Pandemic Policies and Health Outcomes: Evidence from Medicare and Medicaid Claims Data.*

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Abstract

This paper evaluates policies rolled out during the COVID-19 pandemic aimed at stabilizing the economy and their effects on health outcomes. Using difference-in-difference models, we estimate the effects of three stimulus payments and reopening of the economy on mortality, emergency department visits, and inpatient stays of Medicaid and Medicare beneficiaries. The results imply that the effects of stimulus payments on mortality and utilization exhibit considerable heterogeneity across different rounds and public health insurance programs. We find that the effects of stimulus payments were less pronounced for individuals with previous diagnosis of opioid use disorder suggesting that a positive income shock has no impact on drug consumption of the at risk population. The opening of the economy only positively affects the utilization of emergency department services.

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1 Introduction

Deaths of Despair, an American epidemic that began in the 1990s, took 158,000 lives each year by 2018 and disproportionately affected non-Hispanic White individuals without a college degree (Case and Deaton, 2021). The drivers of this epidemic are, however, not precisely established. On the one hand, Case and Deaton (2021) point to stagnant wages resulting from deteriorated economic opportunities as the leading factor for increases in mortality among the less-educated Americans. On the other hand, Ruhm (2019) suggests that changes in supply of high-risk drugs contribute to the increase in Deaths of Despair, especially for drug-related mortality. Economic theory predicts ambiguous effects of changes in income on drug consumption and potential overdose as well because drugs can be either a normal or an inferior good (Dow et al., 2020). Hence, it is an open question to what extent increases in income would affect drug-related mortality.

In this paper, we answer this question by using quasi-natural variation that resulted from economic support policies rolled out during the COVID-19 pandemic and a unique data set containing all Medicaid and Medicare beneficiaries. Specifically, we analyze how the stimulus payments to households affected the fatal and non-fatal health outcomes of individuals enrolled in the two biggest public health insurance programs. Federal government disbursed $814.4 billion in stimulus checks in April 2020, January 2021, and March 2021 to 160 million people (Bureau of the Fiscal Service, 2020). Using the exact date of stimulus payments and high frequency difference-in-difference model, we estimate the effect of an increase in disposable income on fatal and non-fatal outcomes mortality, emergency department, and inpatient hospital admission. To understand whether income shocks exacerbate outcomes of the most vulnerable population, we focus on individuals diagnosed with opioid use disorder before onset of the pandemic. Since the economy began to reopening shortly after the first stimulus round, usinga matched difference-in-difference model we also analyze whether state-mandated removal of pandemic-era restrictions that were rolled out can explain any affect on mortality and health care utilization.

Our analysis is based on 100% Medicaid and Medicare claims and enrollment data from the Centers for Medicare and Medicaid, which captures nearly half of the U.S. population. The rich administrative data with exact date of death and health services utilization combined with big sample sizes allows us to causally identify the effects of changes in income or social and economic environment on adverse outcomes. We also supplement our data with ZIP code median income from the American Community Survey to understand if Medicaid and Medicare beneficiaries from low- and high-income ZIP codes respond differently to the stimulus payment.

We estimate effects within 25 days of the stimulus payment and find notable differences across different rounds. The first stimulus payment leads to an increase in mortality for Medicaid and Medicare beneficiaries. Relative to the baseline mean, these effects range between 14% for Medicare beneficiaries and 36% for Medicaid beneficiaries. In contrast to mortality, emergency department (ED) visits and inpatient (IP) stays increase as a result of the first stimulus payment. The effects on ED visits (IP stays) range between 17% (36%) and 18% (12%) for Medicaid and Medicare beneficiaries, respectively. The second round of stimulus payments has no effect on mortality of Medicare beneficiaries but results in decreased mortality of Medicaid beneficiaries on the order of 12%. The ED visits increase after the second stimulus payment for all individuals with effects ranging between 9% and 12% for Medicaid and Medicare enrollees, respectively. The effects on IP stays move in opposing directions. While Medicare beneficiaries decrease IP stays, hospitalizations for Medicaid beneficiaries increase as a result of the second stimulus payment. The last stimulus payment positively affects mortality and utilization of all groups except individuals without previous OUD diagnosis. The point estimates for mortality (utilization) vary between 6% and 31% (1% and 17%) for Medicare and Medicaid beneficiaries. Across all stimulus rounds, the estimated effects on mortality and utilization for the OUD population are smaller in magnitude than for individuals without previous OUD diagnosis.

The analysis of state-mandated reopening shows that only estimates on ED visits can be

interpreted causally since trends in mortality and IP stays in treatment and control states diverge before the opening which violates the parallel trend assumption. The decision to open the economy could therefore be driven by existing mortality or utilization patterns in each state. We find statistically significant effects only for Medicaid beneficiaries. For individuals with previous OUD, ED visits decrease by 4-5% within two weeks of opening the economy. In contrast, the relationship is reversed for individuals without OUD. ED visits for this group increase by 2% within three weeks of removing lockdown measures. Given that ED visits increase by 17% after the first stimulus round, the state-issued legislation to reopen the economy is less likely to drive the effects on ED visits.

This paper contributes to several strains of literature. First, we contribute to the body of literature that studies the effect of income on adverse outcomes such as substance abuse, hospitalizations, and mortality (Rosenheck and Frisman 1996; Verheul et al. 1997; Maynard and Cox 2000; Halpern and Mechem 2001; Swartz et al. 2003; Phillips et al. 2004; Riddell and Riddell 2006; Dobkin and Puller 2007; Evans and Moore 2011; Li et al. 2007 Atwood et al. 2025). The literature finds evidence to support the hypothesis that a "full wallet" affects certain groups of individuals negatively and documents a positive relationship between changes in income and the risk of mortality and hospitalizations mainly driven by substance abuse. Evans and Moore (2012) generalize the income-mortality relationship for many causes of death, all age groups, races, marital status groups, and education groups. We show that increases in income due to the stimulus payments not always negatively affect health outcomes and that the effects for groups most likely to abuse substances such as individuals with OUD are very similar to the rest of the population. These results suggest that the social and economic environment play an important role for the relationship between income and health and that substance abuse might not be the only explanation for the "full wallet" effects.

Second we contribute to the literature that studies the effects of the stimulus payments on health-related outcomes during the pandemic. The literature has mainly focused on birth

outcomes (Lyu et al. 2025; Krista 2025), food insecurity (Lai et al. 2020; Cardarelli et al. 2021; Wahdat 2022; Jacobs et al. 2023), and mental health (Cooney and Shaefer 2021; Chu and Teng 2022; Tsai et al. 2022; Jeong and Fox 2023).[1] The results point to improvements in mental health and food security, but ambiguous effects on infant health. Most closely related to this paper, Atwood and Fleming (2023) analyzes the effect of the first stimulus payment in April 2020 on cases and deaths related to Covid-19 using an event-study approach at the county-week level before and after the rollout of the stimulus round. The results suggest no statistically significant effects of stimulus payments on confirmed cases and deaths from Covid-19. We add to this literature by using an alternative identification strategy that aims at isolating the cause effect of stimulus payments, focusing on all stimulus rounds, and analyzing a broader range of health outcomes such as emergency department visits, inpatient stays, and mortality due to causes of death other than Covid-19.

Third, we also complement the literature that studies the effects of implementing and removing state-mandated lockdown measures during the pandemic on health outcomes (Fowler et al. 2020; Hsiang et al. 2020; Kaufman et al. 2020; Marroquín et al. 2020; Stock et al. 2020; Ziedan et al. 2020; Berry et al. 2021; Dave et al. 2021; Gupta et al. 2021a; Guy 2021; Tam et al. 2022). This literature provides mixed results on the effects of non-pharmaceutical measures on disease prevalence.[2] Berry et al. (2021) use a difference-in-difference approach to analyze the effects of shelter-in-place measures on COVID-19 cases, COVID-19 deaths, mobility, and unemployment. The results of this work suggest that due to different trends in treatment and control states the estimates cannot be interpreted causally. We extend this work by analyzing a broader set of health outcomes and using a difference-in-difference model with matched treatment and control states that should better account for the different trends in control and treatment states. However, we find that even after matching some

[1] See McNamara et al. (2023) for a systematic review of studies that analyze how economic support policies across the world mitigated the effects of job loss during the first year of the pandemic.

[2] Related literature finds small effects of social distancing measures on mobility (Chen et al. 2020; Wright et al. 2020; Gupta et al. 2021b; Goolsbee and Syverson 2021) and economic outcomes (Goolsbee and Syverson 2021; Bartik et al. 2020; Forsythe et al. 2020; Rojas et al. 2020) suggesting that behavioral changes were largely voluntary.

outcomes (mortality and hospital stays) trend differently in treatment and control states before the reopening of the economy.

The paper is structured as follows. In section 2 we explain the institutional setting of the stimulus payments and state-ordered reopening. Section 3 describes the data sources as well as the construction of the outcome variables and analysis sample. We lay out the empirical models used to answer the research questions in section 4. Section 5 presents the results and section 6 concludes.

2 Background

2.1 Stimulus Payments

During the pandemic, the federal government provided $814.4 billion in stimulus payments in April 2020, January 2021, and March 2021 (Internal Revenue Service, 2022). The size of the stimulus check was based on the family income and size. The first stimulus payment was distributed in April 13, 2020 under the Coronavirus Aid, Relief, and Economic Security (CARES) Act. Individuals earning less than $75,000 received $1,200, married couples earning less than $150,000 received $2,400, and families received an additional $500 for each child. Payments were progressively reduced at higher income levels and fully phased out for households with incomes exceeding $99,000 for single filers without children or $198,000 for married couples without children. The Consolidated Appropriations Act included the second round of stimulus payments available on January 4, 2021. One-person households with income below $75,000 and married households with income below $ 150,000 received $600 per income tax filer. Families with children received additional $600 per child. The stimulus payments were phased out as income increased and single filers with income above $87,000 and married couples who jointly filled with income above $174,000 were not eligible for the payment. The last round of stimulus payments was included in the American Rescue Plan that the Congress passed on March 11, 2021. The eligibility criteria were similar to the

first two rounds except the faster phase out schedule. Single households with income up to $75,000 and married couples with income up to $150,000 received $1,400 per tax filer and the stimulus payments were completely phased out above $80,000 for single individuals without children and $160,000 for married couples without children. The majority of stimulus payments were cashed or deposited immediately after the government issued the payments. For instance during the first round, 69% of stimulus checks were deposited on April 15, 2020 (Bureau of the Fiscal Service, 2020).

2.2 State-Ordered Reopenings

During the early stages of the pandemic U.S. states implemented various lockdown measures to reduce the negative impacts of the pandemic. These mitigation policies included shelter-in-place orders, restrictions on gathering and traveling, and closures of business and schools. Due to the worsening economy, political pressure, and public demand state governments started lifting the restrictions, but eventually imposing restriction again to reduce the spread of COVID-19. There was substantial heterogeneity in the timing and type of the initial reopening process across states. Some states reopened earlier and more parts of the economy than others. We use either the date when a state has removed stay-at-home orders or the date when non-essential businesses were reopened and choose the earlier of the two dates to define the date of reopening. Table A.1 shows the dates and the types of reopening. With exception of Arkansas, Iowa, Nebraska, North Dakota, South Dakota, Utah, and Wyoming all states issued a shelter-in-place order. On April 20, 2020 and June 8, 2020 South Carolina and New York were the first and last state to reopen the economy. In our analysis we exploit the state differences in the timing of the initial reopening to analyze if removing restrictions affects mortality and utilization of health care. The treatment group consists of the first ten states that opened the economy between April 20, 2020 and April 30, 2020.

3 Data

3.1 Medicaid and Medicare Claims Data

We identify emergency department (ED) and inpatient (IP) visits for all Medicare Fee-for-Service (FFS), Medicare Advantage (MA), and Medicaid enrollees. For ED visits, we follow Venkatesh et al. (2017)'s identification algorithm for FFS and adapt it to MA and Medicaid. Additional details about our approach to identifying visits can be found in Sventek et al. (2025).

For Medicare FFS, we use the Medicare Provider Analysis and Review (MedPAR), outpatient (OP), and carrier research identifiable files (RIF). Using the MedPAR, we count IP stays and ED visits that resulted in an IP stay, which are identified by the ED charge amount. In addition, we count ED visits that are found in the OP and carrier files using revenue center codes and Healthcare Common Procedure Coding System (HCPCS) codes.

For MA, we use the MedPAR, Encounter IP, Encounter OP, and Encounter Carrier files. We aggregate IP claims from the Encounter IP file to stays, and then merge them with the IP stays in the MedPAR on admission date because some stays appear in both files (Cotterill, 2023). We follow a similar procedure to FFS to identify ED visits in the Encounter IP, OP, and carrier data files.

To identify IP and ED visits in Medicaid, we use the Transformed Medicaid Statistical Information System (T-MSIS) Analytic Files (TAF) IP RIF and the TAF other services RIF. We follow Centers for Medicare & Medicaid Services (CMS) guidance to identify IP stays (Hula et al., 2019) and identify ED visits in both files using the same codes as for Medicare.

We use cause-of-death information from the National Death Index (NDI) linked to CMS claims data. For Medicare, this data extended through 2021 and we used those files as the primary mortality outcome. For Medicaid, cause-of-death information extended through 2020 and so we used all-cause mortality found in the Medicaid and Medicare demographic file as the primary mortality outcome for 2021. Our prior work shows that the NDI data

is representative of US mortality for most populations and causes, particularly for Medicare (Kunze et al., 2025).

We also created a cohort for everyone in Medicare and Medicaid with opioid use disorder (OUD) using the respective algorithms from CMS's Chronic Conditions Warehouse (CCW) and a one-year lookback. These individuals had either diagnoses on at least two different days within a year, a substance-related poisoning, or medication to treat OUD (MOUD). This cohort is described in prior work (Guth et al., 2025) and we show that these individuals have higher mortality and other risks.

3.2 Supplemental Data

To obtain median household income in the ZIP code we use the five-year estimates from the American Community Survey (ACS). ACS is a nationally representative survey conducted annually by the United States Census Bureau that covers a broad range of topics about social, economic, housing, and demographic characteristics of the U.S. population. The five-year estimates provide data averaged over a five-year period, offering more reliable estimates, especially for smaller populations or areas.

Information about the timing and type of pandemic-era restrictions comes from the COVID-19 US State Policy Database (Skinner et al., 2022). COVID-19 US State Policy Database was collected by researchers from U.S. universities and contains information on health, social, and economic policies in response to the COVID-19 pandemic in the US.

3.3 Construction of Analysis Data

We begin with Medicaid and Medicare beneficiaries that are enrolled for at least one day of the year in 2019-2021 and determine their death status and number of ED visits and IP stays.[3] We then calculate the daily mortality and utilization rate by using the number of

[3]We show results for beneficiaries that are continuously enrolled between 2019 and 2021. The results are very similar between continuously and non-continuously enrolled beneficiaries suggesting that selection into enrollment is less likely to bias the estimates. The results for non-continuously enrolled individuals are

deaths, ED visits, and IP stays on each day as the numerator and number of beneficiaries enrolled in the calendar year as the denominator. For the OUD cohort we follow the same steps, but restrict the sample to individuals that were diagnosed with either OUD before 2020 to avoid potentially endogenous selection into the OUD sample. Table 1 shows the summary statistics for Medicaid and Medicare beneficiaries that are enrolled for at least one day in each year between 2019 and 2021. Among Medicaid (Medicare) beneficiaries, 2.6% (3.5%) are diagnosed with OUD. The continuous enrollment is higher for individuals with OUD and among Medicare beneficiaries overall. Compared to individuals without OUD, the average age of individuals with OUD is higher (lower) among Medicaid (Medicare) beneficiaries. With bigger differences in Medicaid, beneficiaries with OUD are more likely to be white.

4 Empirical Strategy

4.1 Stimulus Payments

To estimate the effect of stimulus payments on health outcomes, we follow Chetty et al. (2023) and use a difference-in-difference model comparing daily mortality and utilization rates before and after the calendar day of stimulus payment versus mortality and utilization before and after the same calendar date in 2019:

$$y_{it} = \beta_0 + \beta_1 Stimulus_t + \beta_2 Pandemic_i + \beta_3 Stimulus_t \times Pandemic_i + \varepsilon_{it} \tag{1}$$

where y_{it} is the outcome of interest at time t (measured in days) and period i (identified as before or after the start of the pandemic). *Stimulus* is an indicator variable equal to one for the post-stimulus period and *Pandemic* is an indicator variable equal to one after the beginning of the pandemic. We use heteroskedasticity-robust standard errors. To account for cyclical fluctuations, we residualize daily mortality and utilization rates with respect to day-of-week fixed effects which are estimated using data for 2019. We also adjust for linear

available upon request.

pretrend in utilization or mortality to capture national shocks in utilization and mortality before the rollout of the stimulus payment.

4.2 State-Ordered Reopenings

We estimate the effect of state-ordered reopenings following Chetty et al. (2023) and estimate a difference-in-difference model that contrasts utilization and mortality rates in states that reopened at different dates:

$$y_{st} = \beta_0 + \beta_1 Open_s + \beta_2 Post_t + \beta_3 Open_s \times Post_t + \varepsilon_{st} \tag{2}$$

where y_{st} is the mortality or utilization rate in state s and day t. $Open_s$ is an indicator variable equal to one if the state is one the first 10 states to remove the stay at home order or began to reopen non-essential business. $Post_t$ is an indicator variable equal to one after the end of stay at home order or non-essential business openings. We cluster the standard errors at the state level.

We define the treatment group by choosing the first 10 states that reopened the economy after the shutdown period on or before 20th of April 2020. To define the control groups, we match the treatment states with control states using pre-treatment utilization and mortality rates during four weeks before reopening. The potential pool of control states is restricted to states that have not issued the end of stay at home orders or reopened non-essential business as of three weeks after the last treated state reopened. For each reopening date (April 20, 24, 26, 27, 30) we estimate the rank of each state in the distribution of each outcome of interest and choose control states that are within 0.5 mean rank of treated states.[4] We then pool all four opening dates and define the calendar time as the time relative to removing stay at home orders or opening non-essential businesses. We use weights proportional to the number of treated states for each event in the regression.[5]

[4]Mean rank of 0.5 is the lowest threshold that provides at least the same number of control states for each reopening date.

[5]Tables A.4-A.7 show the treatment states and the corresponding control states for each opening date.

5 Results

We begin by analyzing trends in mortality and utilization during 2020 and 2021. Figure 1 plots a seven-day moving average of all-cause (panel a) and non-covid (panel b) mortality rate per 100,000 Medicare and Medicaid beneficiaries. We see a strong increase in mortality right before and a strong decrease right after the first and second stimulus payment for all individuals. This increase is mainly driven by an increase in deaths due to COVID-19 and potentially to a lesser degree by some of other causes of death that are also characterized by an inflection point around the stimulus payments (see figure A.1). Figure A.2 shows that while there are differences in the level, the trends in mortality are very similar for individuals with and without OUD. Shown in panel (a) of figures 2 and 3 the ED visits and IP stays rates per 10,000 Medicare and Medicaid beneficiaries decrease substantially before the first stimulus payment and increase right after the first stimulus payment, but never return to the original level. The trends in non-covid related ED visits and IP stays are very similar to all-cause ED visits and IP stays suggesting that the decrease in health care utilization was not driven by covid-related ED visits and IP stays (see panel b in figures 2 and 3). Similarly to mortality, trends in utilization of beneficiaries with and without previous OUD are similar during the analysis period (see panel b in figures A.3 and A.4).

Could stimulus payments have alleviated the negative effects of the COVID-19 pandemic and reversed the trends in mortality and utilization? We answer this question by using the the difference-in-difference model shown in equation 1 and estimate the effects on mortality and utilization rates. Given the big changes in covid-related mortality, We focus on non-covid mortality and all-cause utilization as the outcomes. Since the first round of stimulus payments was fully rolled out on April 15, 2020 we define the analysis window as 25 days before and after April 15. Figure 4 plots the difference in daily mortality in 2020 versus 2019 before and after the stimulus payments for Medicaid and Medicare beneficiaries. Panels (a) shows that differences in mortality before the first stimulus payment fluctuate around zero and decreased after the first stimulus payment for Medicaid and Medicare beneficiaries. We

see a similar pattern for individuals with and without OUD shown in panels (a) and (d) in figure A.5. Top panel in table 2 shows the corresponding difference-in-difference estimates. Relative to the baseline mean, mortality among Medicaid and Medicare beneficiaries decreases by 36% and 14%, respectively. The estimated effects are statistically significant at conventional levels. For Medicaid (Medicare) beneficiaries mortality decreases by 29% (12%) and 45% (16%) for individuals without and with OUD, respectively. ED visits and inpatient stays increase after the first stimulus payment for Medicaid and Medicare beneficiaries (see figures 5 and 6 for the full population and figures A.6 and A.7 for the non-OUD and OUD population). Tables 3 and 4 show the difference-in-difference estimates of the effects of the first stimulus payment on ED visits and IP stays, respectively. The effects on ED visits for the full population, are statistically significant at conventional levels, are similar for Medicaid and Medicare beneficiaries, and range between 17% and 18% relative to the baseline mean. Similarly to mortality estimates, increases in ED visits are stronger for individuals without prior OUD in both programs. The effects on inpatient stays are stronger for Medicaid beneficiaries and individuals without prior OUD.

