12% during the seven week period from March 18 to May 5, accounting for 3,100 of the 6,210 "excess deaths". The decline in emergency, inpatient, and in-person healthcare utilization is identical with national averages, likely because shelter-in-place orders are often at the state level.

4.3 Linking Hospital Avoidance and Mortality

Thus far, I have shown that the distribution of place of death has shifted during the pandemic; combined with the hospital avoidance patterns, some veteran may not be receiving medical care prior to their death. I will show that, the decline in utilization may have led to an increased number of veteran deaths.

By studying descriptive correlations, Figure A.4 shows that counties (based on veteran's place of residence) that experienced a larger decline in healthcare utilization experienced more deaths. Each point represents a collection of counties that fall into one of the 20 equally-spaced intervals that span the change in in-person encounter visits. A county's change in utilization and veteran deaths are calculated via Equation 1 for March 18 to May 5. New York City counties are excluded, but the results are qualitatively robust to its inclusion. The relationship is negative with a slope coefficient of roughly -0.52: A county with a 10pp lower decline in healthcare utilization is associated with a 5.2pp fewer excess deaths. This relationship is despite the fact that more encounters generally lead to more mortality, and patients with COVID would contribute to higher utilization and higher mortality counts.

The negative relationship between county utilization decline and excess deaths masks COVID severity and regional public health policies. For example, places with lower COVID

case counts may find it easier to not shelter-in-place while not experiencing an uptick in mortality. Equation 2 addresses some of these endogeneity concerns by controlling for county-level COVID cases and deaths (total and VA) and economic factors and state policies. Figure 4 plots how within-county changes to in-person healthcare utilization affect overall VA inpatient mortality and total veteran mortality over time. The coefficients in the top panel can be interpreted as the intensive margin effect of changes in healthcare utilization; these conditions are being treated in VA hospitals but the patients are coming in too late and some end up dying. The magnitudes begin to return to baseline starting in the middle of May, which is consistent with the findings on condition severity in Figure 2. The bottom panel displays the effect of in-person healthcare utilization on overall veteran mortality, including those that die without receiving medical attention. The most recent few weeks are not available due to the lag in provisional death data. The magnitudes are larger than those of VA inpatient deaths, which suggests that the effect of avoidance on overall mortality exceed its (intensive margin) effect on deaths in VA inpatient settings. In both graphs there is no significant pre-COVID relationship between utilization and mortality; however, following COVID, higher rates of utilization led to fewer veteran deaths for both VA inpatient settings and others, controlling for COVID, population health, economic, and density. The magnitude for total veteran mortality is roughly -0.0401 during the seven week period between March 18 and May 5, an order of magnitude lower than the cross-sectional correlation between counties.

From March 18 to May 5, total in-person utilization in the VA declined by 39.2%. Taking the estimated coefficient of -0.0401, this implies that total mortality decreased by roughly 1.57pp. From the middle of March to the end of May, CDC (2020) estimates expected total mortality based on historic, non-COVID years to be 607,248 lives. Scaling this national estimate by my coefficient, I arrive at approximately 9,500 Americans who died due to hospital avoidance. During this same period, total national excess deaths were 129,707,[14] 102,655 of which were officially attributed to COVID-19 and 27,052 were unattributed. This

[14]Relative to the CDC "average expected number of deaths" to be consistent with the analyses in this paper.

back of the envelope calculation arrives at the conclusion that 7.4% of total excess deaths can be attributed to hospital avoidance.

Finally, I investigate propensity to utilize in-person outpatient care and mortality during COVID at the veteran level for various types of veterans. Figure 5 plots β^{Visits} and β^{Deaths} separately for blacks, females, seniors, high patient risk (proxied by Elixhauser comorbidity scores, healthcare proactiveness (proxied by flu shot receipt in the previous season), and whether the veteran lives alone. Female veterans are less likely to die during the COVID pandemic than their male counterparts, even controlling for age and Elixhauser scores. Those who are proactive about their health by taking preventive measures such as flu vaccinations are significantly more likely to avoid in-person healthcare visits, while also experiencing lower mortality. Presumably, these two groups of veterans are more careful and healthier in unobservable ways. This leaves us with black veterans, veterans with many prior comorbidities, seniors, and those who live alone. These groups (not necessarily mutually exclusive) are all less likely to utilize healthcare services relative to their low-risk, younger, and co-living counterparts, and are most vulnerable to dying during the pandemic. The higher mortality for Blacks, men, seniors, and high-risk are consistent with Williamson et al., 2020.

The link between hospital avoidance and increased mortality is largely descriptive without cause of death data and precise COVID reporting, hence, the estimates and back of the envelope calculations should be interpreted as descriptive exercises and not precise causal estimates. For example, for the county-level regressions, any under-reporting of COVID risk would result in an upward bias in the estimates. Similarly, in the patient-level regressions, individuals with higher mortality risk may have higher propensity to avoid in-person visits. Nevertheless, the collection of findings show that veterans are avoiding hospitals and there has been a large increase in deaths outside of VA hospitals, relative to expected levels. There is also suggestive evidence consistent with the former being directly responsible for the latter.

5. Conclusion

Healthcare utilization has declined and mortality has increased during the COVID pandemic. In this paper I've studied overall emergency, inpatient, and in-person healthcare utilization and the urgency, mortality rate, and severity of conditions in EDs. The patterns are consistent with hospital avoidance due to fear of hospitals and more veterans are dying in settings outside of (VA) hospitals. I've provided suggestive evidence that the two are related: hospital avoidance may lead to unintended deaths. Using my estimates of avoidance on mortality—identified off of county-level propensity to utilize healthcare variation, controlling for COVID and county characteristics—back of the envelope calculations imply roughly 9,500 Americans may have died due to hospital avoidance (7.4% of total excess deaths relative to historic levels).

