

C A G E

**Liberte, Egalite,
Fraternite...
Contamine?
Estimating the impact
of French municipal
elections on
COVID-19 spread in
France**

CAGE working paper no. 524

November 2020

Guilhem Cassan
Marc Sangnier

Liberté, Égalité, Fraternité... Contaminé?

Estimating the impact of French municipal elections on COVID-19 spread in France*

Guilhem Cassan^a Marc Sangnier^b

June 22, 2020 (main text and results)
November 6, 2020 (minor edits)

Abstract

We investigate the extent to which March 15, 2020 municipal elections contributed to the COVID-19 epidemics in France. We first predict each département's own dynamics using information up to the election to calibrate a standard logistic model. We then take advantage of electoral turnout differences between départements to identify the impact of the election on prediction errors in hospitalizations. We report a detrimental effect of the election in locations that were at relatively advanced stages of the epidemics by the time of the election. Estimates suggest that elections accounted for about 15% of all hospitalizations by the end of March.

KEYWORDS: COVID-19, Hospitalizations, Electoral turnout, Municipal elections, Prediction errors.

*We are grateful to Antonio Brun Macipe, Jérémie Decalf, Romain Lutaud, Vincenzo Verardi and François Woitrin for help and comments. This work was financially supported by the Excellence of Science (EOS) Research project of FNRS O020918F and by French National Research Agency grant ANR-17-EURE-0020.

^aUniversity of Namur, DEFIPP, CRED, CEPREMAP. Mail: guilhem.cassan@unamur.be.

^bUniversity of Namur. Aix-Marseille University (Aix-Marseille School of Economics), CNRS, EHESS, Centrale Marseille. Mail: marc.sangnier@unamur.be.

1 Introduction

The two rounds of 2020 French municipal elections were planned to take place on March 15 and 22. By the beginning of March, the early spread of the COVID-19 epidemics led to a debate in the French society about whether the first round should actually be postponed. This option was finally rejected and Emmanuel Macron—the French President—announced on the evening of March 12 that the first round would take place as planned. This decision was accompanied by the announcement of the closing of all schools and universities by March 16 and was followed by an announcement by Edouard Philippe—the French Prime Minister—on March 14 about the closing of all non essential public spaces by the next day to prevent the spread of COVID 19. This marks the start of anti-contagion policies in France.

According to an [Odoxa opinion poll](#) published on March 12, 64% of French people approved the decision to maintain the election and 61% of voters reported that the epidemics won't change their decision to vote. On March 15, 19,863,660 out of 44,650,472 voters in metropolitan France cast their vote, with no alternative but to go to the voting booth in order to do so. On March 16, Emmanuel Macron announced that strict lockdown measures would be put in place from March 17 onwards and that the second round of the municipal elections was postponed *sine die*.

In this paper, we show that the first round of 2020 municipal elections caused an acceleration of the COVID-19 epidemics in metropolitan France. Our estimates suggest that elections accounted for about 4,000 excess hospitalizations by the end of March, which represents 15% of all hospitalizations by this time.

Our methodology takes advantage of electoral turnout differences between *départements*—the third highest administrative level—to distinguish the impact of the election on hospitalizations from that of simultaneously implemented anti-contagion policies. Our approach builds on methods from the abnormal financial returns and public policies evaluation literatures (see [MacKinlay 1997](#), [Duflo 2001](#), [Fisman 2001](#), [Guidolin and La Ferrara 2007](#), [DellaVigna and Ferrara 2010](#), [Coulomb and Sangnier 2014](#) and [Cassan 2019](#) among others). We proceed in two steps. First, we fit for each département a simple epidemic model of hospitalizations for COVID-19 suspicion on the period that excludes hospitalizations that might relate to events that took place by March 15 or in the following days. We then use these models to predict the evolution of the epidemics in each département as if propagation conditions were held constant and compute daily predictions errors as the difference between the realized and predicted cumulated number of hospitalizations in each département.

Second, we relate prediction errors to March 15 turnout and to differences in the epidemics stage across départements by that date. This approach allows us to assess the causal effect of

elections on hospitalizations while accounting for other contemporaneous events such as anti-contagion policies which were *a priori* uniform throughout the country. It explicitly accounts for different dynamics at the local level and builds on the assumption that prediction errors should not be related to turnout and March 15 epidemics stage in the absence of an effect of the election on hospitalizations. We show that post-calibration errors are increasing with turnout in départements where the COVID-19 epidemics was active by the day of the election. In contrast, turnout is not related to post-calibration errors in locations with low COVID-19 activity by March 15.