We also analyze the effect of the stimulus payments on mortality due to opioid overdose and OUD-related utilization. To be consistent, we only examine the first round for opioid-related outcomes since cause of death is not available for Medicaid beneficiaries after 2020. The results of this analysis are shown in table A.8 and figure A.8. The results suggest that utilization increases for all beneficiaries and mortality decreases for all individuals except for Medicare beneficiaries with previous OUD. Relative to the baseline mean the effects for all outcomes are greater for individuals without previous OUD diagnosis which is driven by very low baseline fatal opioid overdoses or OUD-related utilization of individuals without previous OUD.

Next, we evaluate the second round of stimulus payments that was rolled out on January 4, 2021. The difference-in-difference estimates of mortality are shown in the middle panel of table 2 and the corresponding event-study estimates are shown in panel (b) of figures 4

and A.5 for the full population and OUD population.[6] The results indicate that mortality of Medicare beneficiaries was not affected but decreased for Medicaid beneficiaries after the second round of stimulus payments. Relative to the baseline, the mortality rate of Medicaid beneficiaries decreased by 12%. Shown in table 3 and figures 5 and A.6, utilization of ED services generally increased after the second stimulus payment in both programs with bigger impacts on individuals without OUD. The effects are slightly stronger for Medicare (12%) beneficiaries than for Medicaid (9%) beneficiaries. The effects on inpatient stays are only precisely estimated for individuals without previous diagnosis of OUD and show opposite effects for individuals enrolled in Medicaid and Medicare (see table 4 and figures 6 and A.7)

To evaluate the last stimulus payment, we follow the same empirical approach as for the first and second stimulus payment and use March 17, 2021 - the modal date of deposits - to define the treatment date and exclude March 13 - 16, 2021 since payments were made beginning March 13, 2021. Table 2 and figures 4 and A.5 show that with exception of Medicaid enrollees with previous OUD, mortality increased after the rollout of the the third stimulus payments. We estimate statistically significant effects at conventional levels for Medicare (Medicaid) beneficiaries on the order of 6% to 16% (7% to 31%) relative to the baseline mean. With respect to health service utilization, we find statistically significant increases in ED visits following the third stimulus payment for all analysis groups except for beneficiaries with previous OUD diagnosis. The estimated effects relative to the baseline mean range between 1% and 9% with bigger effects for Medicaid beneficiaries (see table 3 and figures 5 and A.6). Shown in table 4 and figures 6 and A.7, inpatient stays increased after the third stimulus payment with stronger effects for Medicaid beneficiaries. We find that inpatient stays increased by 1%-17% with statistically significant effects at conventional levels for all groups except beneficiaries with previous OUD diagnosis.

Existing literate documents liquidity sensitivity in healthcare consumption, specifically for prescription drugs (Gross et al., 2022). Hence, the effects of stimulus payments on health

[6]Since Medicaid NDI is not available in 2021, we use all-cause mortality when we analyze the effect of second and third stimulus payment on Medicaid and Medicare beneficiaries for comparison reasons.

outcomes could be different across the income distribution due to liquidity constraints of patients. To test this hypothesis, we estimate the effect of stimulus payments on mortality and utilization outcomes separately for individuals living in ZIP codes with median household income in different quartiles of the national distribution. Tables A.9-A.11 show the effects of the stimulus payments on mortality and utilization across the ZIP code income distribution. For the most part, the effects across the different quartiles of ZIP code income are very similar and the point estimates are not statistically different from each other. This result suggest that either Medicaid and Medicare beneficiaries living in low- and high-income areas are equally liquidity constraint or that health care utilization is less responsive to income than prescription drugs.

To counteract the negative effects of the pandemic, states issued various policies. Although none of these policies were implemented at the exact same time as the first stimulus round, some policies were introduced within a week of the stimulus payment and could therefore have affected utilization and mortality. Removal of stay-at-home orders or opening of businesses are the most crucial legislations since they affect the whole population and were rolled out beginning on 20, April 2020. To understand whether state-mandated openings contributed to changes in mortality and utilization, we estimate the difference-in-difference model shown in equation 2 using a two- or three-weeks window around the opening date. We define treatment states as the first 10 states that issued the removal of stay-at-home orders or reopened non-essential businesses and match control states using pre-treatment outcome variables (see section 4 for more details). Figures A.12-A.14 show the corresponding seven-day moving average of mortality and utilization rate in treatment and control states before and after opening the economy. The trends in mortality were very similar in treatment and control states up to 30 days before the opening, but diverged substantially afterward. This change is driven by an increase in mortality in control states which can be seen in figures A.15 and A.16 that show mortality trends for each state separately. The differences in trends before treatment suggest that the decision to open or not to open the economy was based

on changes in mortality trends and that the matched difference-in-difference model will not provide causal estimates when mortality is the outcome of interest. Similarly to mortality, the trends in average daily IP stays begin to diverge in treatment and control states 30 days before the state-mandated reopening begins (see figure A.14). Shown in figure A.13, ED visits in treatment and control states appear to follow each other quite well. We therefore only discuss the effects on ED visits, but provide estimates of mortality and IP stays for reference. Table 5 and 6 shows the effects of reopening of the economy for Medicaid and Medicare beneficiaries. In addition to the baseline model without any controls, we include region-by-day fixed effects to account for potential time-varying omitted variables. We find that ED visits are not affected by state-mandated opening in the two-weeks analysis window except for Medicaid beneficiaries with previous OUD that decrease the ED visits by 4-5% relative to the baseline mean. For the three-week window only Medicaid beneficiaries without prior OUD diagnosis respond to opening the economy by increasing the ED visits (2% relative to the baseline mean). The negative effects on OUD patients and modest positive effects on individuals without OUD suggest that increases in ED visits after the first stimulus payment are less likely to be driven by opening the economy.

6 Conclusion

The COVID-19 pandemic had wide-ranging and profound effects, touching nearly every aspect of life. To alleviate the severe economic and social disruptions, federal and state government took a wide range of actions that included public health, economic, and educational measures. We evaluate how the rollout of stimulus payments and the reopening of the economy affected mortality and health care utilization of Medicare and Medicaid beneficiaries with and without prior OUD diagnosis.

We find different effects of each stimulus round on mortality, ED visits, and IP stays. The first stimulus payment in April 2020 resulted in a decrease of mortality and an increase

in ED visits and IP stays. The second stimulus payment in January 2021 had no effect on mortality of Medicare beneficiaries, but led to a reduction of mortality for Medicaid enrollees. While ED visits increase among beneficiaries of both programs, we find that the effects on IP stays operate in the opposite direction for Medicaid and Medicare beneficiaries. The third stimulus payment positively affects mortality and utilization across all groups. Across all stimulus rounds and outcomes of interest, the effects are stronger for Medicaid beneficiaries and for individuals without a previous diagnosis of OUD.

The analysis of state-mandated reopening suggests that only estimates on the utilization of emergency departments can be interpreted causally since the decision to remove stay-at-home orders or reopen non-essential businesses could be driven by trends in mortality and inpatient stays. We show that reopening the economy results in decreased ED visits for Medicaid beneficiaries with OUD within two weeks and increased ED visits of Medicaid beneficiaries without prior OUD within three weeks after the restrictions were lifted.

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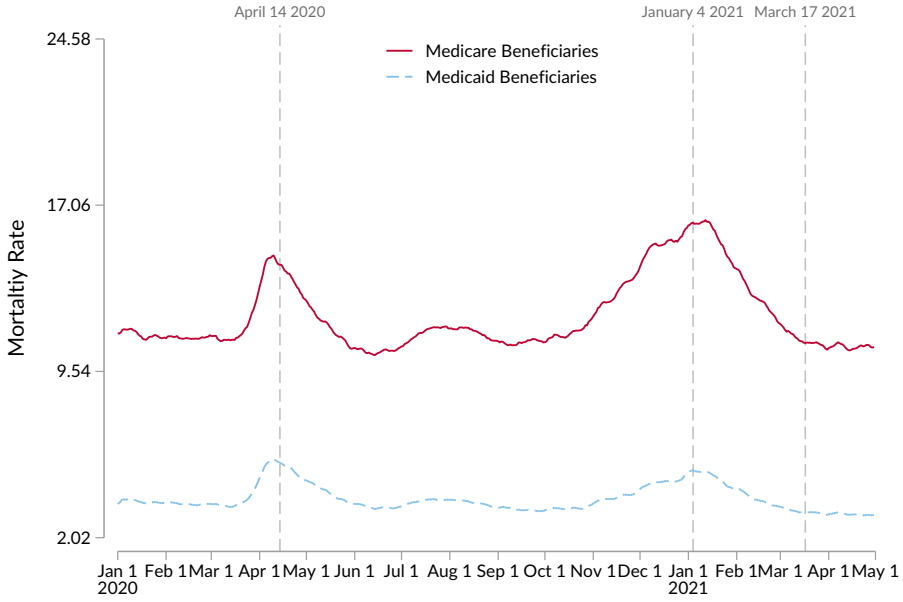
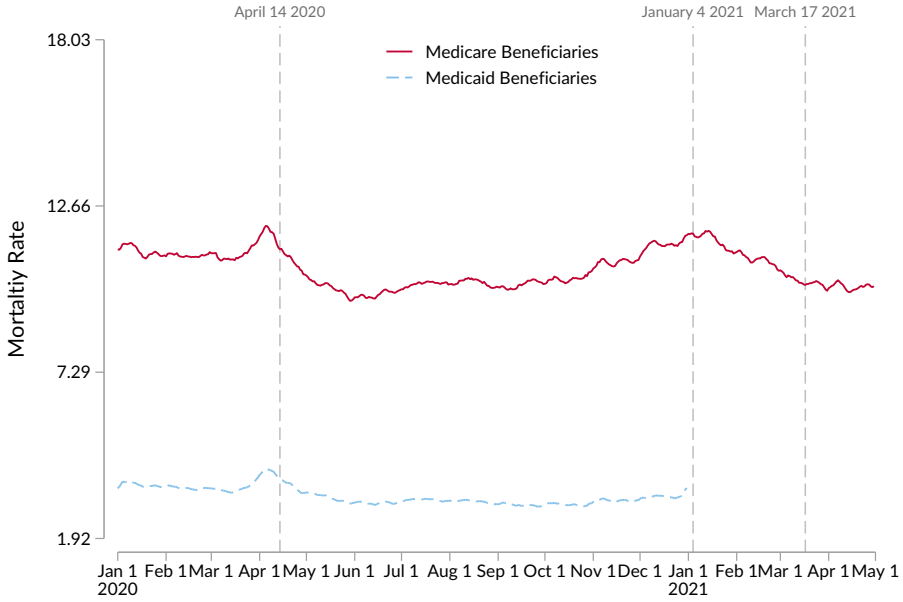
7 Figures and Tables

Figure 1: Trends in Mortality of Medicaid and Medicare Beneficiaries

(a) All-Cause Mortality



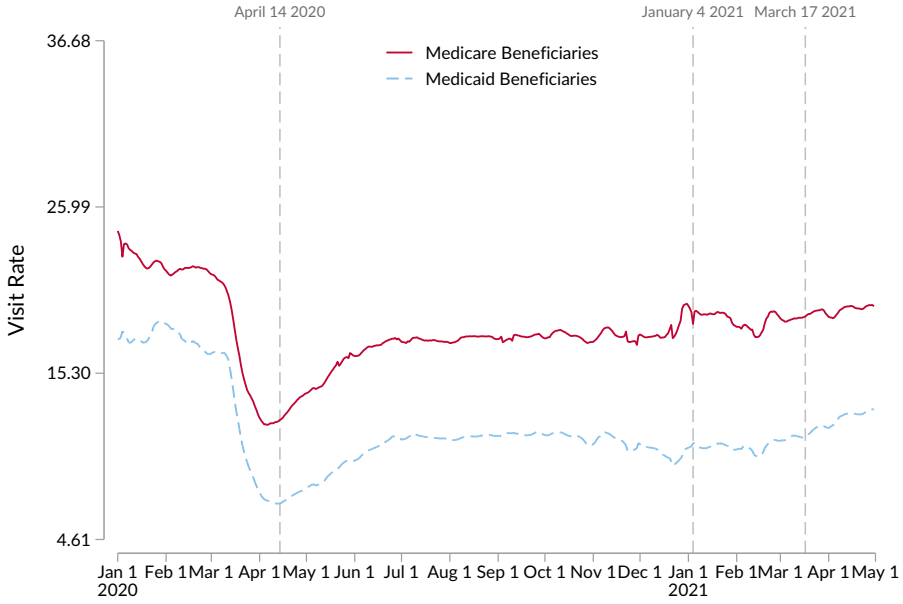
(b) Non-Covid Mortality



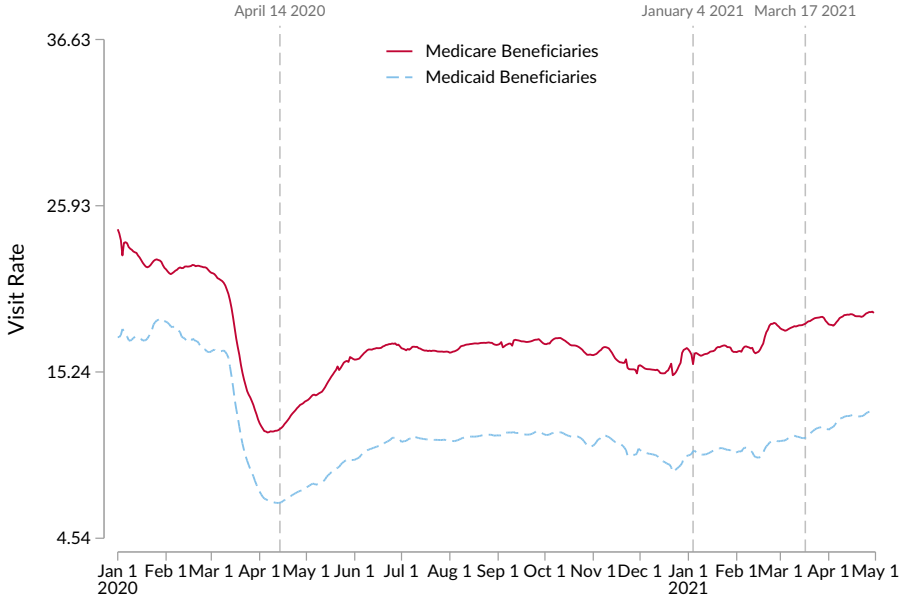
Notes: This figure shows a seven-day moving average of mortality rate per 100,000 Medicaid and Medicare beneficiaries. We obtain the cause of death, death status, and date of death from the Medicaid and Medicare National Death Index and enrollment files. Medicaid National Death Index is only available until 2020.

Figure 2: Trends in Emergency Department Visits of Medicaid and Medicare Beneficiaries

(a) All-Cause ED Visits



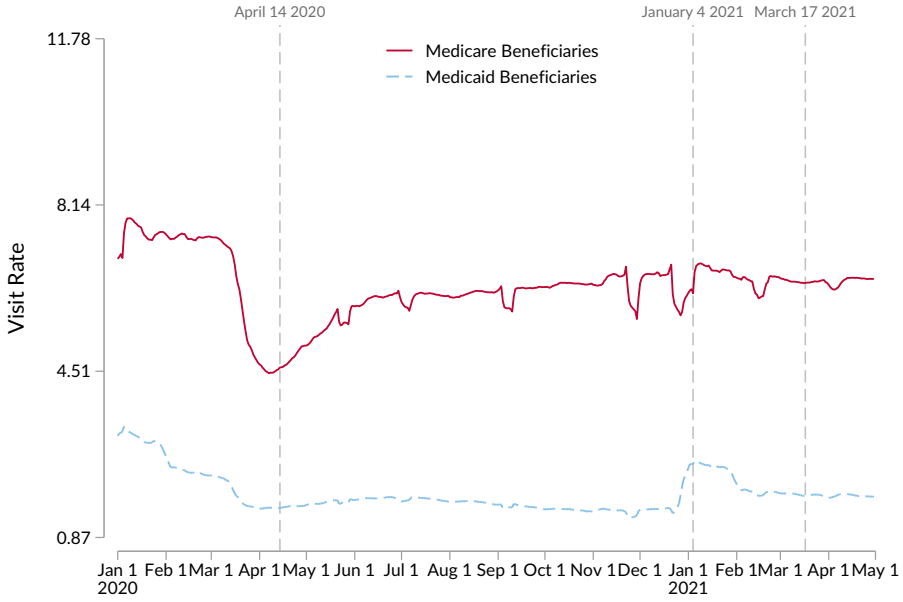
(b) Non-Covid ED Visits



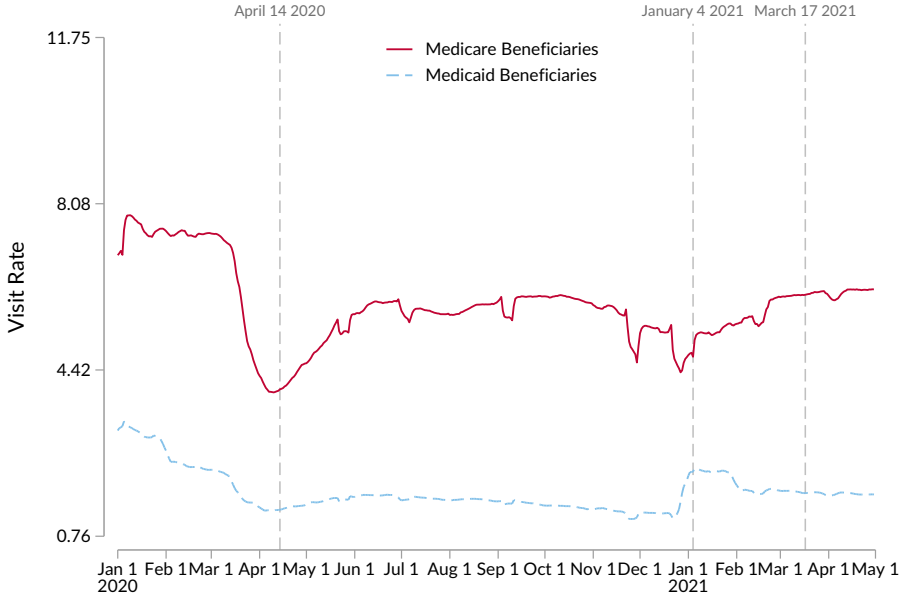
Notes: This figure shows a seven-day moving average of emergency department visit rate per 10,000 Medicaid and Medicare beneficiaries. We obtain information on emergency department visits from Medicare and Medicaid claims data.

Figure 3: Trends in Inpatient Stays of Medicaid and Medicare Beneficiaries

(a) All-Cause Inpatient Stays



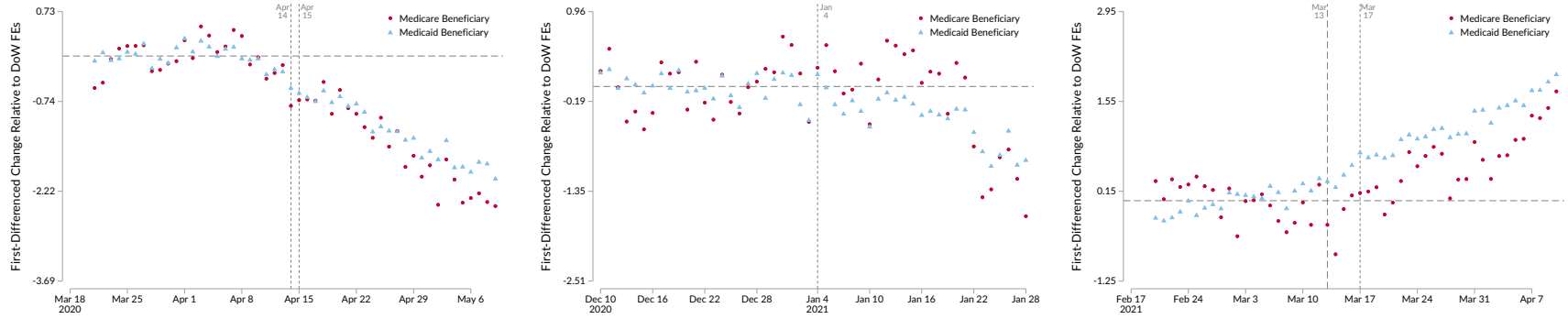
(b) Non-Covid Inpatient Stays



Notes: This figure shows a seven-day moving average of inpatient stay rate per 10,000 Medicaid and Medicare beneficiaries. We obtain information on inpatient stays from Medicare and Medicaid claims data.