My estimates only account for direct deaths that occur within weeks due to avoidance. Overall delay in all care may have profound effects on individual and population health that may persist for years. For example, Lai et al., 2020 estimate almost 34,000 excess cancer deaths in the US within one year, largely due to changes in cancer diagnosis and treatment during COVID. In this sense, the unintended deaths due to hospital avoidance are an underestimate of the true overall costs. As better data become available, investigating the overall burden of the healthcare avoidance is a promising and crucial avenue for future research.

It is important to note that propensity to utilize healthcare (which is linked to propensity to shelter-in-place) is merely used as variation to study the research question of total overall mortality and unintended deaths due to changes in healthcare utilization. The findings in this paper do not imply anything about shelter-in-place mandates. In fact, my estimated deaths from hospital avoidance are an order of magnitude smaller than the direct deaths from COVID-19. However, the majority of the public efforts have been directed at the virus itself, and not the unintended consequences that arise from changes in healthcare consumption. Therefore, my findings have direct and immediate policy implications. As multiple states have eased or rolled back their plans to re-open their economies and COVID case rates continue to

climb as of the end of June, a "second wave" and further shelter-in-place orders may be near. It is crucial that patients receive care for both COVID and non-COVID conditions, especially those that are urgent and life-threatening. Of these 9,500 deaths, many could have been saved if they received medical attention during ordinary times. Additional public efforts should be directed at keeping patients at hospitals safe of contracting the coronavirus, communicating the importance of treating all medical conditions, and providing better healthcare access for vulnerable groups including those who live alone, Blacks, seniors, and high-risk patients.

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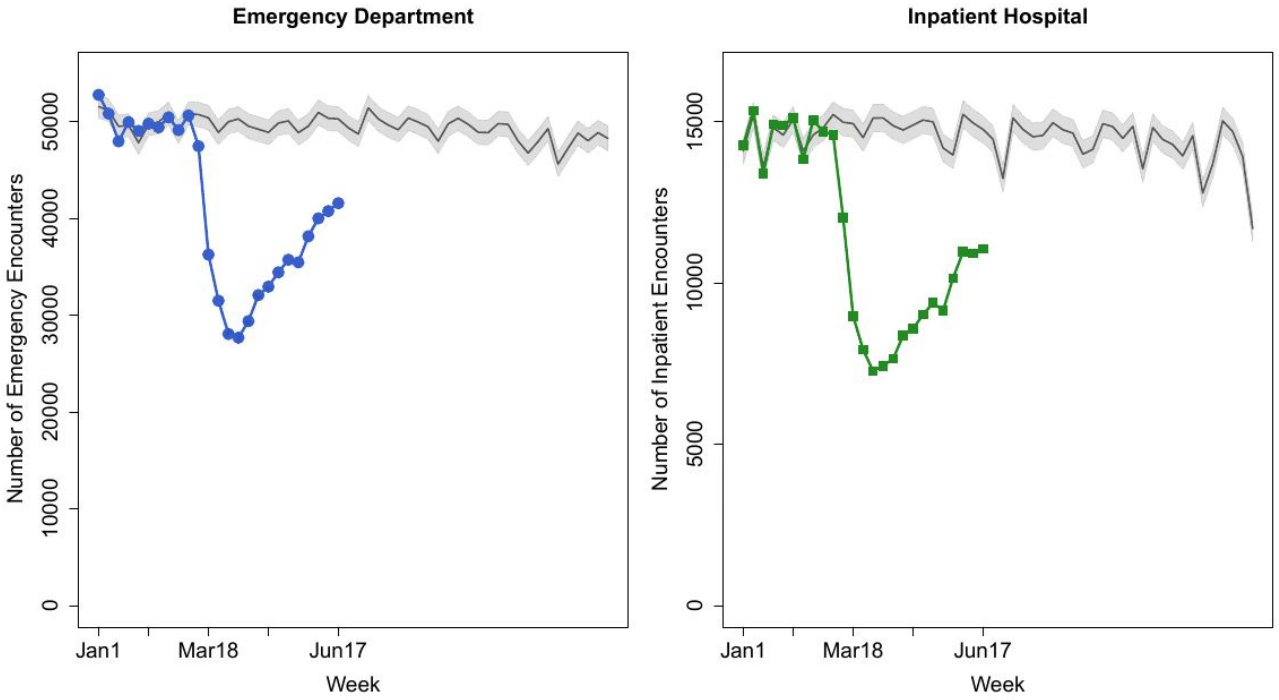
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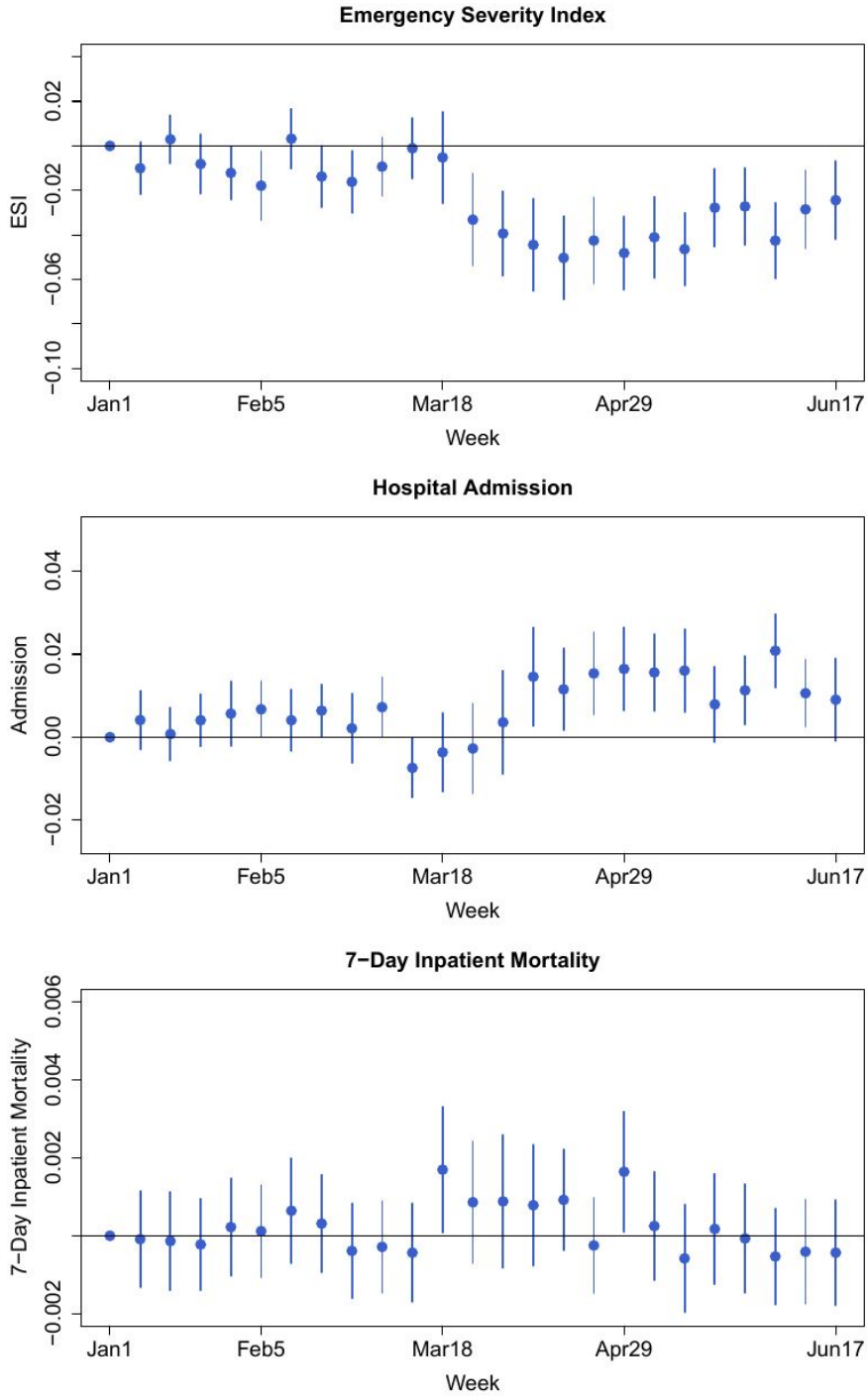
Figures