Our identification strategy is akin to a quadruple-differences method, effectively taking advantage of the following differences: (i) the within-département difference between realized and predicted hospitalizations; (ii) the within-département difference between periods before and after the election; (iii) the between-départements difference in electoral turnout; and (iv) the between-départements difference in epidemics intensity on the election day. This combinations of differences allows us to asses the causal impact of the elections on hospitalizations for COVID-19 suspicion. Importantly, our estimation strategy also allows us to explicitly account for other factors that might explain differences in the dynamics of the epidemics, such as population density or the share of elderly population. This approach allows us to quantify the causal impact of the elections on COVID-19 related hospitalization for metropolitan France. Moreover it also allows us to discuss the likely impact of the second round of the elections on the epidemic, which we (tentatively) anticipate to be non statistically detectable.

As highlighted by [Hsiang et al. \(2020\)](#), most studies that analyze the impact of policies on COVID-19 rely on complex epidemiological models which require a detailed knowledge of the fundamental epidemiological parameters of COVID-19. Our approach, taken from the standard methods of reduced form econometrics commonly used to assess the impact of public polices ([Angrist and Pischke 2009](#)), does not require such detailed information. Our approach allows us to disentangle the impact of the election from others confounding shocks that may have hidden it without requiring much information about the specific mechanism of the disease itself.

To our knowledge, four other papers attempt to measure the impact of elections on the COVID-19 epidemics. [Berry et al. \(2020\)](#) report no impact of the Wisconsin primary elections, comparing the epidemic trajectory of Wisconsin to that of the rest of the US, i.e., assuming that, absent the primary elections, Wisconsin would have followed the same epidemic trajectory as other US states. The three other papers attempt to evaluate the impact of 2020 municipal elections on the COVID-19 epidemics in France. [Zeitoun et al. \(2020\)](#) compare the post-election epidemic trajectories of départements with high turnout

and low turnout. This approach does not allow départements to follow idiosyncratic pre- and post-elections trajectories. It amounts to assume that départements would have followed similar epidemic dynamics if elections had not taken place, no matter how different their underlying characteristics (e.g., population density or share of elderly population) are. It leads [Zeitoun et al. \(2020\)](#) to report no effect of the French local elections on the spread of the epidemics in France. We differ from this study by allowing each département to have its own epidemiological trajectory, and are therefore comparing each département to itself, while also explicitly controlling for factors likely to determine differences in the dynamic of the epidemics at the département level. [Bertoli et al. \(2020\)](#) study the effect of the municipal elections on excess mortality at home in the subset of French municipalities that have no hospital. Using an instrumental variable approach to predict turnout at the very local level, they report a qualitatively strong impact of the election on excess mortality. However, [Bach et al. \(2020\)](#) provide evidence that results reported by [Bertoli et al. \(2020\)](#) are driven by measurement error. We depart from [Bertoli et al. \(2020\)](#) by focusing on départements—an observation unit that is *a priori* more relevant than municipalities to study the epidemics’ dynamics—, by using data that cover the whole metropolitan France, and by implementing a methodology that allow us to provide a quantitative estimate of the impact of the elections on the epidemics. Finally, [Bach et al. \(2020\)](#) show that local politicians who participated in the 2020 municipal elections did not face a higher mortality risk after the elections. This suggests that excess hospitalizations we uncover did not predominantly concern this very specific population.

2 Data and methodology

This section presents the data used in this paper as well as the methodology we rely on to assess the impact of the March 15 elections on the spread of the COVID-19 epidemics.

2.1 Data

Our analysis relies on two main datasets: hospitalizations for COVID-19 suspicion and electoral turnout at the 2020 French municipal elections. We also make use of demographic data at the département level.

In the absence of systematic testing policy by spring 2020, hospitalization data represent the best data that allow to accurately observe the epidemics by this time. French [Hospitalization data](#) are open access data published by the government. Data are based on hospitals’ reports and present the daily counts of hospitalization decisions for COVID-19 suspicion at

département level from February 24 onwards. [2020 electoral turnout data](#) for the first round of municipal elections are official electoral records available at the city-level. We aggregated these data at the département level. We proceed identically with [2014 electoral turnout data](#). Finally, we collect official total population and population aged above 60 on January 1, 2020 in each département from [official records](#) and construct population density at the département level using [départements area information](#).