Figure 4: Effect of Stimulus Payment on Mortality of Medicaid and Medicare Beneficiaries

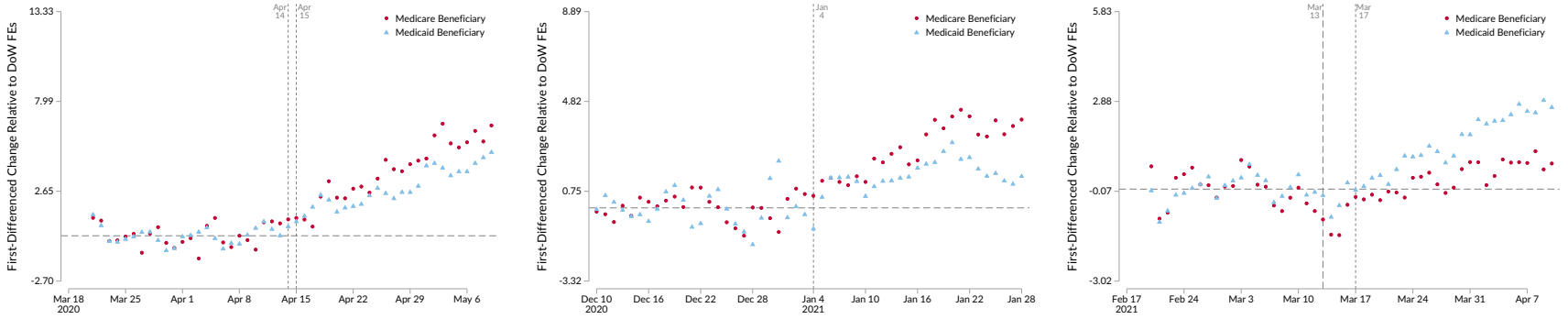
(a) Stimulus 1 (April 2020) (b) Stimulus 2 (January 2021) (c) Stimulus 3 (March 2021)



Notes: This figure shows the effect of stimulus payment on non-covid (stimulus 1) and all-cause (stimulus 2 and 3) mortality rate per 100,000 Medicaid and Medicare beneficiaries. We obtain the cause of death, death status, and date of death from the Medicaid and Medicare National Death Index and enrollment files. Medicaid National Death Index is only available until 2020.

Figure 5: Effect of Stimulus Payment on ED Visits of Medicaid and Medicare Beneficiaries

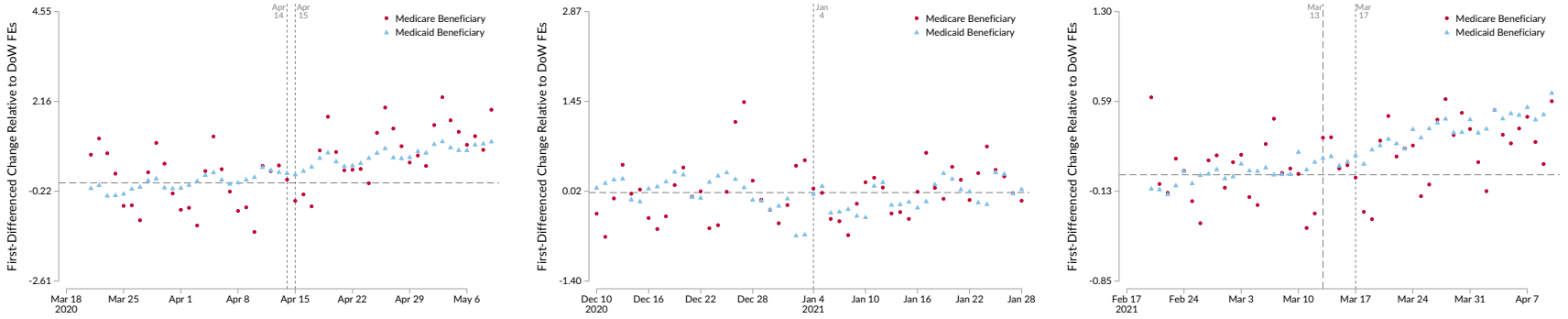
(a) Stimulus 1 (April 2020) (b) Stimulus 2 (January 2021) (c) Stimulus 3 (March 2021)



Notes: This figure shows the effect of stimulus payment on emergency department visit rate per 10,000 Medicaid and Medicare beneficiaries. We obtain information on emergency department visits from Medicare and Medicaid claims data.

Figure 6: Effect of Stimulus Payment on Inpatient Stays of Medicaid and Medicare Beneficiaries

(a) Stimulus 1 (April 2020) (b) Stimulus 2 (January 2021) (c) Stimulus 3 (March 2021)



Notes: This figure shows the effect of stimulus payment on inpatient stay rate per 10,000 Medicaid and Medicare beneficiaries. We obtain information on emergency department visits from Medicare and Medicaid claims data.

Table 1:
Summary Statistics of Medicaid and Medicare Beneficiaries

	Medicaid Beneficiaries			Medicare Beneficiaries		
	All	No OUD	OUD	All	No OUD	OUD
Age	29.43	29.06	43.33	71.75	71.97	65.69
	(22.86)	(22.86)	(13.18)	(11.02)	(11.02)	(13.63)
Male	0.55	0.55	0.52	0.54	0.54	0.58
	(0.50)	(0.50)	(0.50)	(0.50)	(0.50)	(0.49)
Female	0.45	0.45	0.48	0.46	0.46	0.42
	(0.50)	(0.50)	(0.50)	(0.50)	(0.50)	(0.49)
Missing Sex	0.00	0.00	0.00	0.00	0.00	0.00
	(0.03)	(0.03)	(0.01)	(0.00)	(0.00)	(0.00)
White	0.36	0.36	0.62	0.73	0.73	0.76
	(0.48)	(0.48)	(0.49)	(0.44)	(0.44)	(0.43)
Black	0.18	0.18	0.15	0.11	0.11	0.14
	(0.38)	(0.38)	(0.35)	(0.31)	(0.31)	(0.34)
Asian	0.05	0.05	0.01	0.04	0.04	0.01
	(0.21)	(0.21)	(0.10)	(0.19)	(0.19)	(0.09)
AIAN	0.01	0.01	0.02	0.00	0.00	0.01
	(0.11)	(0.11)	(0.13)	(0.06)	(0.06)	(0.09)
Hispanic	0.22	0.22	0.09	0.10	0.10	0.08
	(0.42)	(0.42)	(0.28)	(0.30)	(0.30)	(0.27)
Other	0.01	0.01	0.01	0.03	0.03	0.01
	(0.08)	(0.08)	(0.07)	(0.16)	(0.16)	(0.11)
Missing Race	0.18	0.18	0.12	0.00	0.00	0.00
	(0.38)	(0.38)	(0.32)	(0.00)	(0.00)	(0.00)
Continuous Enrollment	0.78	0.78	0.86	0.94	0.94	0.99
	(0.41)	(0.41)	(0.35)	(0.23)	(0.23)	(0.07)
Dual Status	0.12	0.12	0.16	0.16	0.15	0.41
	(0.32)	(0.32)	(0.36)	(0.37)	(0.36)	(0.49)
Number of Observations	286,679,102	279,402,984	7,531,960	197,373,746	190,458,963	6,914,783

Notes: This table shows summary statistics of Medicaid and Medicare beneficiaries observed in 2019-2021.

Table 2:
Effect of Stimulus Payments on Mortality

	Medicaid Beneficiaries			Medicare Beneficiaries		
	All	No OUD	OUD	All	No OUD	OUD
			Stimulus 1 (April 2020)			
Stimulus	-1.26	-1.68	-1.77	-1.49	-1.62	-1.94
	(0.09)	(0.15)	(0.27)	(0.15)	(0.17)	(0.38)
Number of Observation	98	98	98	98	98	98
Baseline Mean	3.69	3.57	7.72	10.84	10.48	19.41
			Stimulus 2 (January 2021)			
Stimulus	-0.41	-0.56	-0.03	-0.20	-1.08	-0.08
	(0.12)	(0.15)	(0.33)	(0.20)	(0.30)	(0.64)
Number of Observation	100	100	100	100	100	100
Baseline Mean	3.29	3.16	7.46	10.97	10.55	21.08
			Stimulus 3 (March 2021)			
Stimulus	1.20	-0.30	0.56	0.63	1.71	1.80
	(0.08)	(0.07)	(0.24)	(0.10)	(0.13)	(0.38)
Number of Observation	92	92	92	92	92	92
Baseline Mean	3.93	3.79	8.34	11.23	10.87	19.69

Notes: This table shows the difference-in-difference estimates of the effects of three rounds of stimulus payments on non-covid (stimulus 1) and all-cause mortality (stimulus 2 and 3) rate per 100,000 Medicaid and Medicare beneficiaries with and without previous OUD. Robust standard errors are reported in parenthesis. We obtain the cause of death, death status, and date of death from the Medicaid and Medicare National Death Index and enrollment files. Medicaid National Death Index is only available until 2020.

Table 3:
Effect of Stimulus Payments on ED Visits

	Medicaid Beneficiaries			Medicare Beneficiaries		
	All	No OUD	OUD	All	No OUD	OUD
			Stimulus 1 (April 2020)			
Stimulus	2.83	5.67	4.86	3.89	8.31	10.36
	(0.36)	(0.49)	(0.75)	(0.40)	(0.80)	(1.52)
Number of Observation	98	98	98	98	98	98
Baseline Mean	16.17	15.20	46.54	22.67	19.98	86.49
			Stimulus 2 (January 2021)			
Stimulus	1.44	1.99	1.10	2.67	2.20	5.49
	(0.35)	(0.32)	(0.86)	(0.75)	(1.07)	(2.37)
Number of Observation	100	100	100	100	100	100
Baseline Mean	16.37	15.52	42.94	22.51	20.21	77.60
			Stimulus 3 (March 2021)			
Stimulus	1.52	1.38	0.42	0.36	0.92	-0.44
	(0.19)	(0.20)	(0.45)	(0.19)	(0.43)	(1.06)
Number of Observation	92	92	92	92	92	92
Baseline Mean	16.68	15.74	45.99	22.47	19.72	87.79

Notes: This table shows the difference-in-difference estimates of the effects of three rounds of stimulus payments on emergency department visit rate per 10,000 Medicaid and Medicare beneficiaries with and without previous OUD. Robust standard errors are reported in parenthesis. We obtain information on emergency department visits from Medicare and Medicaid claims data.

Table 4:
Effect of Stimulus Payments on Inpatient Stays

	Medicaid Beneficiaries			Medicare Beneficiaries		
	All	No OUD	OUD	All	No OUD	OUD
			Stimulus 1 (April 2020)			
Stimulus	0.73	0.30	0.76	0.90	3.11	3.28
	(0.07)	(0.04)	(0.17)	(0.22)	(0.31)	(0.74)
Number of Observation	98	98	98	98	98	98
Baseline Mean	2.04	1.87	7.33	7.72	7.01	24.53
			Stimulus 2 (January 2021)			
Stimulus	-0.05	0.91	0.65	0.02	-1.19	-0.11
	(0.16)	(0.28)	(0.46)	(0.37)	(0.35)	(1.12)
Number of Observation	100	100	100	100	100	100
Baseline Mean	2.05	1.91	6.65	7.14	6.54	21.51
			Stimulus 3 (March 2021)			
Stimulus	0.37	0.21	0.25	0.22	0.95	0.92
	(0.03)	(0.02)	(0.14)	(0.09)	(0.13)	(0.48)
Number of Observation	92	92	92	92	92	92
Baseline Mean	2.19	2.01	7.97	7.72	70.00	24.91

Notes: This table shows the difference-in-difference estimates of the effects of three rounds of stimulus payments on inpatient stay rate per 10,000 Medicaid and Medicare beneficiaries with and without previous OUD. Robust standard errors are reported in parenthesis. We obtain information on emergency department visits from Medicare and Medicaid claims data.

Table 5:
Effect of Reopening on Mortality and Utilization of Medicaid Beneficiaries

	Two-Weeks Window						Three-Weeks Window					
	All		No OUD		OUD		All		No OUD		OUD	
Mortality												
Opening	0.54	0.46	0.64	0.55	-2.70	-2.12	0.46	0.44	0.60	0.55	-1.47	-1.37
	(0.13)	(0.12)	(0.17)	(0.17)	(3.81)	(2.77)	(0.14)	(0.16)	(0.20)	(0.24)	(2.83)	(2.08)
Number of Observations	1,653	1,653	1,711	1,711	1,769	1,769	2,451	2,451	2,537	2,537	2,623	2,623
Baseline Mean	4.04	4.04	3.90	3.90	10.38	10.38	4.04	4.04	3.90	3.90	10.38	10.38
Emergency Department Visits												
Opening	0.13	0.13	0.18	0.17	-2.15	-1.68	0.29	0.27	0.31	0.29	-0.61	-0.55
	(0.11)	(0.12)	(0.11)	(0.12)	(0.92)	(0.66)	(0.14)	(0.14)	(0.13)	(0.13)	(0.72)	(0.55)
Number of Observations	1,943	1,943	1,885	1,885	2,146	2,146	2,881	2,881	2,795	2,795	3,182	3,182
Baseline Mean	13.69	13.69	12.97	12.97	41.45	41.45	13.69	13.69	12.97	12.97	41.45	41.45
Inpatient Stays												
Opening	0.05	0.05	0.04	0.05	1.15	0.79	0.13	0.13	0.13	0.13	1.26	0.97
	(0.03)	(0.02)	(0.03)	(0.02)	(1.02)	(0.90)	(0.04)	(0.03)	(0.04)	(0.03)	(0.87)	(0.82)
Number of Observations	1,856	1,856	1,943	1,943	2,030	2,030	2,752	2,752	2,881	2,881	3,010	3,010
Baseline Mean	2.59	2.59	2.45	2.45	7.87	7.87	2.59	2.59	2.45	2.45	7.87	7.87
Region x Day FE	No	Yes	No	Yes	No	Yes	No	Yes	No	Yes	No	Yes

Notes: This table shows the difference-in-difference estimates of the effects of removing state-at-home orders or opening non-essential businesses on non-covid mortality and all-cause utilization rate of Medicaid beneficiaries. Standard errors clustered at the state level are reported in parenthesis. We obtain death status and date of death from Medicaid and Medicare National Death Index files and utilization measures from the Medicaid and Medicare claims data.

Table 6:
Effect of Reopening on Mortality and Utilization of Medicare Beneficiaries

	Two-Weeks Window						Three-Weeks Window					
	All		No OUD		OUD		All		No OUD		OUD	
					Mortality							
Opening	0.33	0.29	0.30	0.21	0.38	2.00	0.52	0.40	0.51	0.36	0.58	1.12
	(0.30)	(0.24)	(0.27)	(0.21)	(2.12)	(2.86)	(0.27)	(0.21)	(0.24)	(0.17)	(1.67)	(2.25)
Number of Observations	1,653	1,653	1,624	1,624	1,972	1,972	2,451	2,451	2,408	2,408	2,924	2,924
Baseline Mean	11.46	11.46	11.15	11.15	21.65	21.65	11.46	11.46	11.15	11.15	21.65	21.65
					Emergency Department Visits							
Opening	0.20	0.16	0.17	0.14	1.32	1.05	0.42	0.34	0.41	0.34	0.18	0.53
	(0.17)	(0.24)	(0.16)	(0.22)	(1.72)	(1.73)	(0.21)	(0.26)	(0.21)	(0.23)	(1.72)	(2.09)
Number of Observations	1,943	1,943	1,972	1,972	1,827	1,827	2,881	2,881	2,924	2,924	2,709	2,709
Baseline Mean	20.35	20.35	18.00	18.00	78.35	78.35	20.35	20.35	18.00	18.00	78.35	78.35
					Inpatient Stays							
Opening	0.09	0.01	0.10	0.02	-0.40	-0.40	0.15	0.08	0.16	0.10	-0.77	-0.60
	(0.06)	(0.06)	(0.07)	(0.06)	(0.31)	(0.29)	(0.08)	(0.06)	(0.07)	(0.06)	(0.38)	(0.28)
Number of Observations	1,769	1,769	1,798	1,798	1,566	1,566	2,623	2,623	2,666	2,666	2,322	2,322
Baseline Mean	7.51	7.51	6.90	6.90	20.67	20.67	7.51	7.51	6.90	6.90	20.67	20.67
Region x Day FE	No	Yes	No	Yes	No	Yes	No	Yes	No	Yes	No	Yes

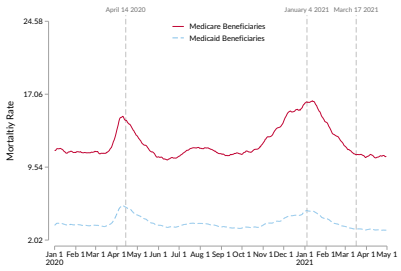
Notes: This table shows the difference-in-difference estimates of the effects of removing state-at-home orders or opening non-essential businesses on non-covid mortality and all-cause utilization rate of Medicare beneficiaries. Standard errors clustered at the state level are reported in parenthesis. We obtain death status and date of death from Medicaid and Medicare National Death Index files and utilization measures from the Medicaid and Medicare claims data.