Figure 1: Declines in Total Number of VA Emergency and Inpatient Encounters



Notes: The solid trend line correspond to total weekly number of VA encounters in emergency departments (left panel, blue circles) and inpatient settings (right panel, green squares) in 2020. The black trend line and corresponding 95% confidence bands are constructed fitting weekly total encounters to a full set of week and year fixed effects from the beginning of 2010 to the end of February 2020. From March 18 to May 26, encounters encounters in ED declined by 35% and inpatient encounters declined by 45%. The decline peaked in early April at 44% and 52% for ED and inpatient encounters, respectively.

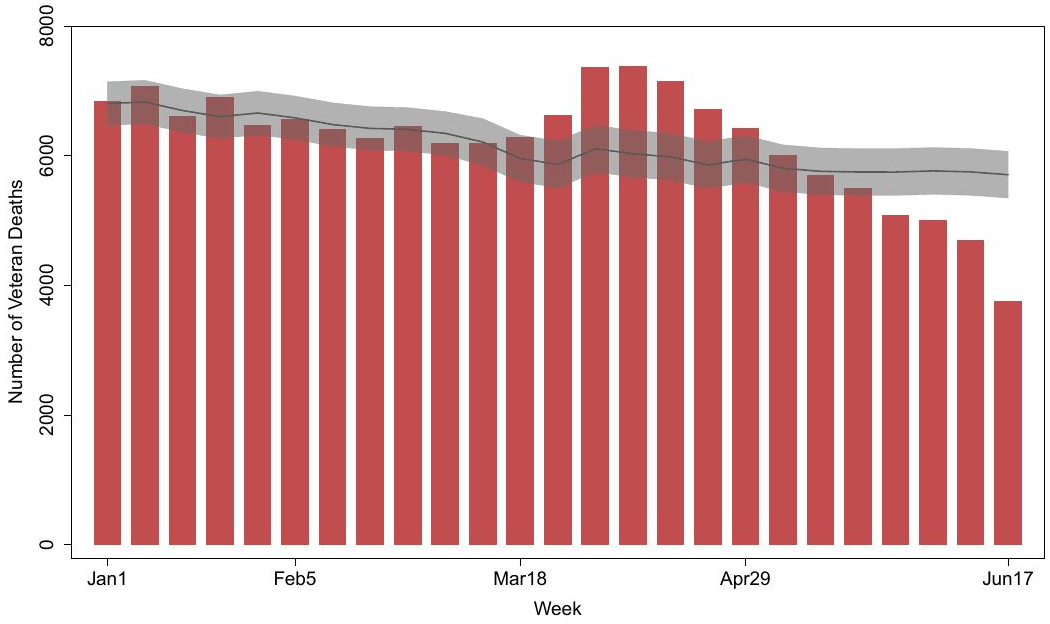
Figure 2: Measures of Severity Conditional on Showing up to the ED