2.2 Methodology

We use the daily cumulated number of hospitalizations for COVID-19 suspicion to fit a series of département-level epidemics trajectories up to the date at which individuals contaminated on March 15 start being hospitalized. We separately estimate the following standard logistic model of epidemiological trajectory for each département d :

$$\text{Cumulated hospitalizations}_{d,t} = \frac{a_d}{1 + \exp(-b_d(t - c_d))}, \quad (1)$$

where a_d , b_d and c_d capture the asymptotic level, the inflection date and the scale of the epidemics trajectory in département d , respectively. We estimate equation (1) using all dates t until March 26, i.e. 11 days after the elections took place. This 11-day lag is one day shorter than the median estimate of the number of days from infection to hospitalization suggested by the clinical studies literature.¹ As a result, the model’s forecasts can be interpreted as départements trajectories in the absence of any event that took place since March 15.

We estimated model (1) for each of the 96 départements of metropolitan France. The model was successfully estimated for 91 départements. The 5 départements for which we are not able to calibrate the model are départements that do not exhibit sufficient variation in hospitalizations until March 26 to allow for parameters’ estimation. These départements account for 1.6% of the total French population.

Following insights from the literature on short term epidemiological forecast ([Chowell et al., 2019](#); [Roosa et al., 2020a,b](#)), we use the series of estimated parameters \hat{a}_d , \hat{b}_d and \hat{c}_d to predict for each département the daily cumulated number of hospitalizations up to 7 days after the end of the calibration period, i.e. up to April 2. Predicted trajectories proxy the evolution of the epidemics in each département in the absence of the election and of any

¹Using Chinese data, [Li et al. \(2020\)](#); [Chan et al. \(2020\)](#); [Guan et al. \(2020\)](#) estimate that the time from infection to onset of symptoms is between 4 and 5 days, while [Li et al. \(2020\)](#), [Huang et al. \(2020\)](#), [Wang et al. \(2020\)](#), [Cai et al. \(2020\)](#), [Chan et al. \(2020\)](#), [Chen et al. \(2020\)](#), [Guan et al. \(2020\)](#) estimate that the time from symptoms to hospitalization is between 5 and 12 days. The French [Institut Pasteur](#) relies on these estimates to announce a 5-day period from infection to onset of symptoms, followed by a 7-day period from symptoms to hospitalization.

other shock contemporary or posterior to the election, such as lockdown policies. We use the actual number of hospitalizations for COVID-19 suspicion in each département to construct prediction errors in hospitalizations per 100,000 inhabitant. As shown by Figures S1(a) and (b) available from Supplementary material A, predictions errors are generally positive over the post-calibration period, which suggest that most départements surpass their predicted epidemics trajectories after March 15. Our interest is however not to assess whether it is possible to correctly predict the evolution of the epidemics, nor to estimate whether policies implemented after this date were able to twist trajectories.

In contrast, our interest lies in whether deviations in epidemics trajectories depend on the March 15 elections. To this end, we take advantage of two sources of variations to assess whether this event impacted the spread of the COVID-19 epidemics. First, we distinguish between départements depending on the local stage of the epidemics by the time of the election. Second, we use differences in electoral turnout to proxy for difference in exposure across départements at comparable stages of the epidemics. We then estimate the following expression:

$$\begin{aligned}
\text{Prediction error}_{d,t} = & \sum_{t=1}^T \beta_t \text{Turnout}_d \times \tau_t \\
& + \sum_{t=1}^T \gamma_t \text{Turnout}_d \times \text{Advanced epidemics}_d \times \tau_t \\
& + \sum_{t=1}^T \delta_t \tau_t \\
& + \sum_{t=1}^T \zeta_t \text{Advanced epidemics}_d \times \tau_t \\
& + \mathbf{Y}_d + \mathbf{Z}_{d,t} + \alpha + \epsilon_{d,t},
\end{aligned} \tag{2}$$

where $\text{Prediction error}_{d,t}$ is the difference between actual and predicted cumulated hospitalizations per 100,000 inhabitants in département d on day t , Turnout_d is electoral turnout on March 15 in département d , τ_t is a variable equal to 1 on day t , $\text{Advanced epidemics}_d$ is a variable equal to 1 for départements at advanced stages of the epidemics on March 15, series of δ and ζ coefficients account for daily patterns in prediction errors across départements in both groups, \mathbf{Y}_d is a vector of département fixed effects which account for département-specific patterns, \mathbf{Z}_{dt} is a vector of interactions between day fixed effects and départements population density and share of population aged above 60, α is a constant term, and ϵ_{dt} is the error term. We estimate expression (2) using ordinary least squares and cluster standard errors at the département and day levels. The sample is made of all days from March 1 to April 2, 2020.