Appendix

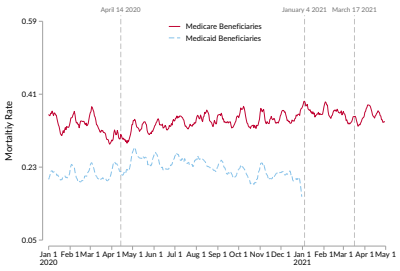
A Supplemental Figures and Tables

Figure A.1: Trends in Mortality Rates Different Causes of Death

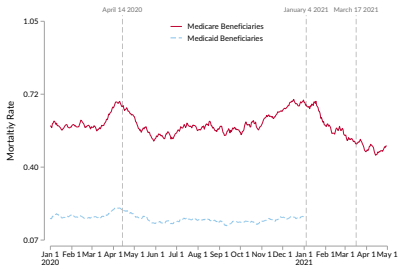
(a) All Cause



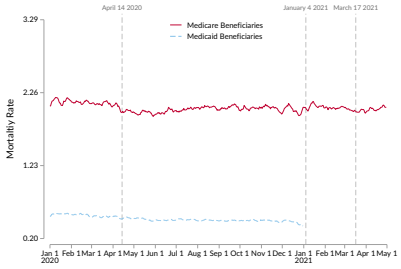
(b) Accidents



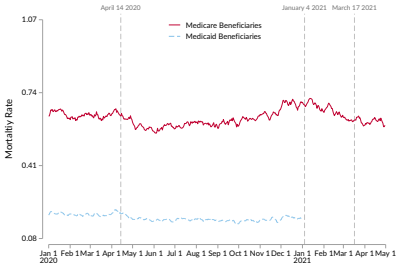
(c) Alzheimer



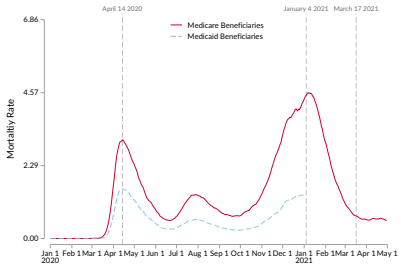
(d) Cancer



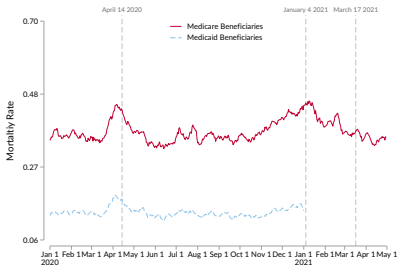
(e) Cerebrovascular



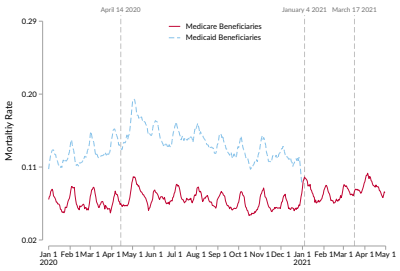
(f) Covid-19



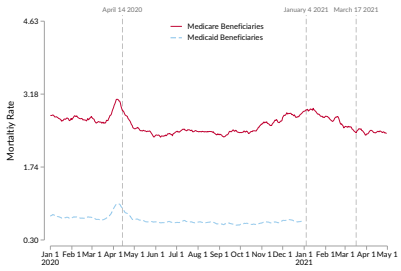
(g) Diabetes



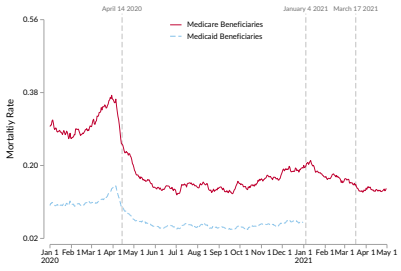
(h) Drug



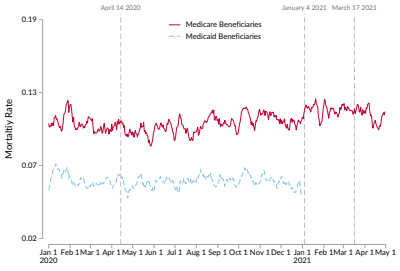
(i) Heart



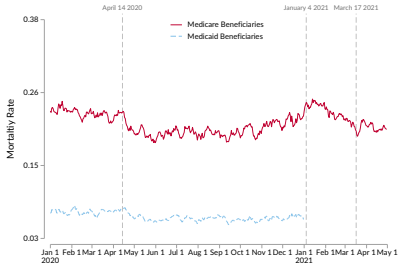
(j) Influenza

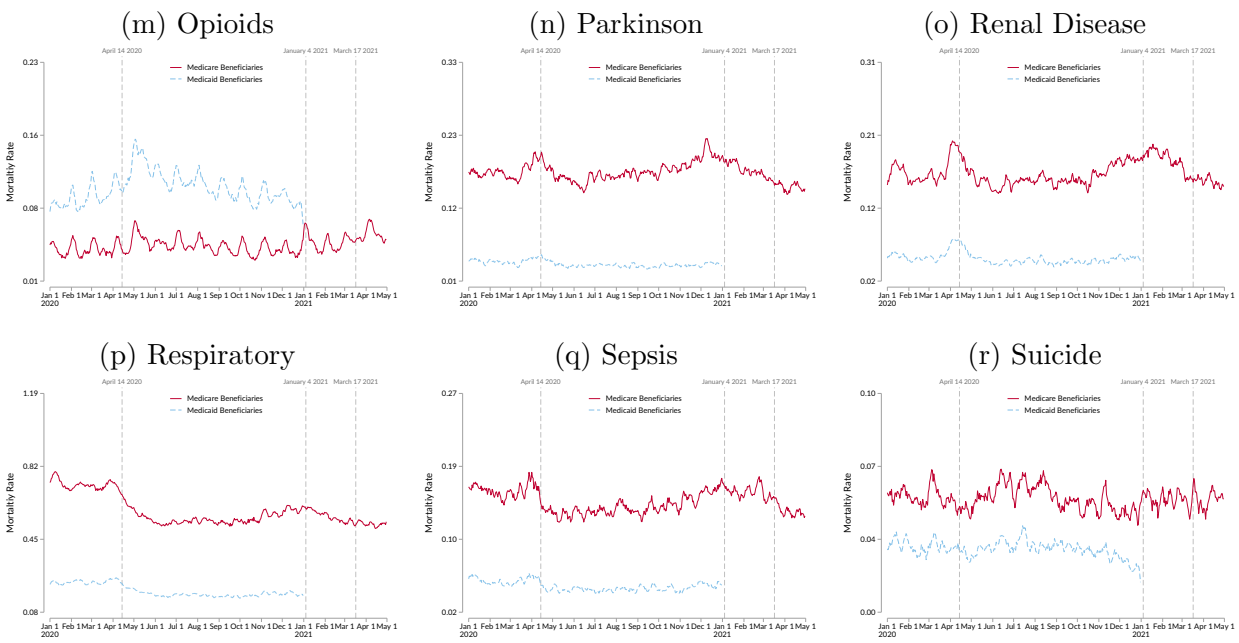


(k) Liver



(l) Nephritis

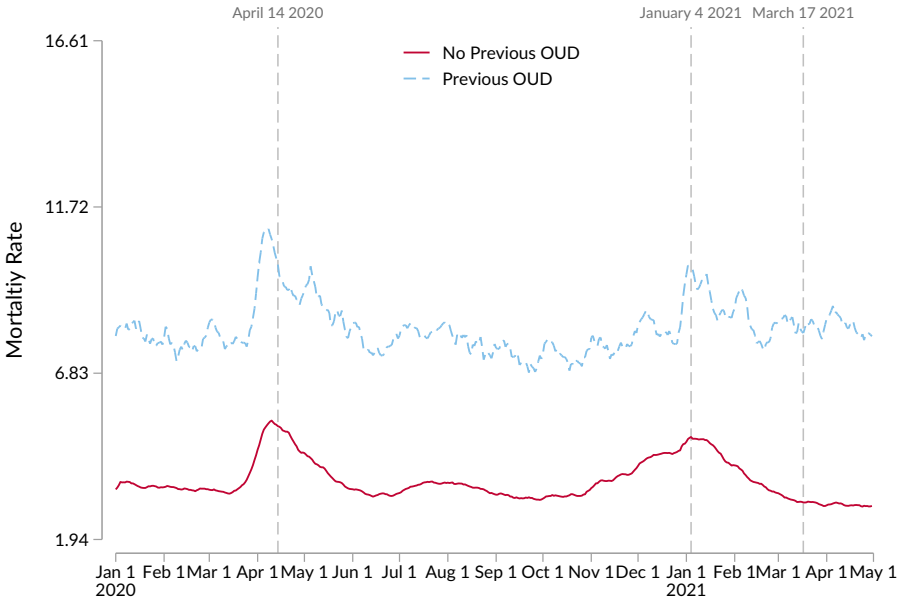




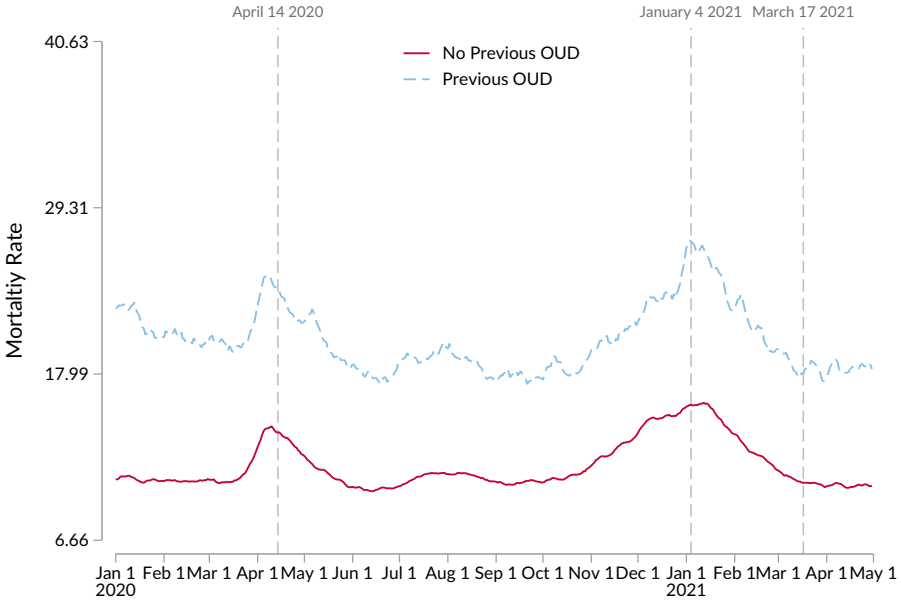
Notes: This figure shows a seven-day moving average of mortality rate per 100,000 Medicaid and Medicare beneficiaries. We obtain the cause of death, death status, and date of death from the Medicaid and Medicare National Death Index and enrollment files. Medicaid National Death Index that includes cause of death is only available until 2020.

Figure A.2: Trends in Mortality of Medicaid and Medicare Beneficiaries with OUD

(a) Medicaid Beneficiaries



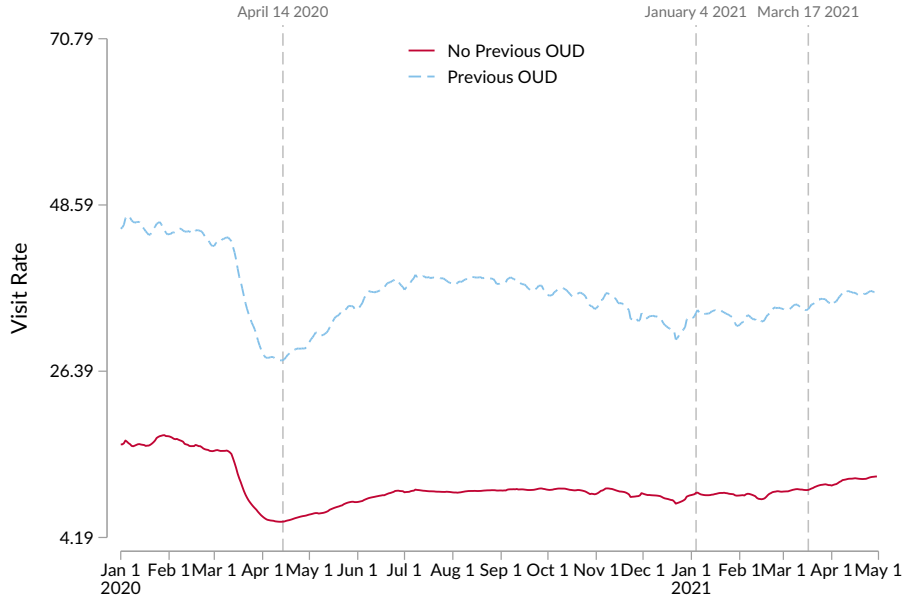
(b) Medicare Beneficiaries



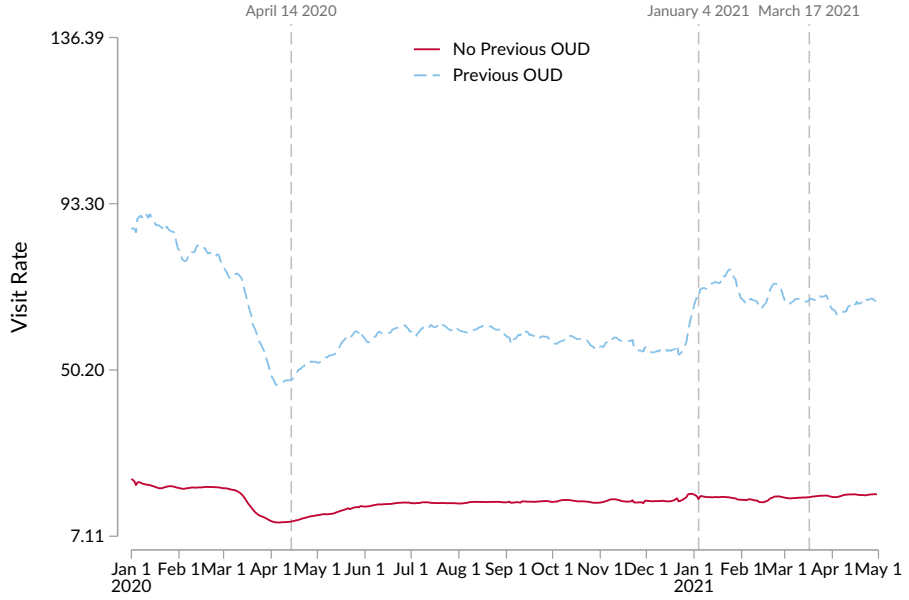
Notes: This figure shows a seven-day moving average of all-cause mortality rate per 100,000 Medicaid and Medicare beneficiaries. We obtain the cause of death, death status, and date of death from the Medicaid and Medicare National Death Index and enrollment files. Medicaid National Death Index that includes cause of death is only available until 2020.

Figure A.3: Trends in ED Visits of Medicaid and Medicare Beneficiaries with OUD

(a) Medicaid Beneficiaries



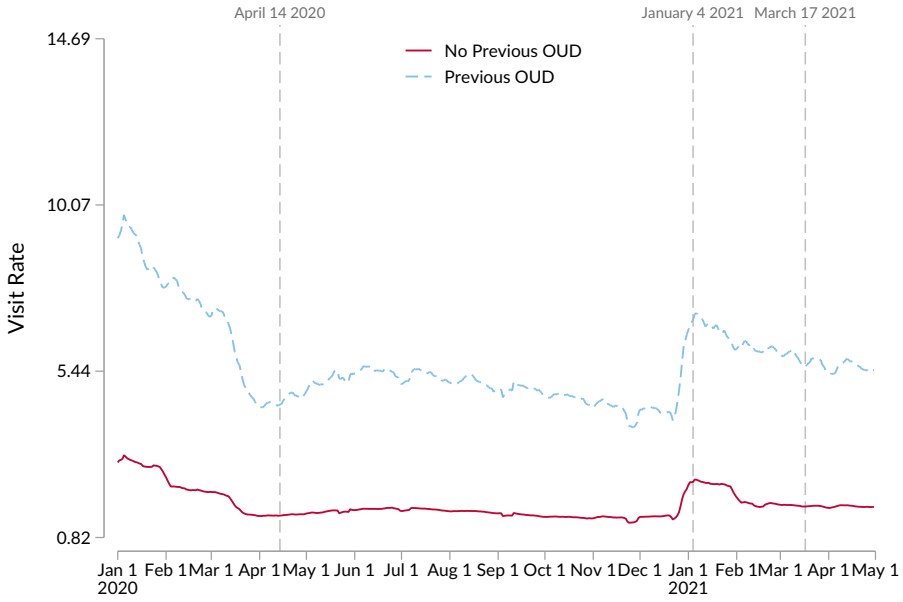
(b) Medicare Beneficiaries



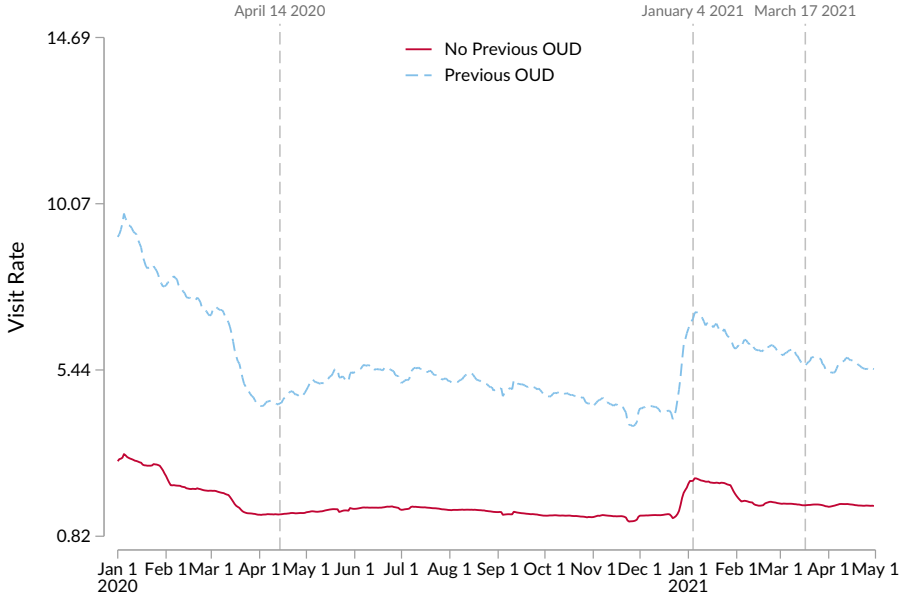
Notes: This figure shows a seven-day moving average of emergency department visit rate per 10,000 Medicaid and Medicare beneficiaries. We obtain information on emergency department visits from Medicare and Medicaid claims data.

Figure A.4: Trends in Inpatient Stays of Medicaid and Medicare Beneficiaries with OUD

(a) Medicaid Beneficiaries



(b) Medicare Beneficiaries

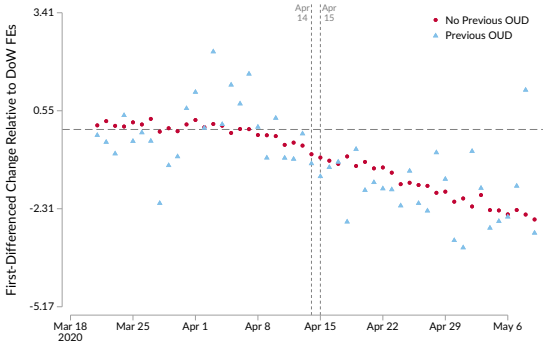


Notes: This figure shows a seven-day moving average of inpatient stay rate per 10,000 Medicaid and Medicare beneficiaries. We obtain information on inpatient stays from Medicare and Medicaid claims data.

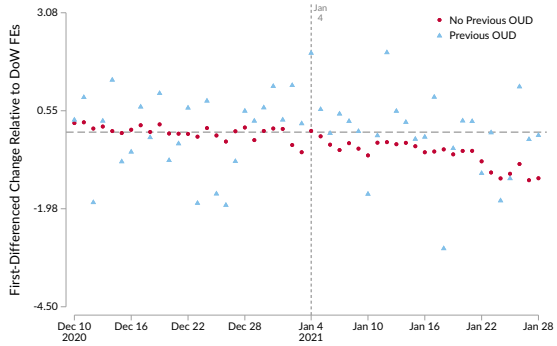
Figure A.5: Effect of Stimulus Payment on Mortality of Medicare Beneficiaries

Top Panel: Medicaid Beneficiaries

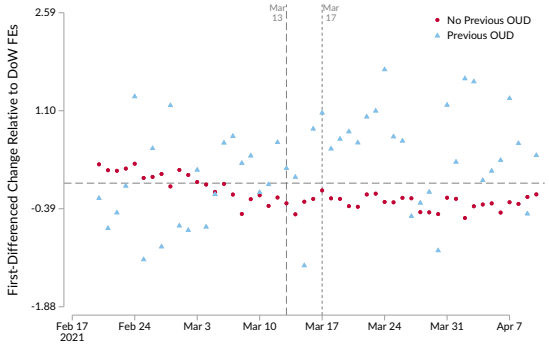
(a) Stimulus 1 (April 2020)



(b) Stimulus 2 (January 2021)

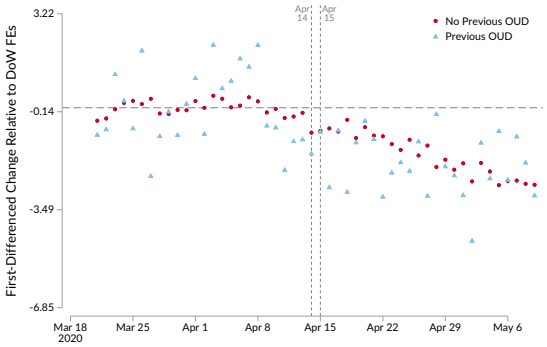


(c) Stimulus 3 (March 2021)

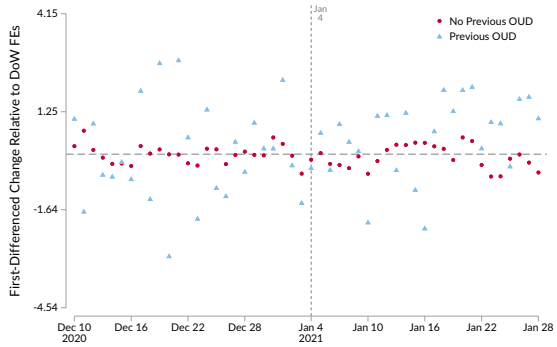


Bottom Panel: Medicare Beneficiaries

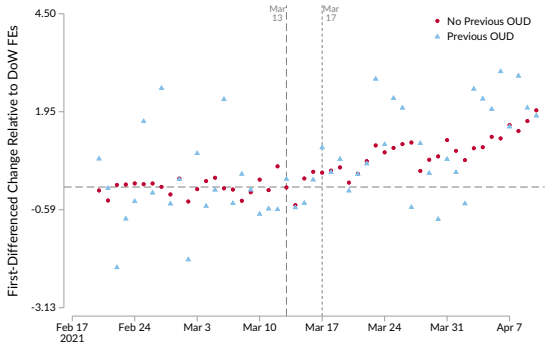
(d) Stimulus 1 (April 2020)



(e) Stimulus 2 (January 2021)



(f) Stimulus 3 (March 2021)

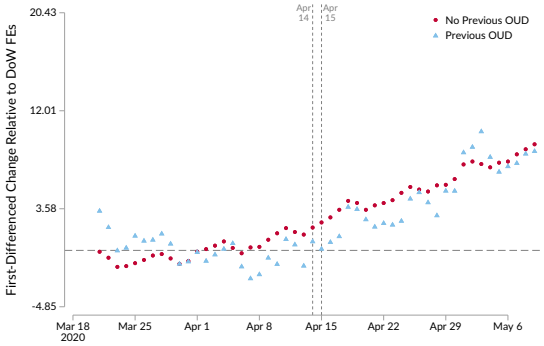


Notes: This figure shows the effect of stimulus payment on non-covid (stimulus 1) and all-cause (stimulus 2 and 3 Medicaid) mortality rate per 100,000 Medicaid and Medicare beneficiaries with and without previous OUD. We obtain the cause of death, death status, and date of death from the Medicaid and Medicare National Death Index and enrollment files. Medicaid National Death Index is only available until 2020.