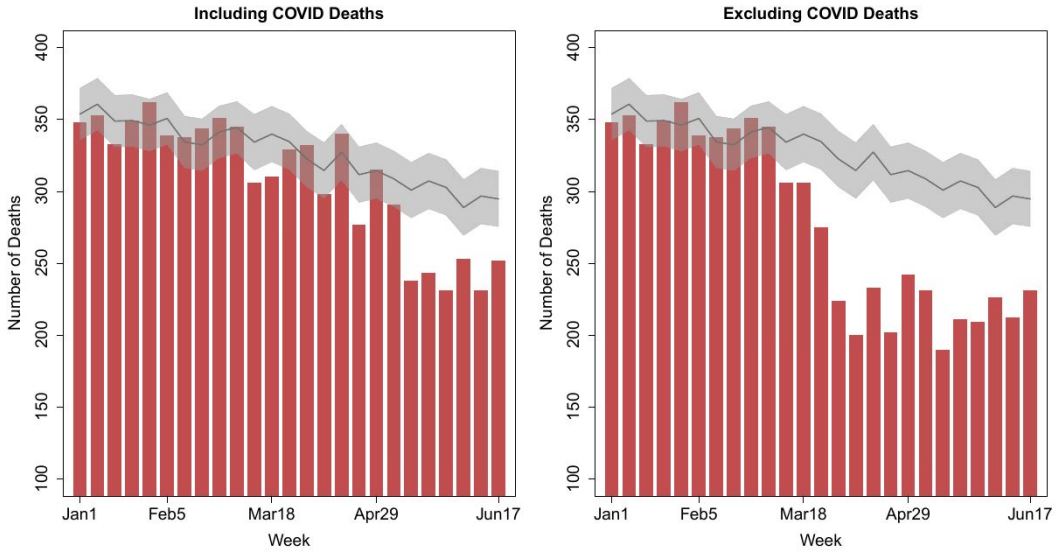
Notes: This figure plots the estimated regression coefficients of three separate measures of severity (emergency severity index: 1 is most severe, inpatient admission, and 7-day VA hospital mortality) on week fixed effects, controlling for diagnosis (HCUP CCS Single-Level), patient county, and facility fixed effects. To avoid complicated associated with COVID, all COVID conditions in the ED and all patients who were COVID-positive prior to the ED visit are dropped. Robust standard errors are clustered at the emergency department level.