Consistent with the aforementioned 11-day lag between infection and hospitalization, we use cumulated hospitalizations per 100,000 inhabitants on March 26 to construct the $\text{Advanced epidemics}_d$ variable that distinguishes between départements depending on the stage of the epidemics by the day of the election. We arbitrarily distinguish between

départements in the bottom third of the COVID-19 epidemics according to this measure and others.² The latter are considered as locations at relatively more advanced stages of the epidemics.³

In expression (2), the main parameters of interest are the estimated series of β_t and γ_t . These coefficients indicate the impact of electoral turnout on hospitalizations for départements with low infection and its additional effect for départements with high infection, respectively. Under the assumption that the March 15 elections impacted epidemics trajectories only in locations that were at advanced stages of the epidemics by that day, we expect β s to be close to zero and γ s to be positive in the post-calibration period.

2.3 Threat to identification

A key assumption for the above presented approach to allow us to safely assess the impact of municipal elections on the dynamics of the COVID-19 epidemics is that electoral turnout on March 15 is unrelated to the stage of the epidemics by that date. Namely, turnout was low as only 45% of voters cast their vote, compared to 64% at the 2014 municipal elections. There is a wide consensus in the French society that this low turnout was mainly caused by the fear of contagion. This might actually be the case but would be a threat to identification only if differences in turnout across départements ended up being related to differences in the epidemics across départements. We find no evidence of such a correlation between the level of turnout in a département and the information on the spread of the epidemic in that département on the day of the election. This is best illustrated by Figure 1(a) which plots turnout against publicly known cumulated hospitalizations on March 15. Turnout appears evenly distributed at each stage of the epidemics.

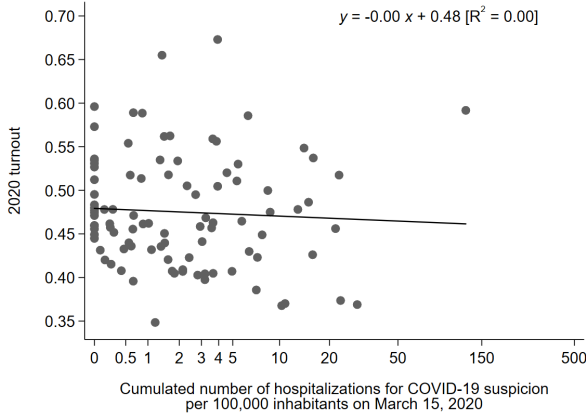
Figure 1(b) further accounts for the 11-day lag from infection to hospitalization to better capture the underlying stage of the epidemics in each département and only reveals a weakly decreasing link between turnout and hospitalizations. In contrast, turnout at the 2020 municipal elections is strongly correlated with turnout at the preceding municipal elections that took place in 2014 as shown by Figure 1(c). This Figure shows that the shift in turnout was uniform across départements. Figure 1(d) and (e) further illustrate this claim by plotting the 2014 to 2020 turnout difference against cumulated hospitalizations on March 15 and 26, respectively.

²As shown by Figure S2, available from Supplementary material B, this threshold correspond to 14 hospitalizations per 100,000 inhabitants.

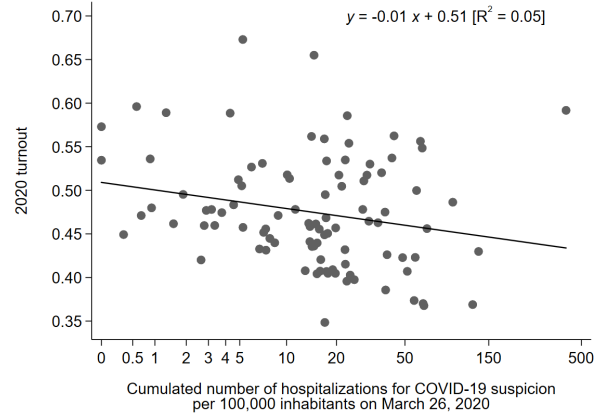
³Supplementary material D show that results are robust to using a 10-day lag in lieu of a 11-day lag. Supplementary material E displays results obtained using alternative definitions of the group of départements considered as at advanced epidemic stage by the day of the election. Supplementary material F presents point estimates obtained when removing each département one-by-one.