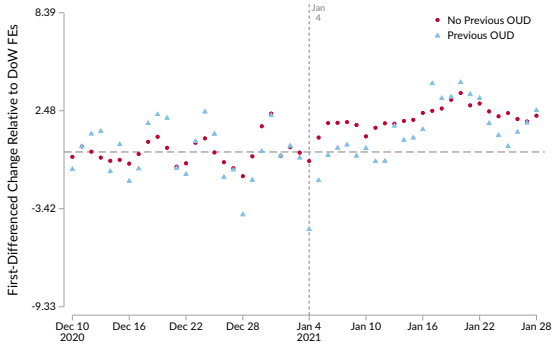
Figure A.6: Effect of Stimulus Payment on ED Visits of Medicare Beneficiaries

Top Panel: Medicaid Beneficiaries

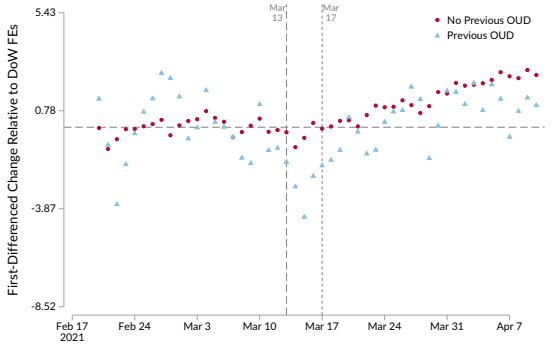
(a) Stimulus 1 (April 2020)



(b) Stimulus 2 (January 2021)

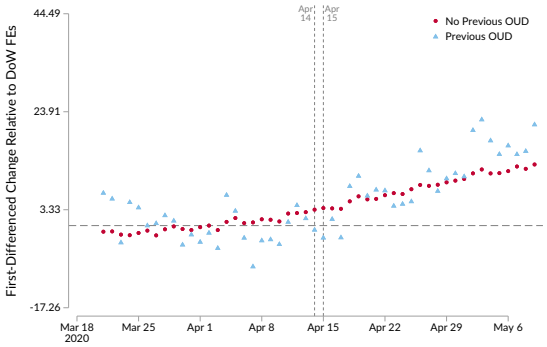


(c) Stimulus 3 (March 2021)

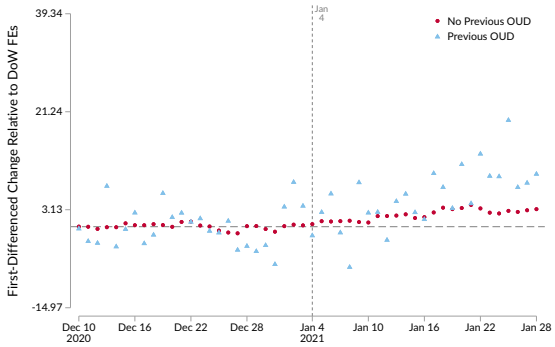


Bottom Panel: Medicare Beneficiaries

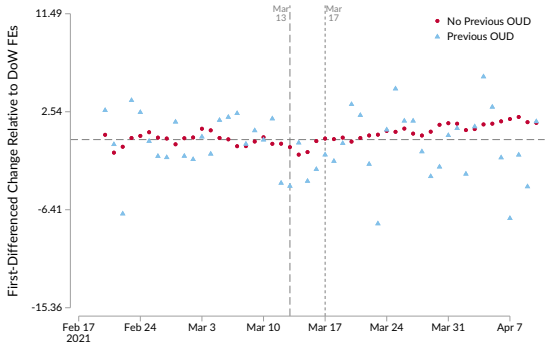
(d) Stimulus 1 (April 2020)



(e) Stimulus 2 (January 2021)



(f) Stimulus 3 (March 2021)



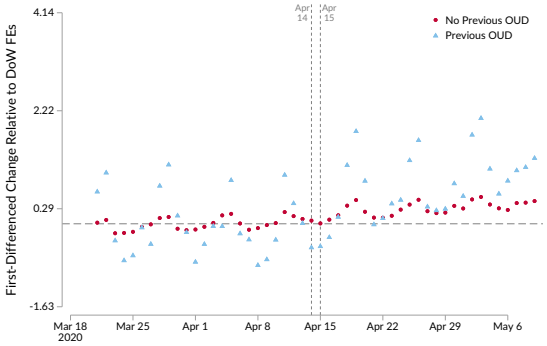
Notes: This figure shows the effect of stimulus payment on emergency department visit rate per 10,000 Medicaid and Medicare beneficiaries with and without previous OUD.

We obtain information on emergency department visits from Medicare and Medicaid claims data.

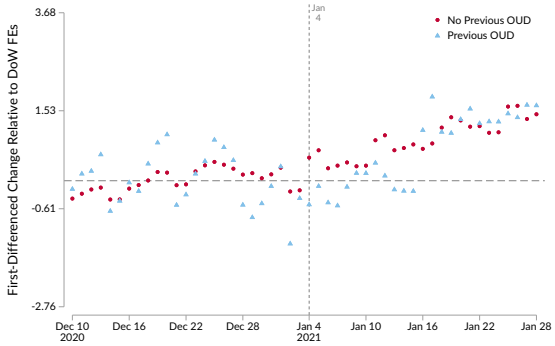
Figure A.7: Effect of Stimulus Payment on Inpatient Stays of Medicare Beneficiaries

Top Panel: Medicaid Beneficiaries

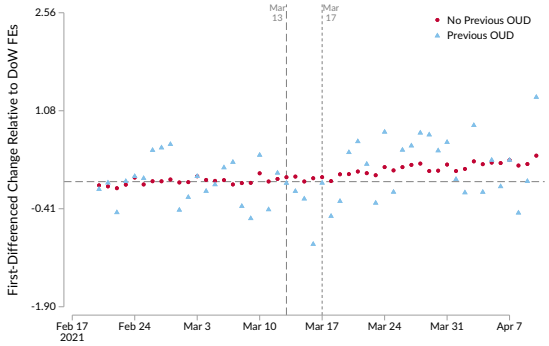
(a) Stimulus 1 (April 2020)



(b) Stimulus 2 (January 2021)

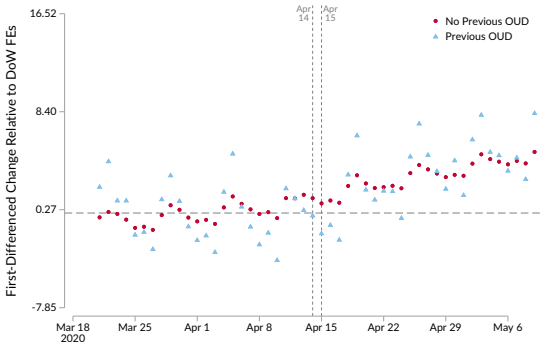


(c) Stimulus 3 (March 2021)

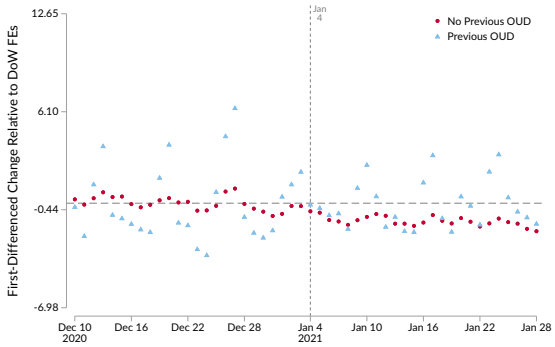


Bottom Panel: Medicare Beneficiaries

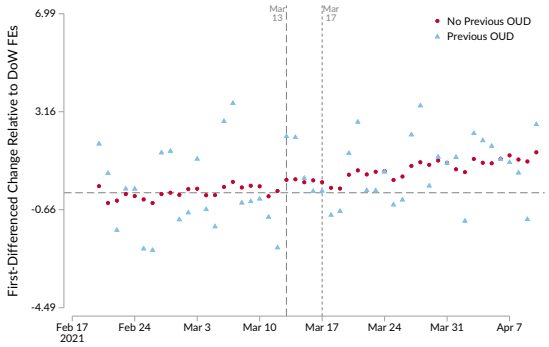
(d) Stimulus 1 (April 2020)



(e) Stimulus 2 (January 2021)



(f) Stimulus 3 (March 2021)

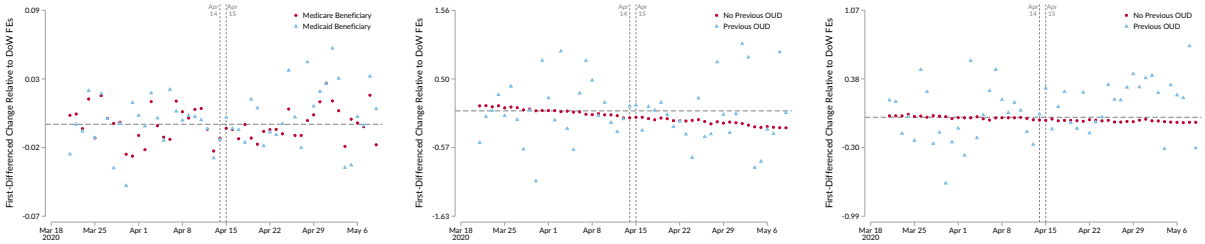


Notes: This figure shows the effect of stimulus payment on inpatient stay rate per 10,000 Medicaid and Medicare beneficiaries with and without previous OUD. We obtain information on emergency department visits from Medicare and Medicaid claims data.

Figure A.8: Effect of Stimulus Payment on OUD-Related Mortality and Utilization

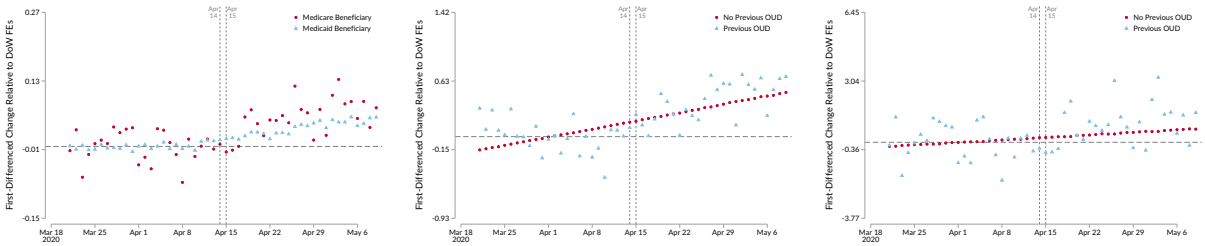
Mortality

(a) Full Sample (b) Medicaid (c) Medicare



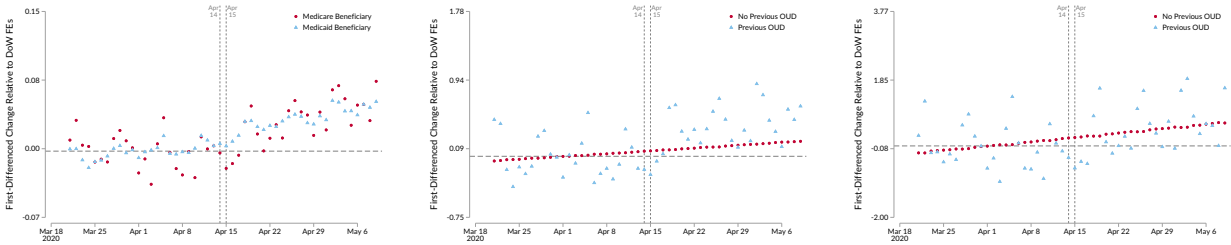
Emergency Department Visits

(d) Full Sample (e) Medicaid (f) Medicare



Inpatient Stays

(g) Full Sample (h) Medicaid (i) Medicare

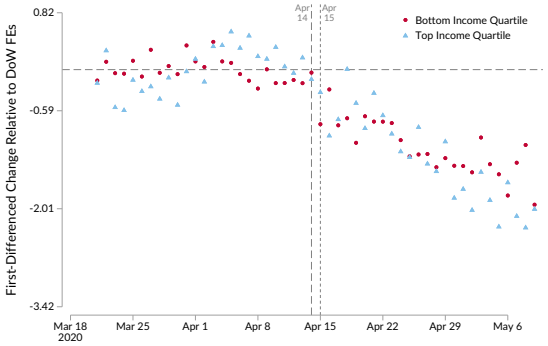


Notes: This table shows the effects of the first round of stimulus payment on OUD-related mortality rate per 100,000 and utilization rate per 10,000 Medicaid and Medicare beneficiaries with and without previous OUD. We obtain the cause of death, death status, and date of death from the Medicaid and Medicare National Death Index and enrollment files. Medicaid National Death Index is only available until 2020. We obtain information on emergency department visits from Medicare and Medicaid claims data.

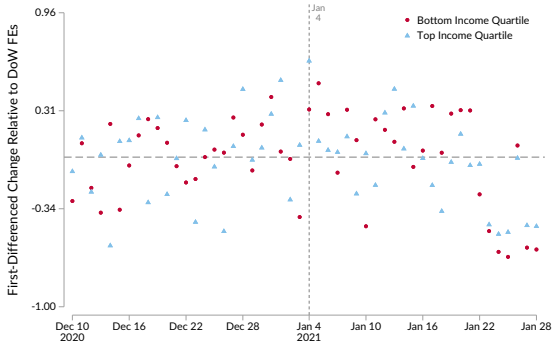
Figure A.9: Effect of Stimulus Payment on Mortality of Medicaid and Medicare Beneficiaries

Top Panel: Medicaid Beneficiaries

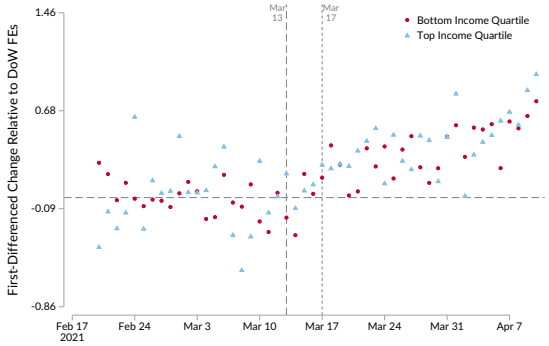
(a) Stimulus 1 (April 2020)



(b) Stimulus 2 (January 2021)

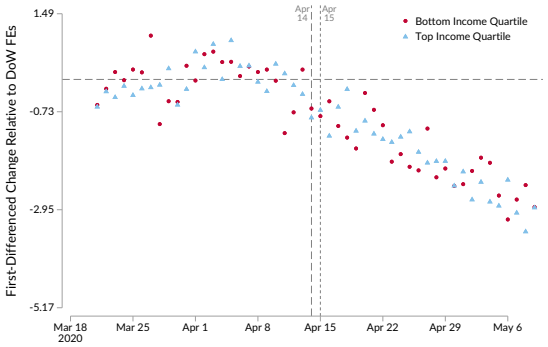


(c) Stimulus 3 (March 2021)

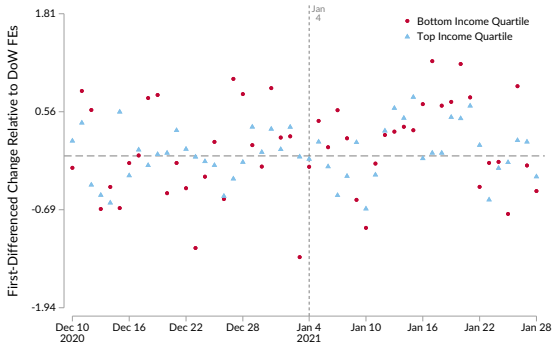


Bottom Panel: Medicare Beneficiaries

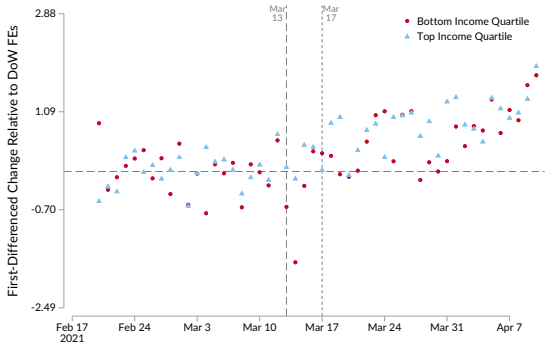
(d) Stimulus 1 (April 2020)



(e) Stimulus 2 (January 2021)



(f) Stimulus 3 (March 2021)

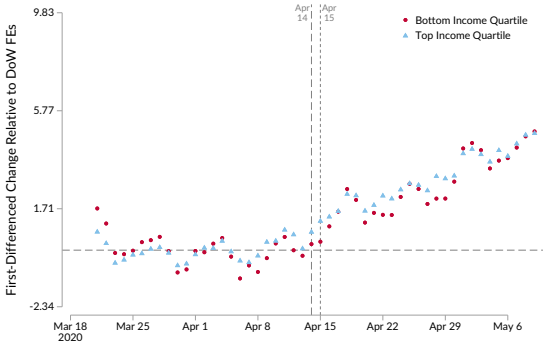


Notes: This figure shows the effect of stimulus payment on non-covid (stimulus 1) and all-cause (stimulus 2 and 3 Medicaid) mortality rate per 100,000 Medicaid and Medicare beneficiaries with and without previous OUD. We obtain the cause of death, death status, and date of death from the Medicaid and Medicare National Death Index and enrollment files. Medicaid National Death Index is only available until 2020.

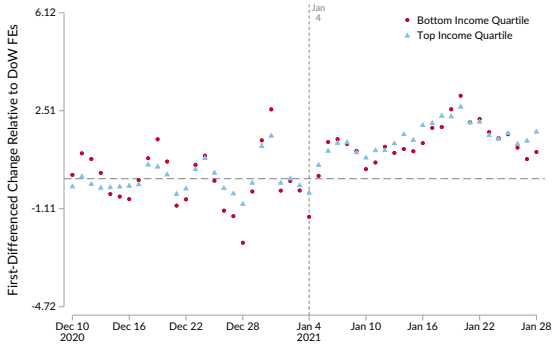
Figure A.10: Effect of Stimulus Payment on ED Visits of Medicaid and Medicare Beneficiaries

Top Panel: Medicaid Beneficiaries

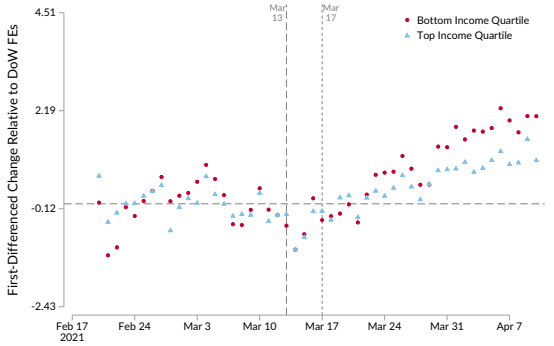
(a) Stimulus 1 (April 2020)



(b) Stimulus 2 (January 2021)

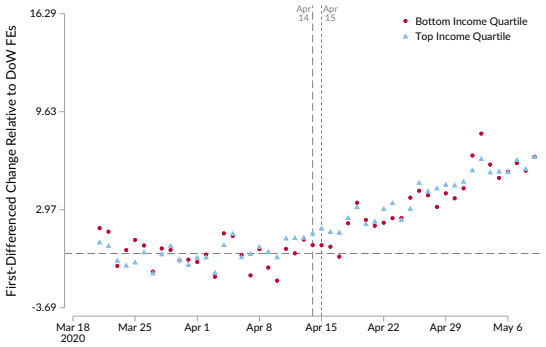


(c) Stimulus 3 (March 2021)

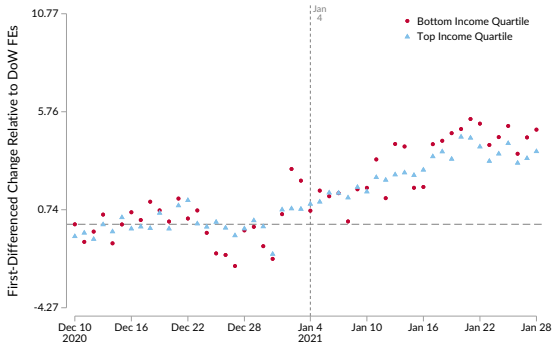


Bottom Panel: Medicare Beneficiaries

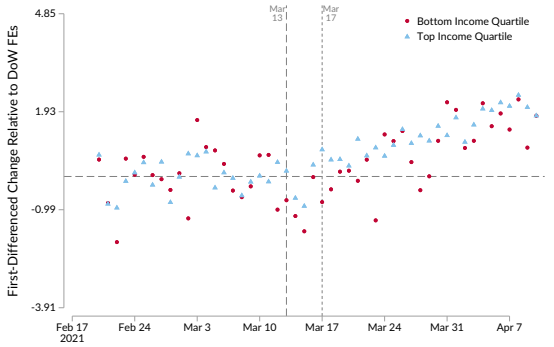
(d) Stimulus 1 (April 2020)



(e) Stimulus 2 (January 2021)



(f) Stimulus 3 (March 2021)



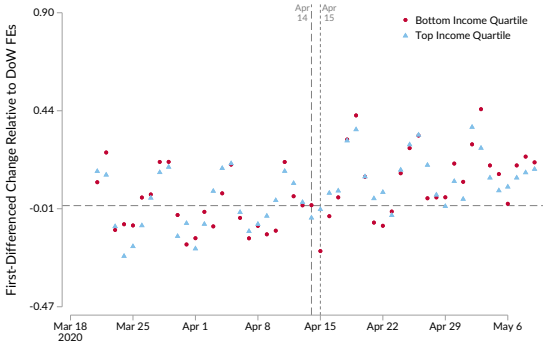
Notes: This figure shows the effect of stimulus payment on emergency department visit rate per 10,000 Medicaid and Medicare beneficiaries with and without previous OUD.

We obtain information on emergency department visits from Medicare and Medicaid claims data.