Figure 3: Provisional 2020 Total Deaths Relative to the Historic Average

Panel A. Total deaths among veterans who ever received VA care

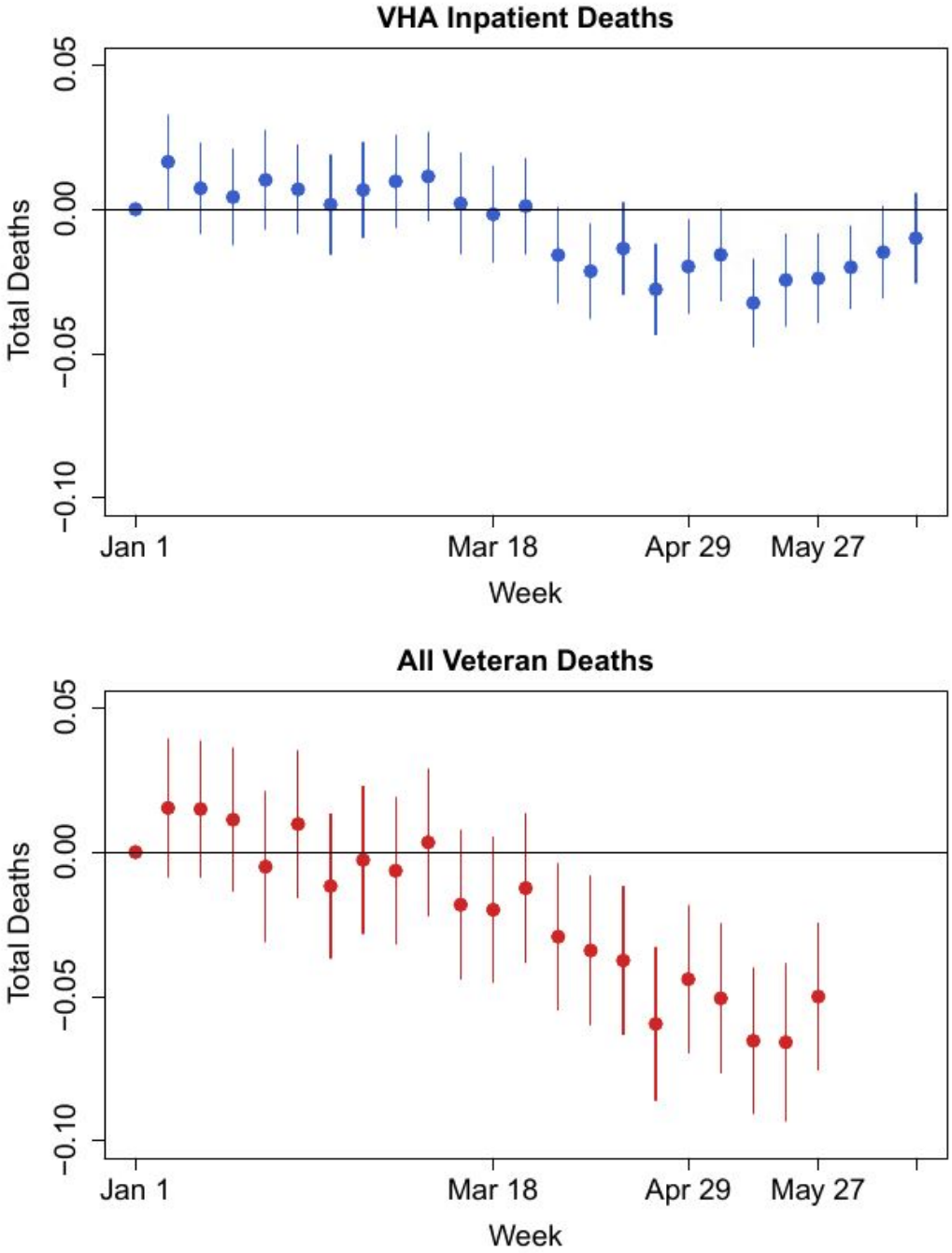


Panel B. VA inpatient deaths among veterans who ever received VA care



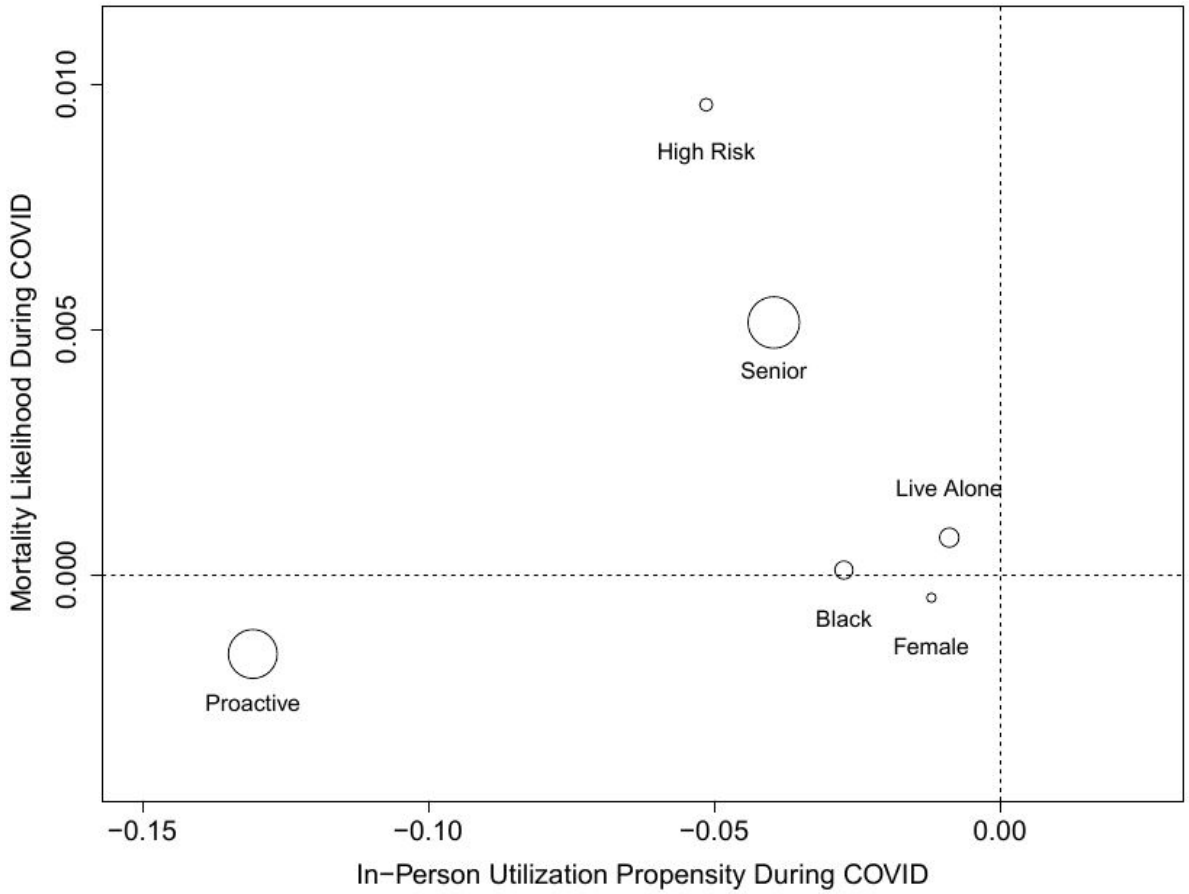
Notes: This figure plots a histogram of the total weekly number of veteran (veterans who ever received VA care) deaths, across all causes and sources, and VA inpatient deaths in 2020. The top panel plots the total number of veteran deaths. The bottom panel plots the veteran deaths in VA inpatient settings, including COVID patients (bottom left) and excluding COVID patients (bottom right). COVID deaths are defined as any veteran who is diagnosed with COVID in a VA *inpatient* setting and dies within 30 days in a VA inpatient setting is classified as a "COVID death". Non-VA death data is provisional and lags by a few weeks so the most recent few weeks in the top panel are very preliminary. The black trend line and corresponding 95% confidence bands are constructed fitting weekly total VA veteran deaths to a full set of week and year fixed effects from the beginning of 2010 to the end of February 2020.

Figure 4: Mortality by Variation in Across-County Differences in In-Person Encounters



Notes: The figure plots the impact of in-person healthcare utilization on VA inpatient deaths in the top panel and all veteran (VA veteran patient) deaths in the bottom panel. The coefficients are from empirical specification Equation 2. The most recent few weeks are excluded from the bottom panel due to lag in provisional death data for deaths in non-VA settings. Standard errors are clustered at the county level and 95% confidence intervals are plotted.

Figure 5: Propensity to Utilize Healthcare and Mortality by Patient Characteristics



Notes: For each patient characteristic, β^{Visit} and β^{Death} are obtained from Equation 3 and Equation 4 and plotted. Point size is in relation to the number of veterans in each group. Sample are all patients that utilized any outpatient VA services since January 2019. Any veteran who is COVID-positive or die prior to April 1, 2020 are excluded.