Figure 1: Electoral turnout and the COVID-19 epidemics.

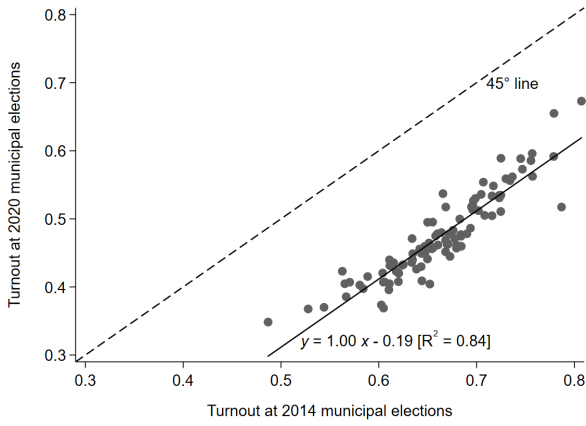
(a) 2020 turnout and hospitalizations on March 15.



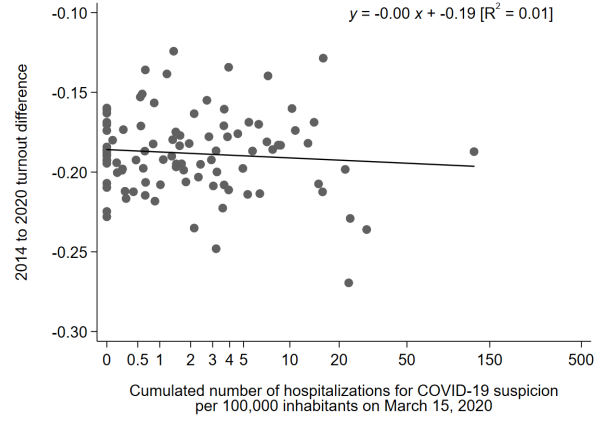
(b) 2020 turnout and hospitalizations on March 26.



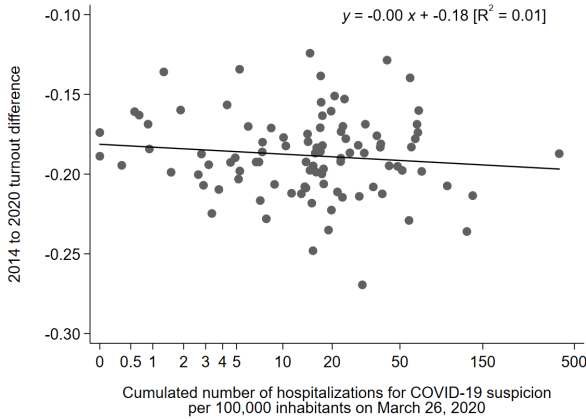
(c) 2020 and 2014 turnout.



(d) 2014 to 2020 turnout difference and hospitalizations on March 15.



(e) 2014 to 2020 turnout difference and hospitalizations on March 26.



Sources: Authors' calculation using Santé publique France, Ministère de l'intérieur and Institut national de la statistique et des études économiques data.

All in all, while the COVID-19 epidemics might have impacted turnout at the 2020 municipal elections—a question that is beyond the scope of this paper—differences in the spread of the epidemics by March 15 did not translate into differences in turnout across départements, thereby allowing us to confidently interpret estimates that will be delivered by our identification strategy.

2.4 Discussion of the methodology

The outcome of interest of our approach is the extent to which the first-step predictive model fails to predict the evolution of hospitalizations. In the absence of an effect of the election on hospitalization, our model should make similar errors of predictions across départements, no matter their turnout.