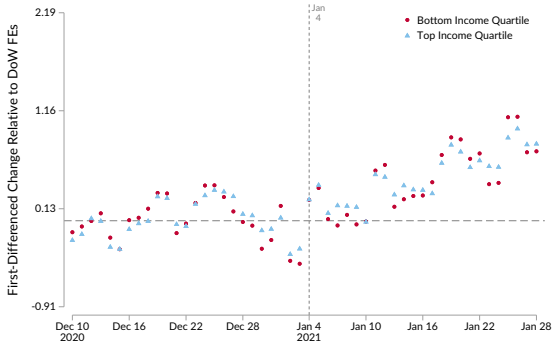
Figure A.11: Effect of Stimulus Payment on Inpatient Stays of Medicaid and Medicare Beneficiaries

Top Panel: Medicaid Beneficiaries

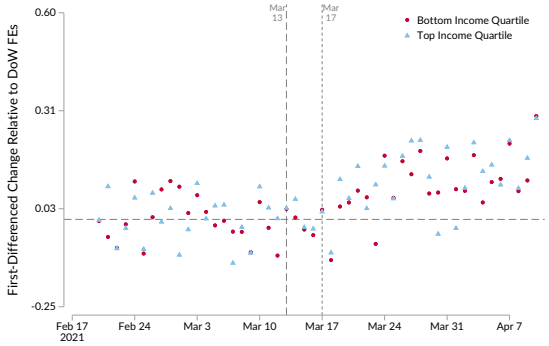
(a) Stimulus 1 (April 2020)



(b) Stimulus 2 (January 2021)

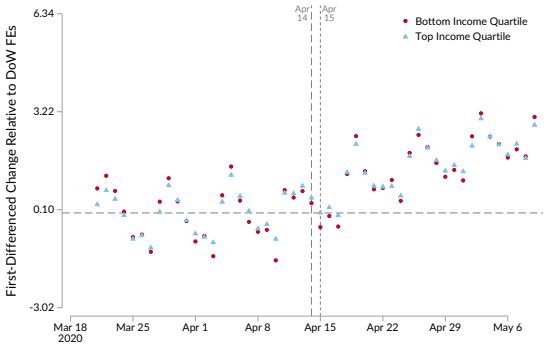


(c) Stimulus 3 (March 2021)

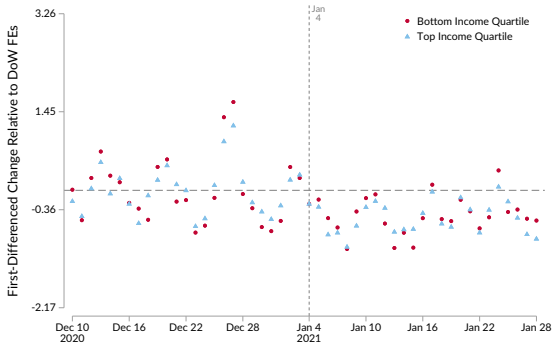


Bottom Panel: Medicare Beneficiaries

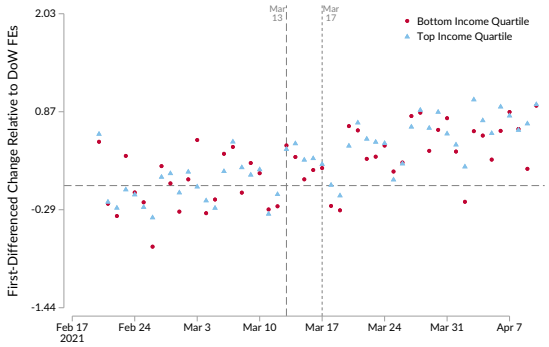
(d) Stimulus 1 (April 2020)



(e) Stimulus 2 (January 2021)



(f) Stimulus 3 (March 2021)

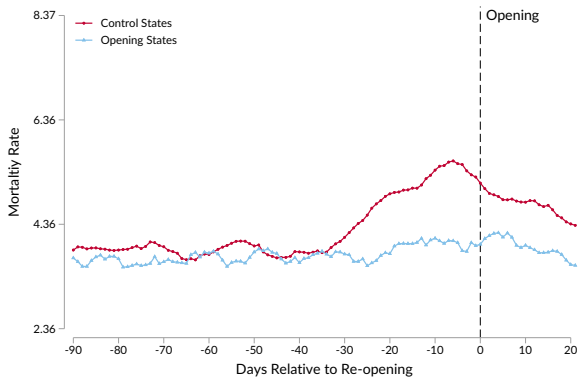


Notes: This figure shows the effect of stimulus payment on inpatient stay rate per 10,000 Medicaid and Medicare beneficiaries with and without previous OUD. We obtain information on emergency department visits from Medicare and Medicaid claims data.

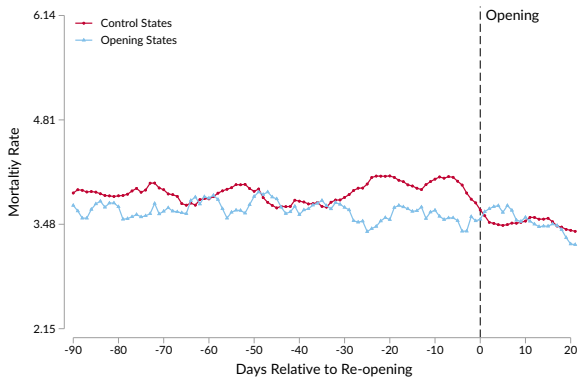
Figure A.12: Trends in Mortality in Opening and Control States

Top Panel: Medicaid Beneficiaries

(a) All Cause

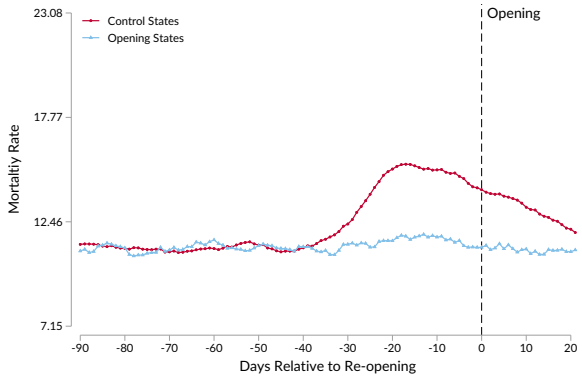


(b) Non Covid

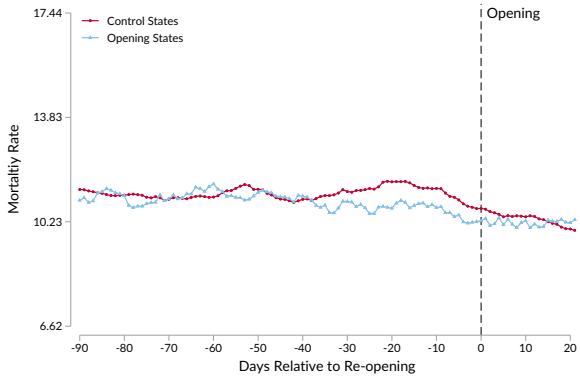


Bottom Panel: Medicare Beneficiaries

(c) All Cause



(d) Non Covid

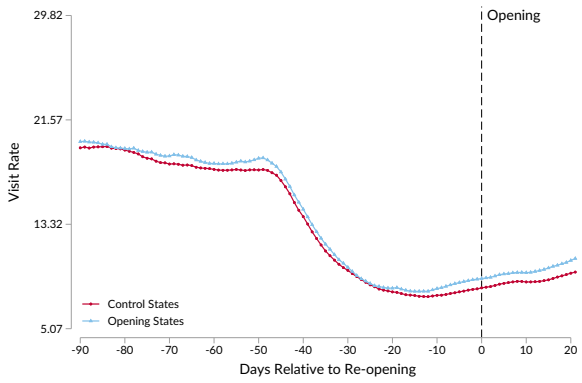


Notes: This figure shows a seven-day moving average of all-cause and non-covid mortality rate per 10,000 Medicaid and Medicare beneficiaries. We obtain the cause of death, death status, and date of death from the Medicaid and Medicare National Death Index and enrollment files. Medicaid National Death Index that includes cause of death is only available until 2020.

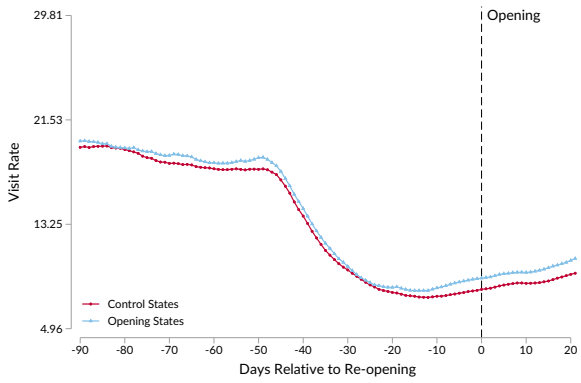
Figure A.13: Trends in ED Visits in Opening and Control States

Top Panel: Medicaid Beneficiaries

(a) All Cause

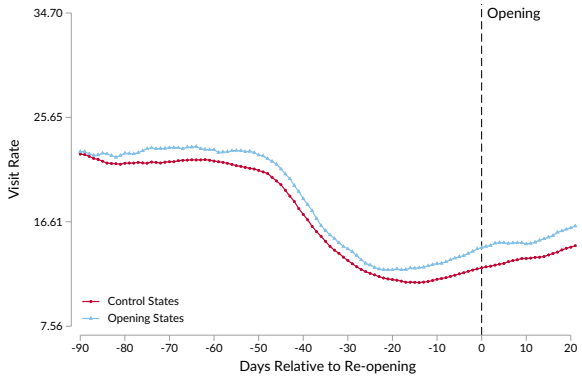


(b) Non Covid

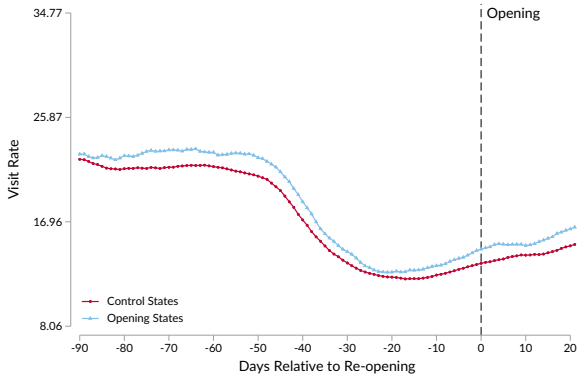


Bottom Panel: Medicare Beneficiaries

(c) All Cause



(d) Non Covid

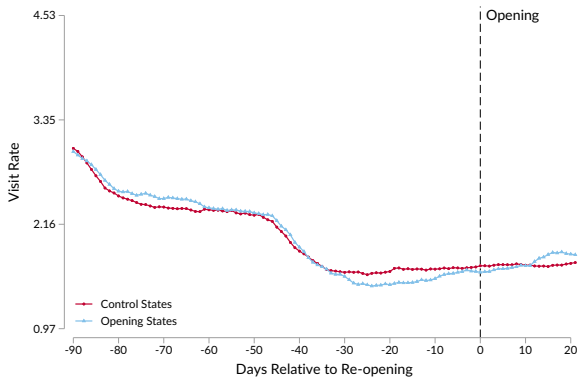


Notes: This figure shows a seven-day moving average of all-cause and non-covid emergency department visit rate per 10,000 Medicaid and Medicare beneficiaries. We obtain information on emergency department visits from Medicare and Medicaid claims data.

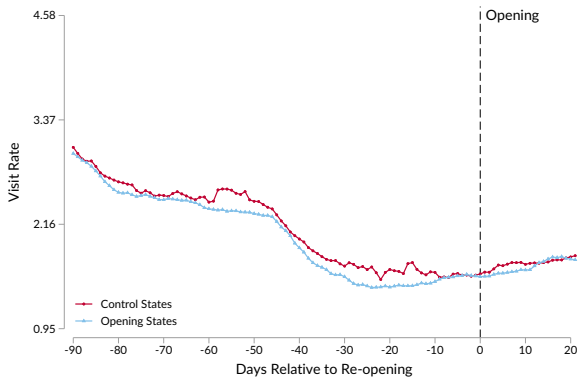
Figure A.14: Trends in Inpatient Stays in Opening and Control States

Top Panel: Medicaid Beneficiaries

(a) All Cause

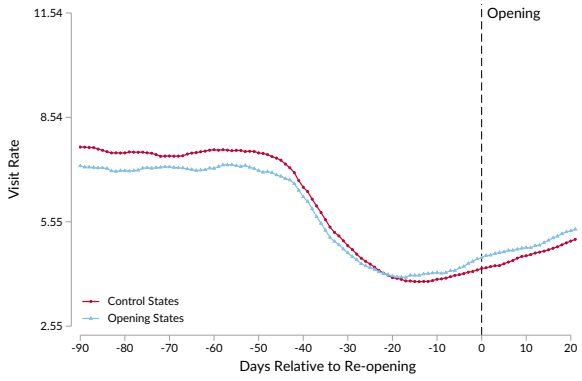


(b) Non Covid

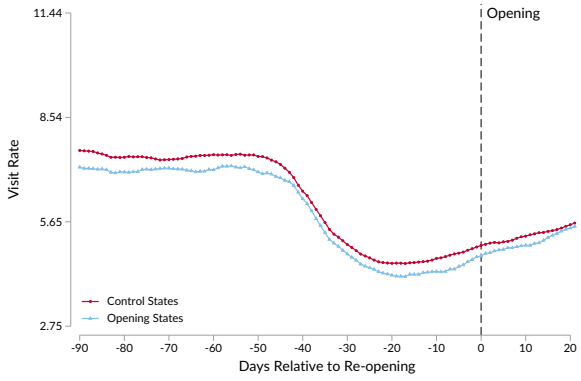


Bottom Panel: Medicare Beneficiaries

(c) All Cause

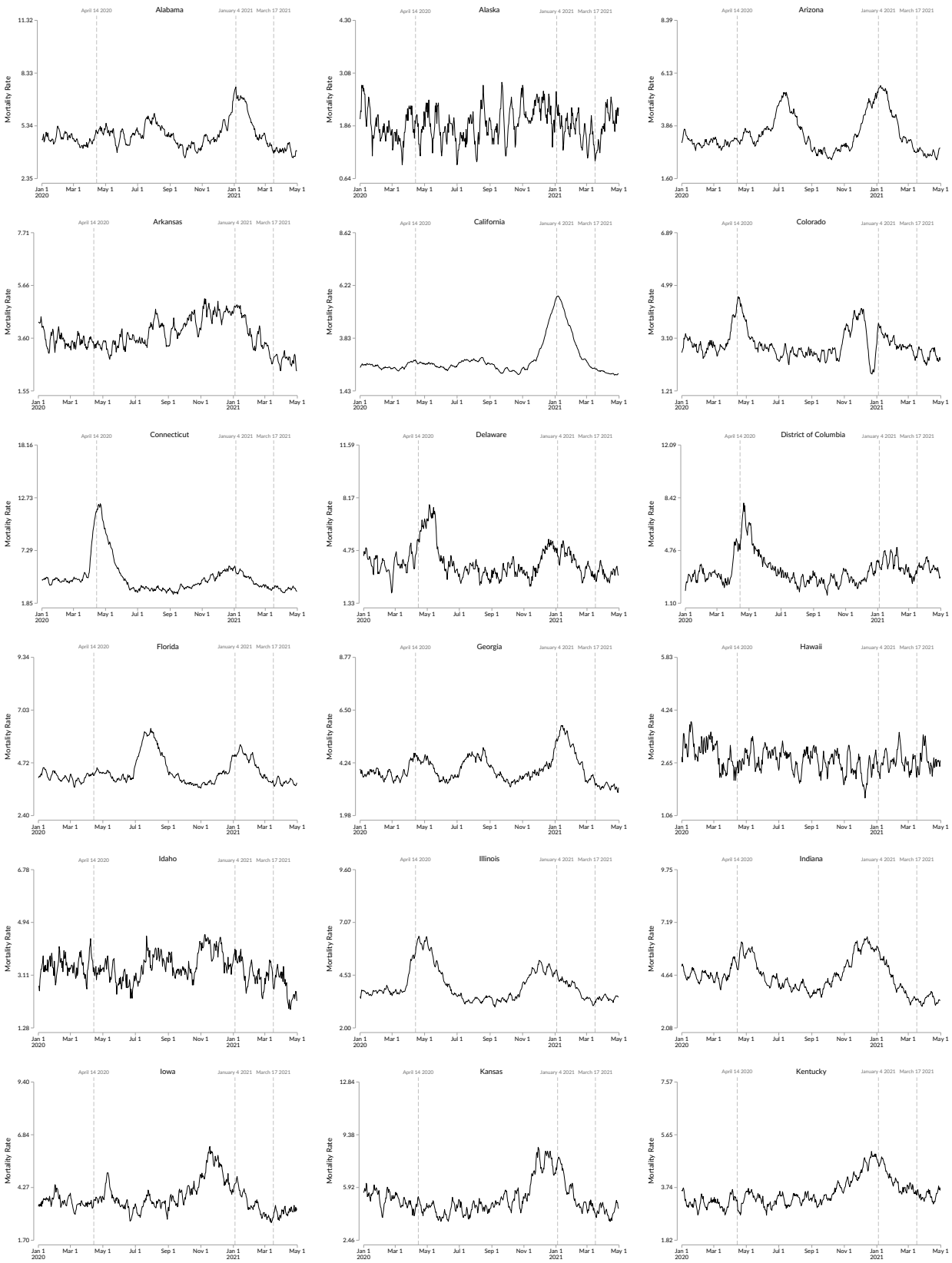


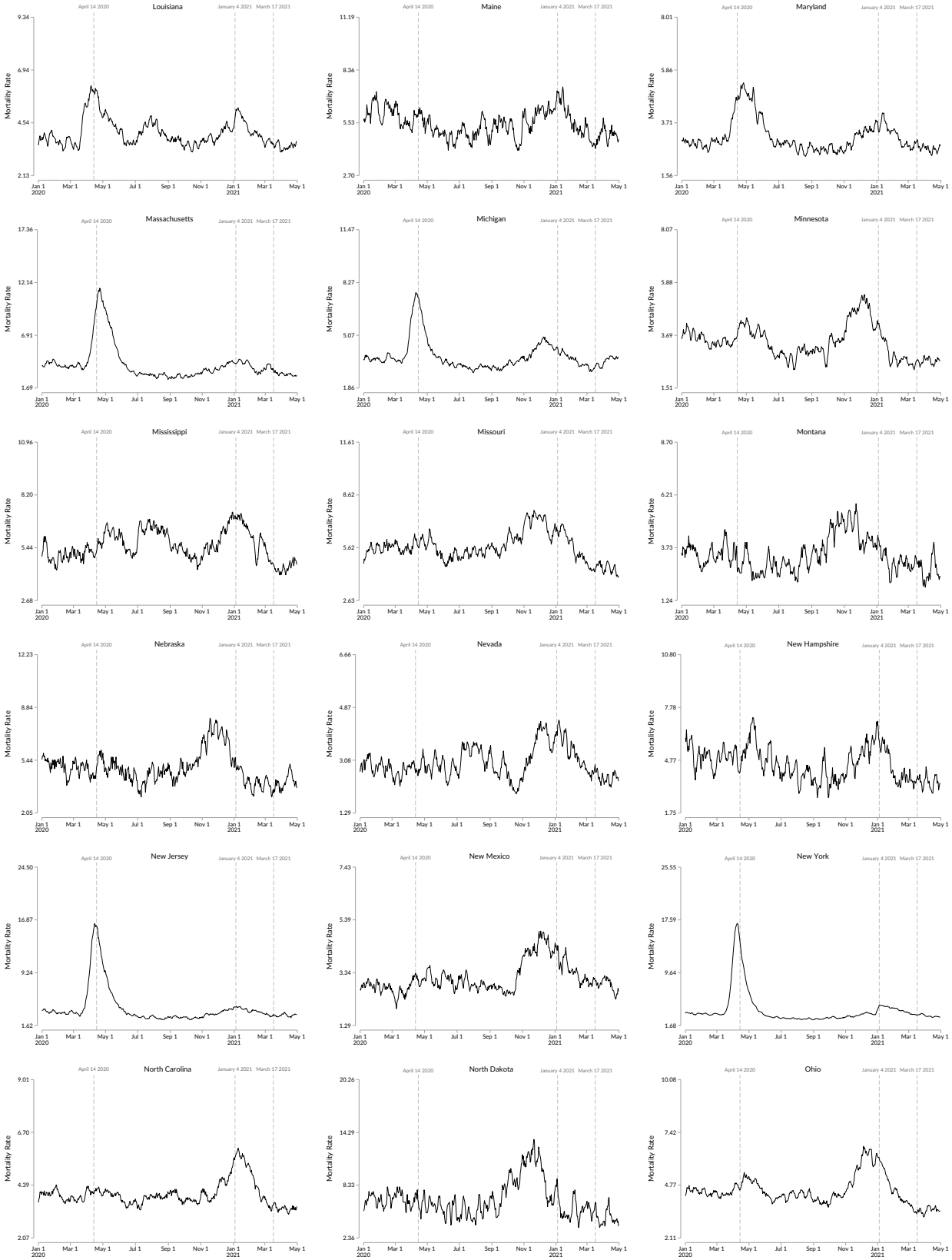
(d) Non Covid

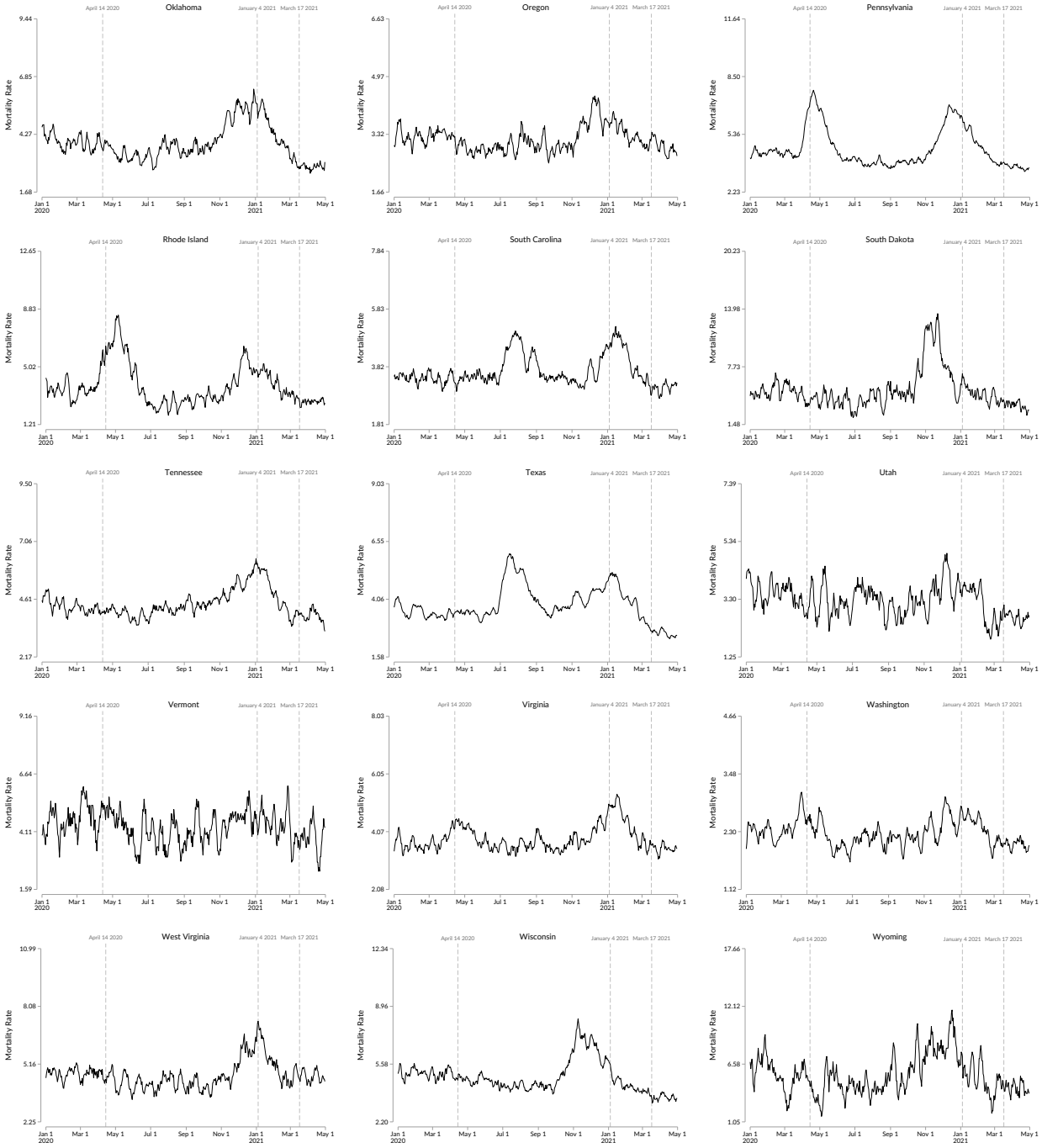


Notes: This figure shows a seven-day moving average of inpatient stay rate per 10,000 Medicaid and Medicare beneficiaries. We obtain information on inpatient stays from Medicare and Medicaid claims data.