Appendices

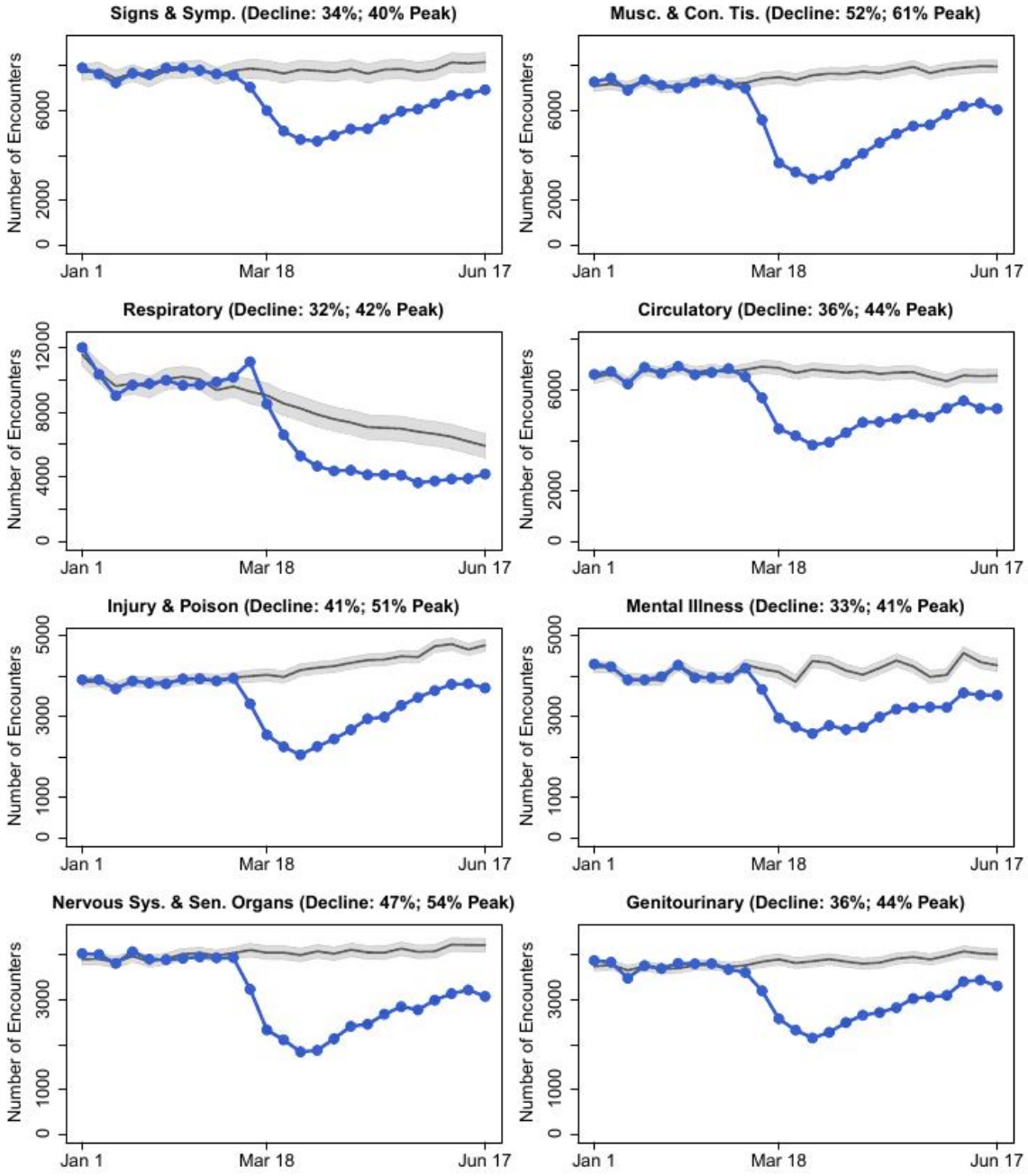
A. Additional Figures and Tables

Table A.1: Diagnosis Conditions that Experienced the Largest and Smallest Declines in EDs

Largest Declines		Smallest Declines	
Diagnosis Condition	Decline	Diagnosis Condition	Decline
Influenza	92%	Immunization & screen for infect. dis.	-263%
External cause: motor vehicle traffic	60%	Fever of unknown origin	-71%
Acute bronchitis	57%	Viral infection	-52%
Otitis media and related conditions	56%	Other lower respiratory disease	3%
Multiple sclerosis	56%	Cancer of head & neck	11%
Other non-traumatic joint disorder	54%	Other infections; including parasitic	15%

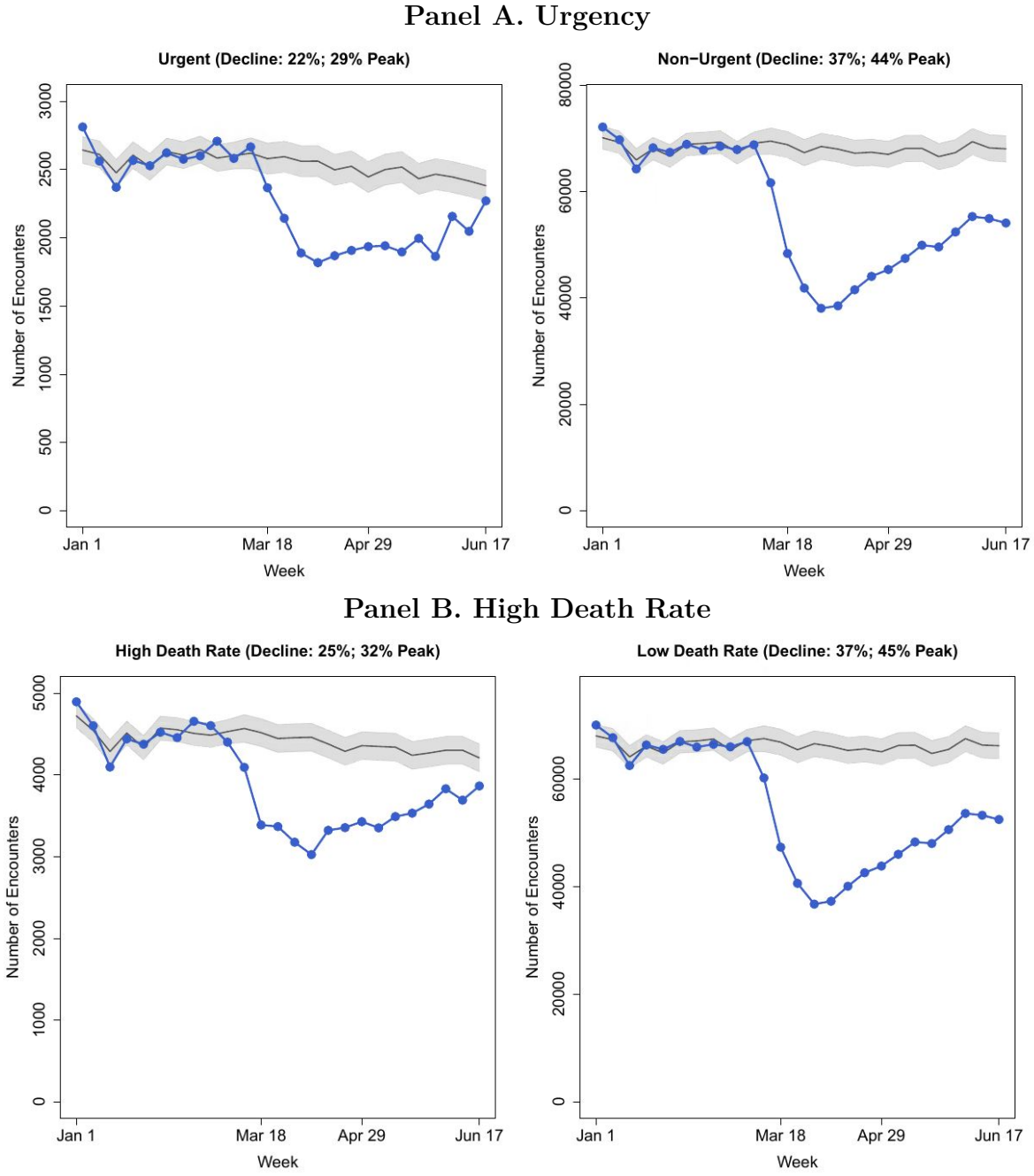
Notes: Diagnosis conditions (HCUP Single-Level CCS) that experienced the largest and smallest declines in EDs from March 18 to May 5 compared to historic levels. Negative declines are increases during the pandemic. COVID *diagnosis code* cases are excluded.