However, if the election indeed had an effect on the epidemic, the prediction errors should be relatively larger in départements with relatively higher turnout. Indeed, if elections did contribute to spread the epidemics, the predictive model should underestimate by a larger amount the number of cases in départements with high turnout compared to départements with low electoral turnout. And this stronger underestimation should start only when individuals infected on the election day are hospitalized, not before. Similarly, the effect of turnout on the epidemics' spread should only exist in départements in which the contagious individuals are indeed present: a high turnout in a département with no or few contagious individuals should result in 0 additional contagions.

We therefore analyse prediction errors via a triple-difference approach: not only do we compare départements with high and low turnout before and after the elections, but we study how this double-difference varies between départements with very low infection rates around the election date and other départements. We would expect turnout to only have an effect on the epidemics in départements already affected by the epidemics at the time of the election.

This approach has several advantages. First, it does not require blind faith in the ability of the predictive model to deliver accurate predictions. In fact, it does rely on the model's predictions being wrong while *a priori* uncorrelated with turnout under the null assumption that elections had no impact on the spread of the COVID-19 epidemics. Second, the event study aspect of the approach allows us to exactly observe when the prediction errors become correlated with turnout: prediction error should start being correlated with turnout *only* when people infected on the election day start showing up at hospital, that is, only when enough (but not too much) time has passed since the election for the symptoms to be severe enough to lead to hospitalization. This approach therefore automatically implements a sanity

check as the correlation between the model’s prediction errors and turnout should emerge with a lag compared to the election date, but not too long a lag.

A drawback of our approach is however that these type of simple predictive models are typically precise in the short run only, so that predictions are likely to become more and more noisy the further away we move from the end of the calibration period, which should result in imprecise estimates. This is the reason why we stop the analysis 7 days after the end of the model’s fit. This time span is however likely to cover most of the additional hospitalizations that could be related to the March 15 elections as severe lockdown policies were implemented in the days that immediately follow, thereby limiting further transmission by people who would have been contaminated on that day.

3 Results

This section presents and interprets the results of the study.

3.1 Relationship between electoral turnout and hospitalizations

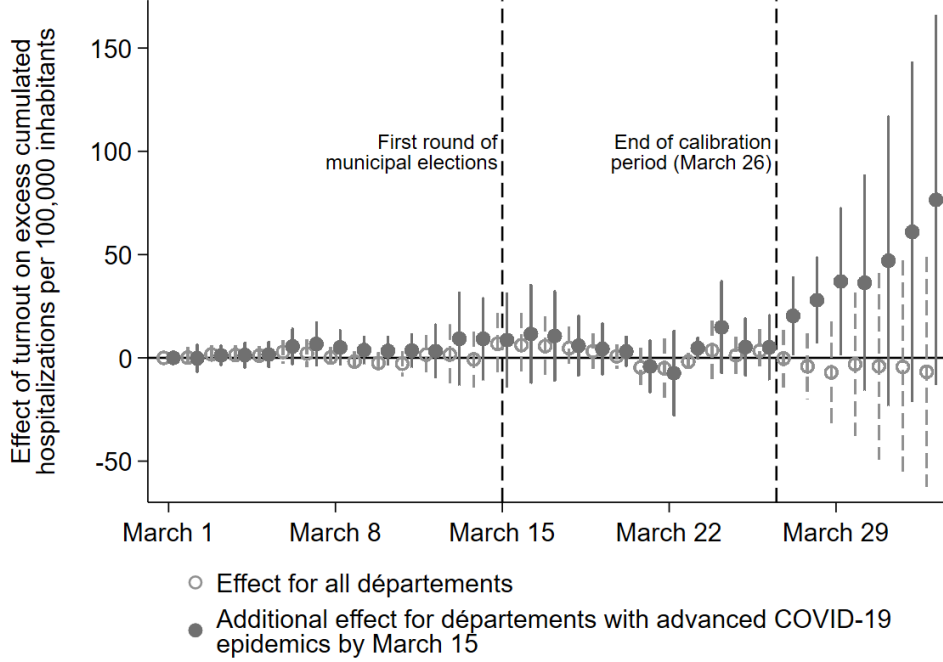
Figure 2 presents the series of β_t and γ_t coefficients estimated from equation 2. The series of β_t coefficients stays small and insignificant over both the calibration and prediction periods. This shows that turnout did not have any impact on hospitalizations in départements with very low infection rates on the day of the election. Similarly, the series of γ_t coefficients is close to zero and statistically insignificant over the calibration period. In contrast, the series starts increasing by March 27. This suggests that turnout is positively associated with hospitalizations in départements in which there were a relatively high number of contagious individuals by the election day exactly 12 days after the day of the election, in line with the 12-day lag between infection and hospitalization estimated by the literature.