Figure A.15: Trends in Mortality Rate of Medicaid Beneficiaries by State

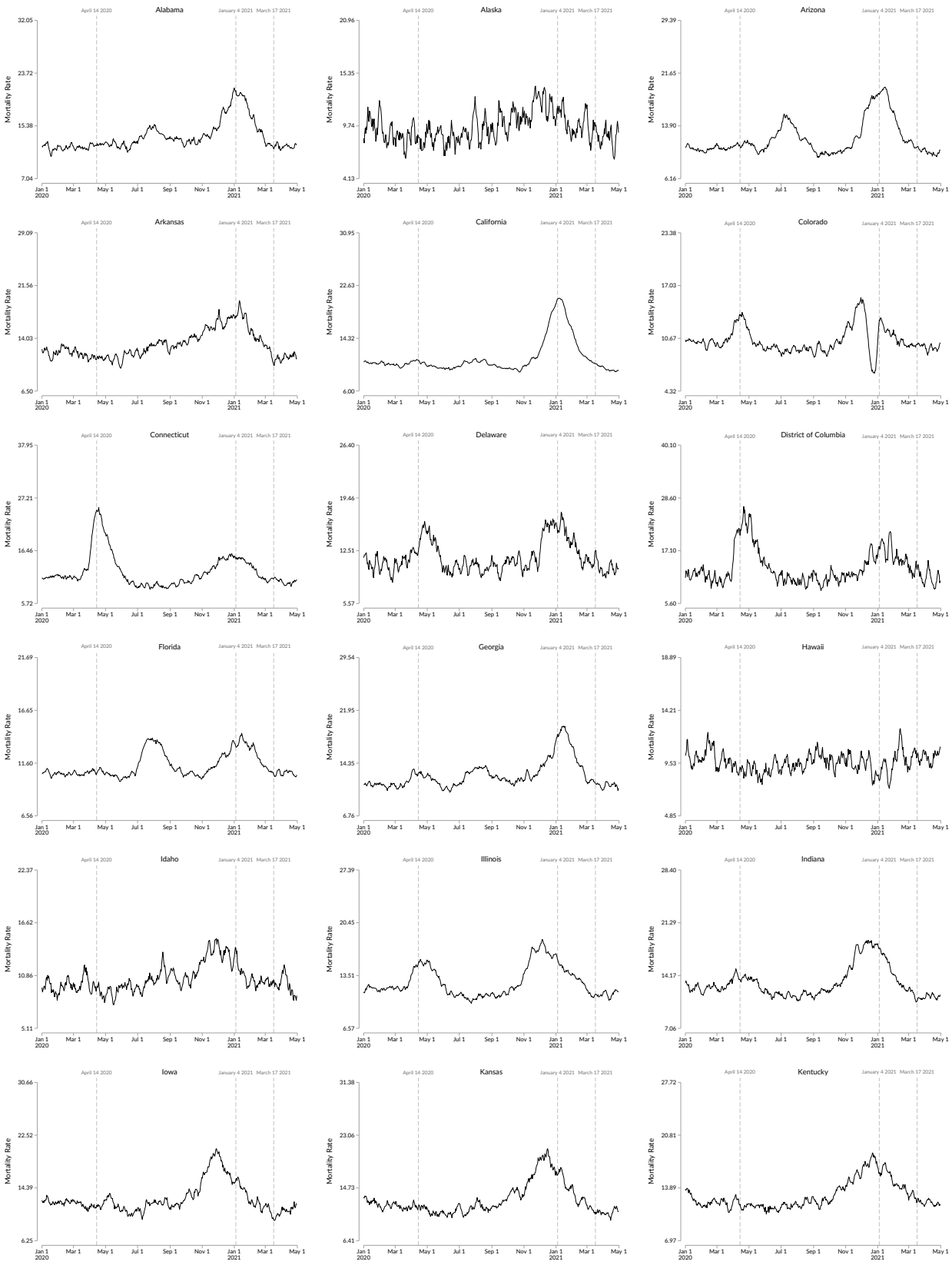


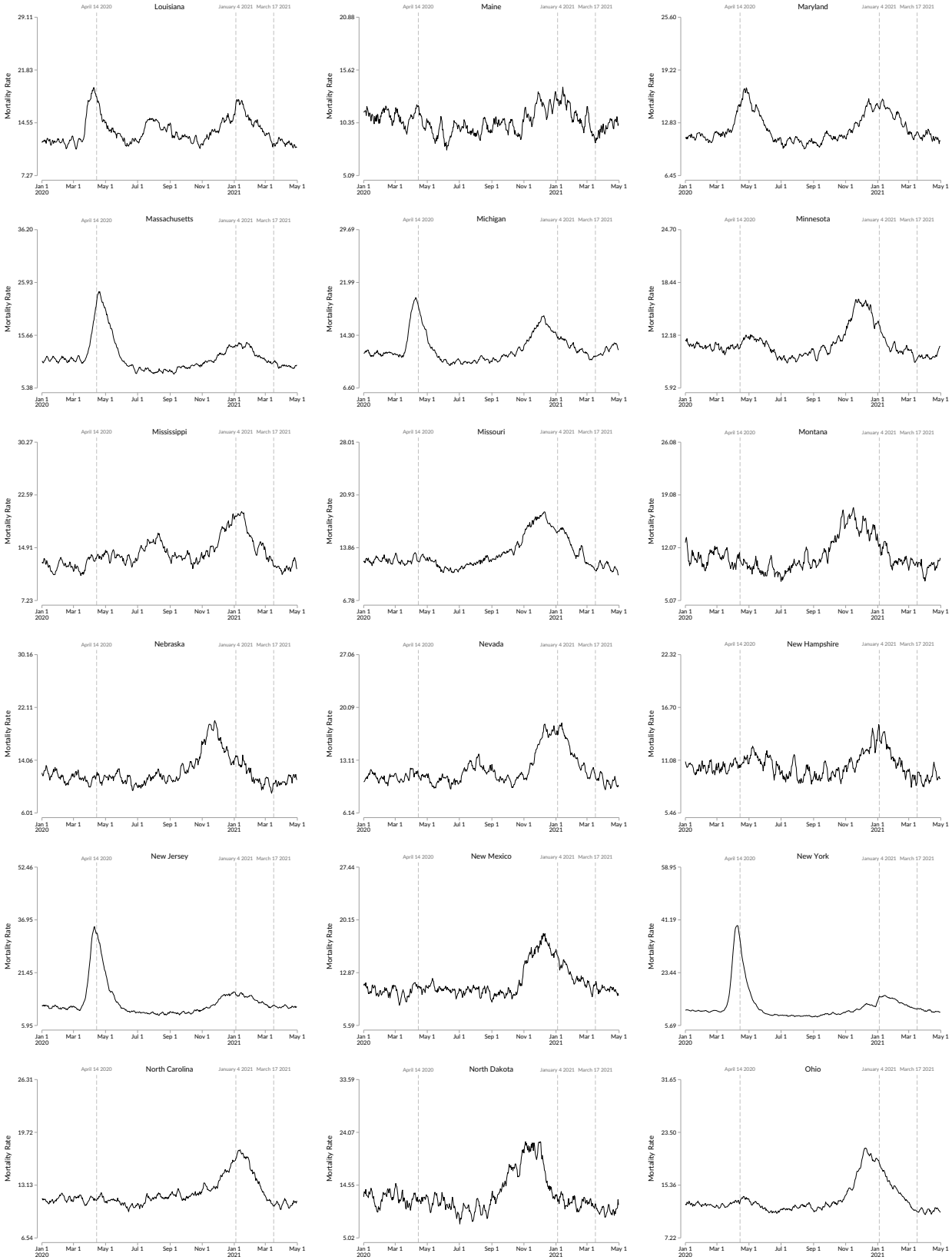

Louisiana
Maine
Maryland
Massachusetts
Michigan
Minnesota
Mississippi
Missouri
Montana
Nebraska
Nevada
New Hampshire
New Jersey
New Mexico
New York
North Carolina
North Dakota
Ohio
April 14 2020
January 4 2021
March 17 2021
Mortality Rate

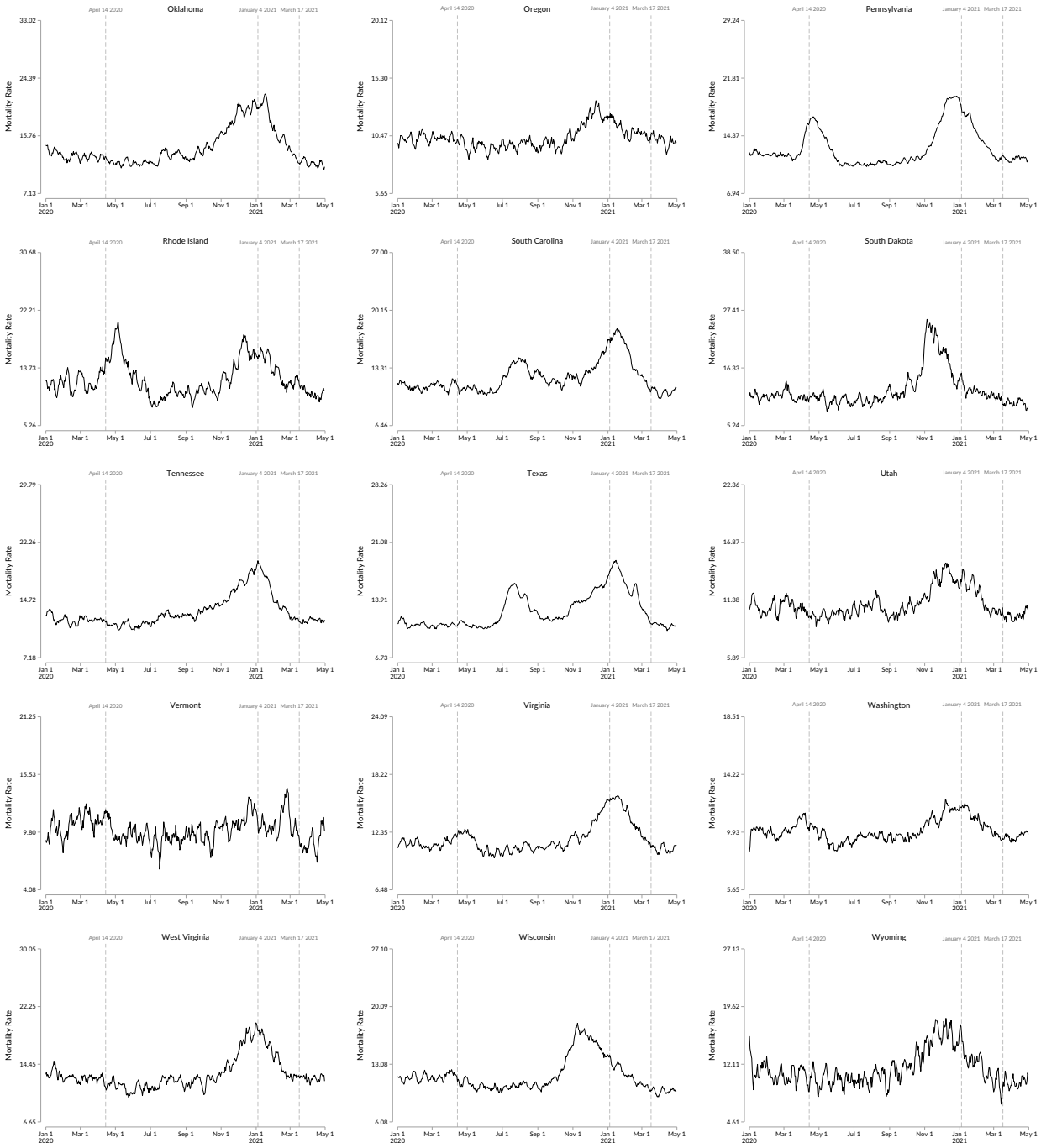


Notes: This figure shows a seven-day moving average of all-cause mortality rate per 100,000 Medicaid beneficiaries. We obtain the cause of death, death status, and date of death from the Medicaid and Medicare National Death Index and enrollment files. Medicaid National Death Index that includes cause of death is only available until 2020.

Figure A.16: Trends in Mortality Rate of Medicare Beneficiaries by State




Louisiana
Maine
Maryland
Massachusetts
Michigan
Minnesota
Mississippi
Missouri
Montana
Nebraska
Nevada
New Hampshire
New Jersey
New Mexico
New York
North Carolina
North Dakota
Ohio
April 14 2020
January 4 2021
March 17 2021
Mortality Rate
Jan 1 2020
Mar 1
May 1
Jul 1
Sep 1
Nov 1
Jan 1 2021
Mar 1
May 1



Notes: This figure shows a seven-day moving average of all-cause mortality rate per 100,000 Medicare beneficiaries. We obtain the cause of death, death status, and date of death from the Medicaid and Medicare National Death Index and enrollment files. Medicaid National Death Index that includes cause of death is only available until 2020.

Table A.1:
State Reopening Dates

State Name	Reopening Date	Type of Reopening
South Carolina	4/20/2020	State reopened non-essential businesses
Oklahoma	4/24/2020	State reopened non-essential businesses
Alaska	4/24/2020	State reopened non-essential businesses
Montana	4/26/2020	State removed stay-at-home order
Tennessee	4/27/2020	State reopened non-essential businesses
Minnesota	4/27/2020	State reopened non-essential businesses
Vermont	4/27/2020	State reopened non-essential businesses
Mississippi	4/27/2020	State reopened non-essential businesses
Colorado	4/27/2020	State removed stay-at-home order
Alabama	4/30/2020	State reopened non-essential businesses
Wyoming	5/1/2020	State reopened non-essential businesses
Georgia	5/1/2020	State reopened non-essential businesses
North Dakota	5/1/2020	State reopened non-essential businesses
Louisiana	5/1/2020	State reopened non-essential businesses
Texas	5/1/2020	State reopened non-essential businesses
Idaho	5/1/2020	State reopened non-essential businesses
Maine	5/1/2020	State reopened non-essential businesses
Utah	5/1/2020	State reopened non-essential businesses
Arkansas	5/4/2020	State reopened non-essential businesses
West Virginia	5/4/2020	State reopened non-essential businesses
Kansas	5/4/2020	State reopened non-essential businesses
Missouri	5/4/2020	State reopened non-essential businesses
Ohio	5/4/2020	State reopened non-essential businesses
Hawaii	5/7/2020	State reopened non-essential businesses
North Carolina	5/8/2020	State reopened non-essential businesses
Delaware	5/8/2020	State reopened non-essential businesses
Arizona	5/8/2020	State reopened non-essential businesses
California	5/8/2020	State reopened non-essential businesses
Rhode Island	5/9/2020	State reopened non-essential businesses
Nevada	5/9/2020	State reopened non-essential businesses
Kentucky	5/11/2020	State reopened non-essential businesses
Wisconsin	5/11/2020	State reopened non-essential businesses
New Hampshire	5/11/2020	State reopened non-essential businesses
Iowa	5/15/2020	State reopened non-essential businesses
Maryland	5/15/2020	State reopened non-essential businesses
Oregon	5/15/2020	State reopened non-essential businesses
New Mexico	5/16/2020	State reopened non-essential businesses
Indiana	5/18/2020	State reopened non-essential businesses
New Jersey	5/18/2020	State reopened non-essential businesses
Florida	5/18/2020	State reopened non-essential businesses
Massachusetts	5/18/2020	State reopened non-essential businesses
Connecticut	5/20/2020	State reopened non-essential businesses
Michigan	5/26/2020	State reopened non-essential businesses
District of Columbia	5/29/2020	State reopened non-essential businesses
Illinois	5/29/2020	State reopened non-essential businesses
Virginia	5/29/2020	State reopened non-essential businesses
Nebraska	6/1/2020	State reopened non-essential businesses
Washington	6/1/2020	State reopened non-essential businesses
Pennsylvania	6/5/2020	State reopened non-essential businesses
New York	6/8/2020	State reopened non-essential businesses
South Dakota		State has not issued stay-at-home order or business closures

Notes: This table shows whether a state issued stay-at-home orders and the date these orders were lifted. If the state has not issued stay-at-home orders the date corresponds to reopenings of non-essential businesses. The data is coming from the COVID-19 US State Policy Database.

Table A.2:
Reopening Control States for Mortality of Medicaid Beneficiaries

Opening Date	Opening State	Control States		
		All	No OUD	OUD
4/20/2020	South Carolina	District Of Columbia, Florida, Illinois, Indiana, Iowa, Maryland, Massachusetts, Michigan, New Mexico, Oregon, Pennsylvania, South Dakota, Virginia, Washington	District Of Columbia, Florida, Illinois, Indiana, Iowa, Maryland, Massachusetts, New Mexico, Oregon, Pennsylvania, South Dakota, Virginia, Washington	District Of Columbia, Florida, Illinois, Indiana, Iowa, Maryland, Massachusetts, Michigan, Nebraska, New Jersey, New Mexico, New York, Oregon, Pennsylvania, South Dakota, Virginia
4/24/2020	Alaska, Oklahoma	District Of Columbia, Florida, Illinois, Indiana, New Mexico, South Dakota, Virginia, Washington	District Of Columbia, Florida, Illinois, Indiana, New Mexico, South Dakota, Virginia, Washington	Connecticut, District Of Columbia, Florida, Illinois, Indiana, Massachusetts, Michigan, Nebraska, New Jersey, New Mexico, New York, Pennsylvania, South Dakota, Virginia, Washington
4/26/2020	Montana	District Of Columbia, Florida, Illinois, Indiana, South Dakota, Virginia, Washington	District Of Columbia, Florida, Illinois, Indiana, South Dakota, Virginia, Washington	Connecticut, District Of Columbia, Florida, Illinois, Indiana, Massachusetts, Michigan, Nebraska, New Jersey, New York, Pennsylvania, South Dakota, Virginia, Washington
4/27/2020	Colorado, Minnesota, Mississippi, Tennessee, Vermont	Connecticut, District Of Columbia, Illinois, Michigan, Nebraska, New York, Pennsylvania, South Dakota, Virginia, Washington	Connecticut, District Of Columbia, Illinois, Michigan, Nebraska, New York, Pennsylvania, South Dakota, Virginia, Washington	Connecticut, Illinois, Michigan, Nebraska, New York, Pennsylvania, South Dakota, Virginia, Washington
4/30/2020	Alabama	District Of Columbia, Illinois, Michigan, Nebraska, New York, Pennsylvania, South Dakota, Virginia	District Of Columbia, Illinois, Michigan, Nebraska, New York, Pennsylvania, South Dakota, Virginia	District Of Columbia, Illinois, Michigan, Nebraska, New York, South Dakota, Virginia

Notes: This table shows the opening and control states for each opening date. The data on opening dates is coming from the COVID-19 US State Policy Database. The control states are matched to the treatment states using pre-treatment outcomes during four weeks before reopening. See section 4 for more details.