Figure A.1: Declines in Emergency Encounters by Major Category (Excluding COVID)



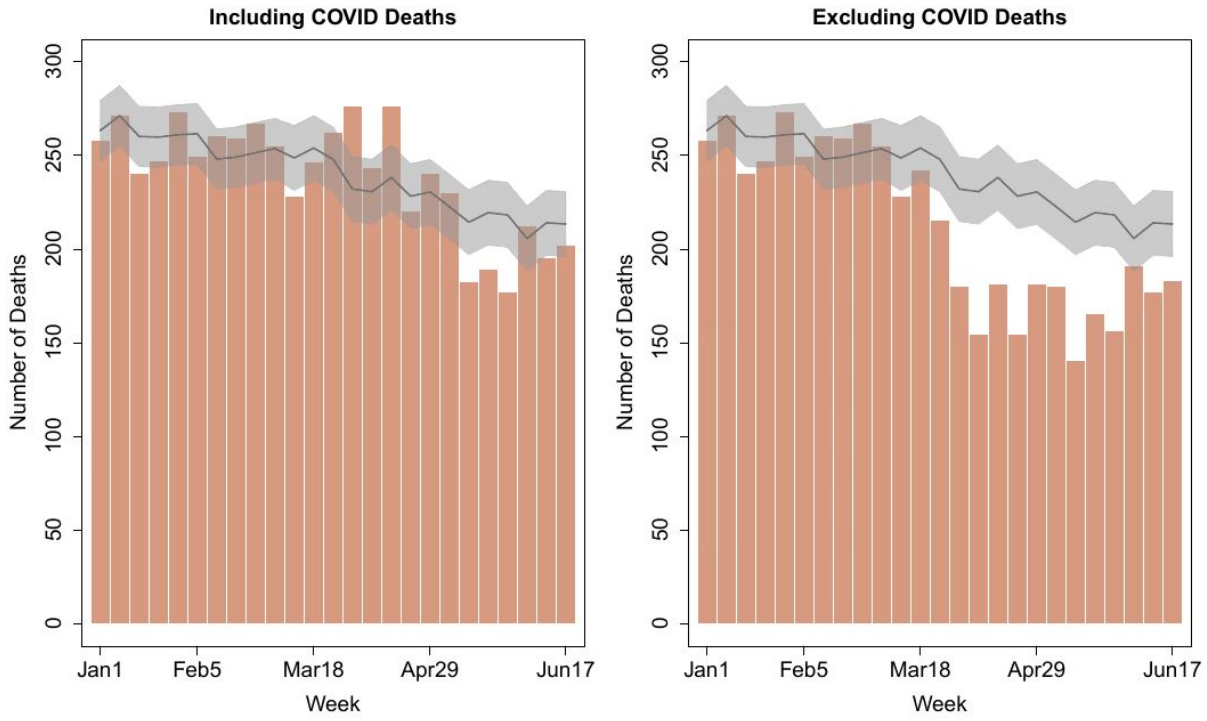
Notes: This figure plots the change in total weekly number of VA emergency encounters for eight major diagnosis categories (HCUP Multi-Level 1 CCS). The total decline and peak single week decline are displayed in the titles. COVID diagnoses are excluded; however, including them makes little difference because the vast majority of ED encounters are still unrelated to COVID. The black trend line and corresponding 95% confidence bands are constructed fitting weekly total encounters to a full set of week and year fixed effects from the beginning of 2016 to the end of February 2020.

Figure A.2: Declines in Emergency Encounters by Urgency and Death Rate (Excluding COVID)



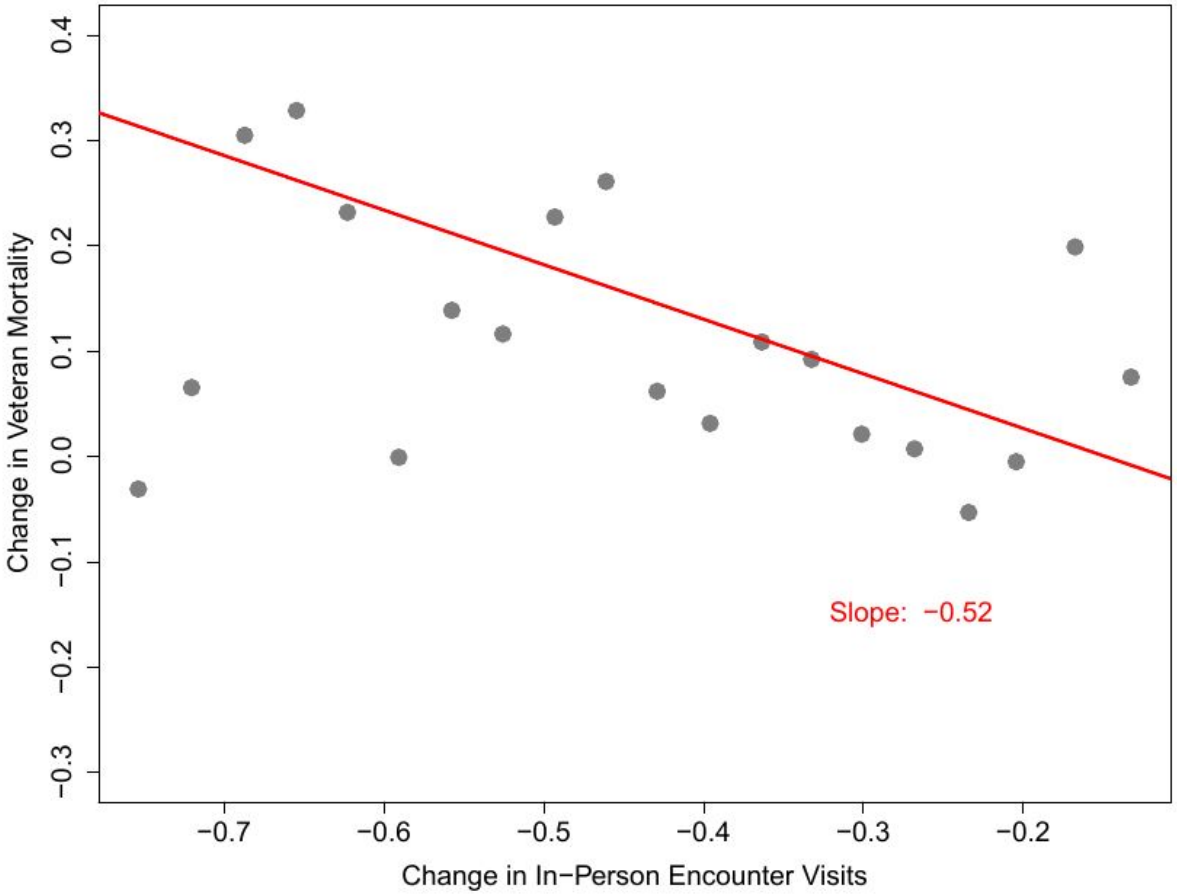
Notes: This figure plots the change in total weekly number of VA emergency encounters for conditions based on i) urgency (panel A) and ii) mortality rate (panel B). Urgent conditions are defined as HCUP CCS Single-Level codes from Card et al. (2009), Cabral and Mahoney (2019), and Ryan et al. (2010) and non-urgent conditions are all others. High death rate conditions are conditions with a 7-day inpatient mortality rate of over 1% in 2018 and 2019; COVID pandemic data is not used to determine these conditions and hence neither panel include COVID diagnoses. All other conditions are categorized as low death rate.

Figure A.3: VA Inpatient Deaths for Veterans who Veterans Who Have Not Used non-VA care in the Prior Year



Notes: This figure plots the bottom panel of Figure 3 for veterans who have not utilized non-VA (excluding CMS due to data limitations) care in the prior year. These veterans are more unlikely to die at non-VA hospitals, and therefore, presumably more likely to die at VA hospitals or at home.

Figure A.4: Change in Mortality and Change in Utilization at the County Level



Notes: This figure plots a binned scatterplot of the correlation between change in in-person encounters and total veteran mortality at the (veteran) residing county. COVID deaths are included. Each point represents a collection of counties that fall into each of the 20 equally-spaced intervals ("bins"). Both metrics are calculated from Equation 1 separately for each county. Points and regression are weighted by county veteran population. New York City counties are excluded.

B. Urgent and High Death Rate Conditions

Urgent conditions:

Appendicitis and other appendiceal conditions; Acute myocardial infarction; Fracture of neck of femur (hip); Viral infection; Aortic and peripheral arterial embolism or thrombosis; Gastrointestinal hemorrhage; Diverticulosis and diverticulitis; Biliary tract disease; Intestinal obstruction without hernia; Respiratory failure; insufficiency; arrest (adult); Acute cerebrovascular disease; Epilepsy; convulsions; Asthma; Coronary atherosclerosis and other heart disease.

High death rate conditions:

Fetal distress and abnormal forces of labor; Delirium dementia and amnestic and other cognitive disorders; Acute posthemorrhagic anemia; Non-Hodgkin's lymphoma; Coma, stupor, and brain damage; Aspiration pneumonitis, food/vomitus; Cancer of other male genital organs; Pleurisy, pneumothorax, pulmonary collapse; Nutritional deficiencies; Diseases of white blood cells; Leukemias; Acute and unspecified renal failure; Congestive heart failure; nonhypertensive; Acute myocardial infarction; Cancer of other GI organs, peritoneum; Cancer of rectum and anus; Cancer of esophagus; Cancer of the prostate; Cardiac and circulatory congenital anomalies; Peri-, endo-, and myocarditis, cardiomyopathy (except that caused by tuberculosis or sexually transmitted disease); Cancer of bladder; Cancer of breast; Septicemia (except in labor); Malignant neoplasm without specification of site; Cancer, other and unspecified primary; Peritonitis and intestinal abscess; Cancer of kidney and renal pelvis; Coagulation and hemorrhagic disorders; Cancer of brain and nervous system; Cancer of thyroid; Cancer of colon; Fracture of neck of femur (hip); Shock; Aortic and peripheral arterial embolism or thrombosis; Multiple myeloma; Cancer; other respiratory and intrathoracic; Intrauterine hypoxia and birth asphyxia; Secondary malignancies; Respiratory failure, insufficiency, arrest (adult); Cancer of liver and intrahepatic bile duct; Cancer of the stomach; Melanomas of skin; Cancer of other urinary organs; Cancer of pancreas; Cardiac

arrest and ventricular fibrillation; Intestinal obstruction without hernia; Other liver diseases; Pneumonia (except that caused by tuberculosis or sexually transmitted disease); Maintenance chemotherapy; radiotherapy; Cancer of head and neck; Cancer of uterus.