Table A.3:
Reopening Control States for Mortality of Medicare Beneficiaries

Opening Date	Opening State	Control States		
		All	No OUD	OUD
4/20/2020	South Carolina	Connecticut, Florida, Illinois, Indiana, Iowa, Maryland, Massachusetts, Michigan, Nebraska, New Mexico, Oregon, Pennsylvania, South Dakota, Virginia, Washington	Connecticut, Florida, Illinois, Indiana, Iowa, Maryland, Massachusetts, Nebraska, New Mexico, Oregon, Pennsylvania, South Dakota, Virginia, Washington	Connecticut, District Of Columbia, Florida, Illinois, Indiana, Iowa, Maryland, Massachusetts, Michigan, Nebraska, New Jersey, New Mexico, Oregon, Pennsylvania, South Dakota, Virginia, Washington
4/24/2020	Alaska, Oklahoma	Connecticut, Florida, Illinois, Indiana, Massachusetts, Nebraska, New Mexico, Pennsylvania, South Dakota, Virginia, Washington	Connecticut, Florida, Illinois, Indiana, Massachusetts, Nebraska, New Mexico, Pennsylvania, South Dakota, Virginia, Washington	Florida, Indiana, Massachusetts, Michigan, New Mexico, Pennsylvania, South Dakota, Virginia, Washington
4/26/2020	Montana	Florida, Nebraska, South Dakota, Virginia, Washington	Florida, Nebraska, South Dakota, Virginia, Washington	Connecticut, District Of Columbia, Florida, Illinois, Indiana, Massachusetts, Michigan, Nebraska, New Jersey, New York, Pennsylvania, South Dakota, Virginia, Washington
4/27/2020	Colorado, Minnesota, Mississippi, Tennessee, Vermont	Connecticut, Illinois, Nebraska, Pennsylvania, South Dakota, Virginia, Washington	Connecticut, Illinois, Michigan, Nebraska, Pennsylvania, South Dakota, Virginia, Washington	Connecticut, Illinois, Michigan, Nebraska, Pennsylvania, South Dakota, Virginia, Washington
4/30/2020	Alabama	District Of Columbia, Illinois, Michigan, Nebraska, New York, Pennsylvania, South Dakota, Virginia	District Of Columbia, Illinois, Michigan, Nebraska, New York, Pennsylvania, South Dakota, Virginia	Michigan, Pennsylvania, South Dakota, Virginia, Washington

Notes: This table shows the opening and control states for each opening date. The data on opening dates is coming from the COVID-19 US State Policy Database. The control states are matched to the treatment states using pre-treatment outcomes during four weeks before reopening. See section 4 for more details.

Table A.4:
Reopening Control States for Emergency Department Visits of Medicaid Beneficiaries

Opening Date	Opening State	Control States		
		All	No OUD	OUD
4/20/2020	South Carolina	Connecticut, Florida, Illinois, Maryland, Massachusetts, Michigan, Nebraska, New Jersey, New Mexico, New York, Oregon, Pennsylvania, South Dakota, Washington	Connecticut, Florida, Illinois, Maryland, Massachusetts, Michigan, New Jersey, New Mexico, New York, Oregon, Pennsylvania, South Dakota, Washington	Connecticut, District Of Columbia, Florida, Indiana, Iowa, Maryland, Massachusetts, Michigan, Nebraska, New Jersey, New Mexico, New York, Oregon, Pennsylvania, South Dakota, Virginia, Washington
4/24/2020	Alaska, Oklahoma	Connecticut, District Of Columbia, Florida, Illinois, Indiana, Massachusetts, Michigan, Nebraska, New Jersey, New Mexico, New York, Pennsylvania, South Dakota, Virginia, Washington	Connecticut, District Of Columbia, Florida, Illinois, Indiana, Massachusetts, Michigan, Nebraska, New Jersey, New Mexico, New York, Pennsylvania, South Dakota, Virginia, Washington	Connecticut, District Of Columbia, Florida, Illinois, Indiana, Massachusetts, Michigan, Nebraska, New Jersey, New Mexico, New York, Pennsylvania, South Dakota, Virginia, Washington
4/26/2020	Montana	Connecticut, District Of Columbia, Florida, Indiana, Massachusetts, Michigan, Nebraska, New Jersey, New York, Pennsylvania, South Dakota, Virginia, Washington	Connecticut, District Of Columbia, Florida, Indiana, Massachusetts, Michigan, Nebraska, New Jersey, Pennsylvania, South Dakota, Virginia, Washington	Connecticut, District Of Columbia, Florida, Illinois, Indiana, Massachusetts, Michigan, Nebraska, New Jersey, New York, Pennsylvania, South Dakota, Virginia, Washington
4/27/2020	Colorado, Minnesota, Mississippi, Tennessee, Vermont	Connecticut, District Of Columbia, Michigan, Nebraska, Pennsylvania, South Dakota, Virginia, Washington	Connecticut, District Of Columbia, Michigan, Nebraska, Pennsylvania, South Dakota, Virginia, Washington	Connecticut, District Of Columbia, Michigan, Nebraska, New York, Pennsylvania, South Dakota, Virginia, Washington
4/30/2020	Alabama	Illinois, Michigan, Nebraska, New York, Pennsylvania, South Dakota, Washington	Illinois, Michigan, Nebraska, New York, Pennsylvania, South Dakota, Washington	District Of Columbia, Illinois, Michigan, Nebraska, New York, Pennsylvania, South Dakota, Virginia, Washington

Notes: This table shows the opening and control states for each opening date. The data on opening dates is coming from the COVID-19 US State Policy Database. The control states are matched to the treatment states using pre-treatment outcomes during four weeks before reopening. See section 4 for more details.

Table A.5:
Reopening Control States for Emergency Department Visits of Medicare Beneficiaries

Opening Date	Opening State	Control States		
		All	No OUD	OUD
4/20/2020	South Carolina	District Of Columbia, Florida, Illinois, Indiana, Iowa, Massachusetts, Michigan, Nebraska, New Mexico, Oregon, Virginia	District Of Columbia, Florida, Illinois, Indiana, Iowa, Massachusetts, Michigan, Nebraska, New Mexico, New York, Virginia	Connecticut, District Of Columbia, Illinois, Indiana, Iowa, Massachusetts, Nebraska, Oregon, Virginia, Washington
4/24/2020	Alaska, Oklahoma	Connecticut, District Of Columbia, Florida, Illinois, Indiana, Massachusetts, Michigan, Nebraska, New Jersey, New Mexico, New York, Pennsylvania, South Dakota, Virginia, Washington	Connecticut, District Of Columbia, Florida, Illinois, Indiana, Massachusetts, Michigan, Nebraska, New Jersey, New Mexico, New York, Pennsylvania, South Dakota, Virginia, Washington	Connecticut, District Of Columbia, Florida, Indiana, Massachusetts, Michigan, New Jersey, New Mexico, New York, Pennsylvania, South Dakota, Virginia, Washington
4/26/2020	Montana	Connecticut, Florida, Illinois, Indiana, Massachusetts, Michigan, Nebraska, New Jersey, New York, Pennsylvania, South Dakota, Virginia, Washington	Connecticut, Florida, Illinois, Indiana, Massachusetts, Michigan, Nebraska, New Jersey, New York, Pennsylvania, South Dakota, Virginia, Washington	Connecticut, District Of Columbia, Florida, Illinois, Indiana, Massachusetts, Michigan, Nebraska, New York, Pennsylvania, Virginia, Washington
4/27/2020	Colorado, Minnesota, Mississippi, Tennessee, Vermont	Connecticut, District Of Columbia, Illinois, Michigan, Nebraska, New York, Pennsylvania, South Dakota, Virginia, Washington	Connecticut, District Of Columbia, Illinois, Michigan, Nebraska, New York, Pennsylvania, South Dakota, Virginia, Washington	Connecticut, District Of Columbia, Michigan, Nebraska, New York, Pennsylvania, South Dakota, Virginia, Washington
4/30/2020	Alabama	District Of Columbia, Illinois, Michigan, Nebraska, New York, Pennsylvania, Virginia, Washington	District Of Columbia, Illinois, Michigan, Nebraska, New York, Pennsylvania, South Dakota, Virginia, Washington	District Of Columbia, Illinois, Michigan, Nebraska, New York, Pennsylvania, South Dakota, Virginia, Washington

Notes: This table shows the opening and control states for each opening date. The data on opening dates is coming from the COVID-19 US State Policy Database. The control states are matched to the treatment states using pre-treatment outcomes during four weeks before reopening. See section 4 for more details.

Table A.6:
Reopening Control States for Inpatient Stays of Medicaid Beneficiaries

Opening Date	Opening State	Control States		
		All	No OUD	OUD
4/20/2020	South Carolina	District Of Columbia, Florida, Illinois, Indiana, Iowa, Maryland, Michigan, New Jersey, New Mexico, Oregon, Pennsylvania, South Dakota, Virginia, Washington	District Of Columbia, Florida, Illinois, Indiana, Iowa, Maryland, Michigan, New Jersey, New Mexico, Oregon, Pennsylvania, South Dakota, Virginia, Washington	Connecticut, District Of Columbia, Florida, Illinois, Indiana, Iowa, Maryland, Massachusetts, Michigan, New Jersey, New Mexico, New York, Oregon, Pennsylvania, South Dakota, Virginia, Washington
4/24/2020	Alaska, Oklahoma	Connecticut, District Of Columbia, Florida, Illinois, Indiana, Michigan, New Jersey, New Mexico, Pennsylvania, South Dakota, Virginia, Washington	Connecticut, District Of Columbia, Florida, Illinois, Indiana, Massachusetts, Michigan, New Jersey, New Mexico, Pennsylvania, South Dakota, Virginia, Washington	Connecticut, District Of Columbia, Illinois, Indiana, Massachusetts, Michigan, New Jersey, New Mexico, New York, Pennsylvania, South Dakota, Virginia, Washington
4/26/2020	Montana	Connecticut, District Of Columbia, Florida, Illinois, Indiana, Michigan, New Jersey, Pennsylvania, South Dakota, Virginia, Washington	Connecticut, District Of Columbia, Florida, Illinois, Indiana, Massachusetts, Michigan, New Jersey, Pennsylvania, South Dakota, Virginia, Washington	Connecticut, District Of Columbia, Florida, Illinois, Indiana, Massachusetts, Michigan, New Jersey, New York, Pennsylvania, Virginia, Washington
4/27/2020	Colorado, Minnesota, Mississippi, Tennessee, Vermont	Connecticut, District Of Columbia, Illinois, Michigan, New York, Pennsylvania, South Dakota, Virginia, Washington	Connecticut, District Of Columbia, Illinois, Michigan, Nebraska, New York, Pennsylvania, South Dakota, Virginia, Washington	Connecticut, District Of Columbia, Illinois, Michigan, New York, Pennsylvania, South Dakota, Virginia, Washington
4/30/2020	Alabama	District Of Columbia, Illinois, Nebraska, New York, Pennsylvania, South Dakota, Virginia, Washington	District Of Columbia, Illinois, Nebraska, New York, Pennsylvania, South Dakota, Virginia, Washington	District Of Columbia, Illinois, Michigan, Nebraska, New York, Pennsylvania, South Dakota, Virginia, Washington

Notes: This table shows the opening and control states for each opening date. The data on opening dates is coming from the COVID-19 US State Policy Database. The control states are matched to the treatment states using pre-treatment outcomes during four weeks before reopening. See section 4 for more details.

Table A.7:
Reopening Control States for Inpatient Stays of Medicare Beneficiaries

Opening Date	Opening State	Control States		
		All	No OUD	OUD
4/20/2020	South Carolina	Connecticut, District Of Columbia, Florida, Illinois, Indiana, Iowa, Maryland, Massachusetts, Michigan, Nebraska, New Jersey, New Mexico, New York, Pennsylvania, South Dakota, Virginia, Washington	Connecticut, District Of Columbia, Florida, Illinois, Indiana, Iowa, Maryland, Massachusetts, Michigan, Nebraska, New Jersey, New Mexico, New York, Pennsylvania, South Dakota, Virginia, Washington	Connecticut, District Of Columbia, Florida, Illinois, Indiana, Iowa, Maryland, Massachusetts, Michigan, Nebraska, New Jersey, New Mexico, New York, Oregon, Pennsylvania, South Dakota, Virginia, Washington
4/24/2020	Alaska, Oklahoma	Connecticut, District Of Columbia, Florida, Illinois, Indiana, Massachusetts, Michigan, Nebraska, New Jersey, New Mexico, Pennsylvania, South Dakota, Virginia, Washington	Connecticut, District Of Columbia, Florida, Illinois, Indiana, Massachusetts, Michigan, Nebraska, New Jersey, New Mexico, Pennsylvania, South Dakota, Virginia, Washington	Connecticut, Indiana, Michigan, New Jersey, New Mexico, New York, Pennsylvania, South Dakota, Virginia, Washington
4/26/2020	Montana	Indiana, Nebraska, South Dakota, Virginia, Washington	Indiana, Nebraska, South Dakota, Virginia, Washington	Michigan, New Jersey, South Dakota, Washington
4/27/2020	Colorado, Minnesota, Mississippi, Tennessee, Vermont	Connecticut, Illinois, Michigan, Nebraska, Pennsylvania, South Dakota, Virginia, Washington	Connecticut, Illinois, Michigan, Nebraska, Pennsylvania, South Dakota, Virginia, Washington	Michigan, Pennsylvania, South Dakota, Virginia, Washington
4/30/2020	Alabama	District Of Columbia, Illinois, Michigan, Nebraska, New York, Pennsylvania, Virginia	District Of Columbia, Illinois, Michigan, Nebraska, New York, Pennsylvania, South Dakota, Virginia	Michigan, Nebraska, New York, Pennsylvania, South Dakota, Virginia, Washington

Notes: This table shows the opening and control states for each opening date. The data on opening dates is coming from the COVID-19 US State Policy Database. The control states are matched to the treatment states using pre-treatment outcomes during four weeks before reopening. See section 4 for more details.

Table A.8:
Effect of Stimulus Payments on OUD-Related Mortality and Utilization

	Medicaid Beneficiaries			Medicare Beneficiaries		
	All	No OUD	OUD	All	No OUD	OUD
			Mortality			
Stimulus	0.01	-0.18	-0.05	0.00	-0.04	0.16
	(0.01)	(0.02)	(0.15)	(0.00)	(0.02)	(0.09)
Number of Observation	98	98	98	98	98	98
Baseline Mean	0.08	0.04	1.60	0.04	0.02	0.61
			Emergency Department Visits			
Stimulus	0.04	0.34	0.40	0.06	0.46	0.91
	(0.00)	(0.02)	(0.06)	(0.01)	(0.07)	(0.26)
Number of Observation	98	98	98	98	98	98
Baseline Mean	0.08	0.01	2.26	0.31	0.00	7.59
			Inpatient Stays			
Stimulus	0.03	0.13	0.36	0.03	0.44	0.50
	(0.00)	(0.01)	(0.07)	(0.01)	(0.04)	(0.19)
Number of Observation	98	98	98	98	98	98
Baseline Mean	0.08	0.00	2.56	0.20	0.00	4.79

Notes: This table shows the difference-in-difference estimates of the effects of the first round of stimulus payment on OUD-related mortality rate per 100,000 and utilization rate per 10,000 Medicaid and Medicare beneficiaries with and without previous OUD. Robust standard errors are reported in parenthesis. We obtain the cause of death, death status, and date of death from the Medicaid and Medicare National Death Index and enrollment files. Medicaid National Death Index is only available until 2020. We obtain information on emergency department visits from Medicare and Medicaid claims data.

Table A.9:
Effect of Stimulus Payments on Mortality

	Medicaid Beneficiaries				Medicare Beneficiaries			
	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4
				Stimulus 1 (April 2020)				
Stimulus	-1.13	-0.99	-1.23	-1.27	-1.73	-1.32	-1.59	-1.80
	(0.08)	(0.10)	(0.11)	(0.14)	(0.19)	(0.19)	(0.16)	(0.20)
Number of Observation	98	98	98	98	98	98	98	98
Baseline Mean	3.63	3.82	3.54	3.82	11.73	11.64	10.75	9.96
				Stimulus 2 (January 2021)				
Stimulus	0.00	-0.32	-0.39	-0.05	-0.05	-0.61	-0.68	-0.28
	(0.11)	(0.12)	(0.12)	(0.11)	(0.26)	(0.28)	(0.24)	(0.19)
Number of Observation	100	100	100	100	100	100	100	100
Baseline Mean	3.29	3.33	3.19	3.39	11.83	11.62	10.95	10.16
				Stimulus 3 (March 2021)				
Stimulus	0.37	0.51	0.67	0.43	1.12	1.23	1.62	1.54
	(0.06)	(0.07)	(0.06)	(0.08)	(0.17)	(0.17)	(0.18)	(0.13)
Number of Observation	92	92	92	92	92	92	92	92
Baseline Mean	3.80	4.03	3.86	4.05	12.01	11.99	11.31	10.29

Notes: This table shows the difference-in-difference estimates of the effects of three rounds of stimulus payments on non-covid (stimulus 1) and all-cause mortality (stimulus 2 and 3) rate per 100,000 Medicaid and Medicare beneficiaries living in each ZIP code income quartile. Robust standard errors are reported in parenthesis. We obtain the cause of death, death status, and date of death from the Medicaid and Medicare National Death Index and enrollment files. Medicaid National Death Index is only available until 2020.

Table A.10:
Effect of Stimulus Payments on ED Visits

	Medicaid Beneficiaries				Medicare Beneficiaries			
	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4
				Stimulus 1 (April 2020)				
Stimulus	2.69	2.85	2.88	2.96	3.79	4.08	4.19	4.02
	(0.41)	(0.37)	(0.36)	(0.34)	(0.49)	(0.42)	(0.41)	(0.37)
Number of Observation	98	98	98	98	98	98	98	98
Baseline Mean	18.65	16.79	15.28	13.14	30.09	25.21	21.64	18.03
				Stimulus 2 (January 2021)				
Stimulus	1.27	1.74	1.28	1.45	3.23	2.39	2.49	2.80
	(0.39)	(0.33)	(0.29)	(0.25)	(0.94)	(0.87)	(0.79)	(0.71)
Number of Observation	100	100	100	100	100	100	100	100
Baseline Mean	19.02	17.17	15.32	13.00	29.09	24.92	21.73	18.23
				Stimulus 3 (March 2021)				
Stimulus	1.01	1.07	0.86	0.55	0.84	0.83	1.07	1.30
	(0.22)	(0.20)	(0.17)	(0.13)	(0.33)	(0.22)	(0.19)	(0.17)
Number of Observation	92	92	92	92	92	92	92	92
Baseline Mean	19.09	17.51	15.83	13.46	30.14	24.85	21.47	17.77

Notes: This table shows the difference-in-difference estimates of the effects of three rounds of stimulus payments on emergency department visit rate per 10,000 Medicaid and Medicare beneficiaries living in each ZIP code income quartile. Robust standard errors are reported in parenthesis. We obtain information on emergency department visits from Medicare and Medicaid claims data.

Table A.11:
Effect of Stimulus Payments on Inpatient Stays

	Medicaid Beneficiaries				Medicare Beneficiaries			
	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4
				Stimulus 1 (April 2020)				
Stimulus	0.13	0.14	0.14	0.14	1.50	1.56	1.56	1.55
	(0.04)	(0.04)	(0.04)	(0.04)	(0.26)	(0.25)	(0.24)	(0.22)
Number of Observation	98	98	98	98	98	98	98	98
Baseline Mean	2.20	2.07	1.98	1.89	9.05	8.23	7.61	6.89
				Stimulus 2 (January 2021)				
Stimulus	0.45	0.49	0.46	0.46	-0.46	-0.45	-0.52	-0.51
	(0.19)	(0.19)	(0.18)	(0.18)	(0.44)	(0.39)	(0.36)	(0.32)
Number of Observation	100	100	100	100	100	100	100	100
Baseline Mean	2.22	2.08	1.98	1.89	8.38	7.61	7.03	6.36
				Stimulus 3 (March 2021)				
Stimulus	0.10	0.10	0.09	0.12	0.45	0.40	0.50	0.57
	(0.03)	(0.03)	(0.02)	(0.02)	(0.11)	(0.10)	(0.09)	(0.09)
Number of Observation	92	92	92	92	92	92	92	92
Baseline Mean	2.36	2.23	2.12	2.04	9.10	8.23	7.61	6.87

Notes: This table shows the difference-in-difference estimates of the effects of three rounds of stimulus payments on inpatient stay rate per 10,000 Medicaid and Medicare beneficiaries living in each ZIP code income quartile. Robust standard errors are reported in parenthesis. We obtain information on emergency department visits from Medicare and Medicaid claims data.