As discussed in section 2, the uncovered positive relationship can be interpreted as evidence of a causal relationship from the election to hospitalizations. However, beyond the increasing pattern of the series of γ_t coefficients after March 27, Figure 2 also displays increasing standard errors of the estimates as close as 3 days from the end of the calibration period. This feature calls for caution in the interpretation of the point estimates.

3.2 Quantification of the total effect

As shown by Table S1 available from Supplementary material C, γ coefficients estimated for March 27, 28 and 29 correspond to 20.3 (p-value = 0.032), 27.9 (0.009) and 37.0 (0.041) excess cumulated hospitalizations, respectively, for an hypothetical change in turnout from

Figure 2: Relationship between electoral turnout and excess hospitalizations.



Estimates of β_t and γ_t from equation (2) (see section 2). Vertical lines are 95% confidence intervals. *Département with advanced COVID-19 epidemics by March 15* are départements in the top two thirds of the distribution of cumulated hospitalizations for COVID-19 suspicion by March 26.

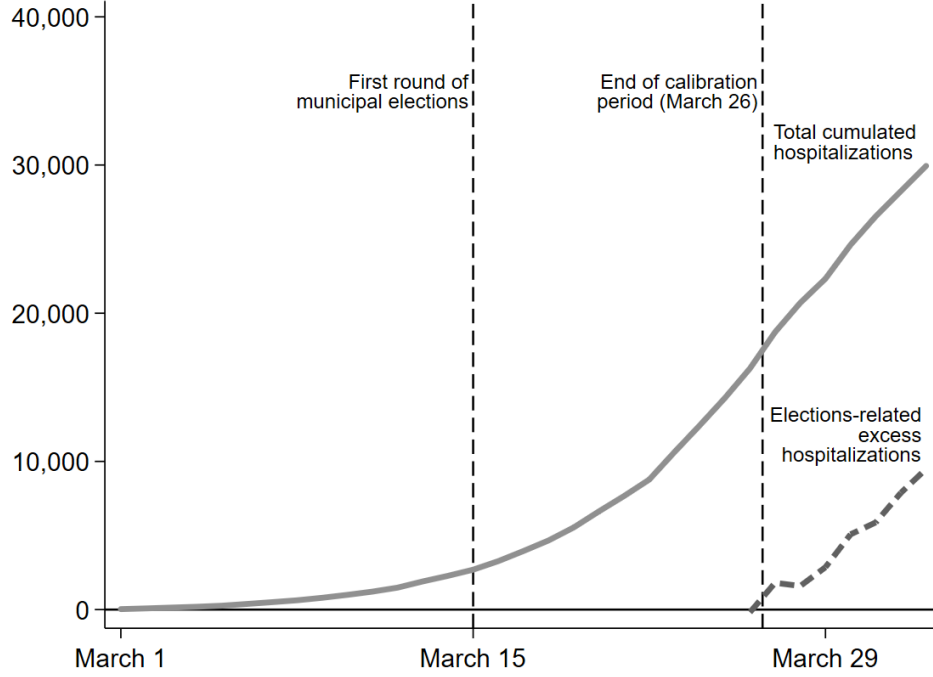
0% to 100% in départements at relatively advanced stages of the epidemics by the election day. This contrasts with the coefficient estimated on the following days that are much larger and less precisely estimated. For instance, coefficients estimated for April 1 and 2 correspond to 61.0 (p-value = 0.139) and 76.5 (0.090) excess cumulated hospitalizations, respectively, for the same hypothetical change.

Actual electoral turnout data can help us to quantify the contribution of the March 15 elections to the COVID-19 epidemics. To this end, we use estimated coefficients of equation (2) and compute turnout-related excess cumulated hospitalizations per 100,000 inhabitants on each day from the end of the calibration period to April 2 in départements that were at advanced stages of the epidemics on March 15 as:

$$\text{Excess}_{d,t} = (\hat{\gamma}_t + \hat{\beta}_t) \times \text{Turnout}_d + (\hat{\delta}_t + \hat{\zeta}_t) + \hat{\alpha}. \quad (3)$$

We then multiply these figures by each département population to obtain absolute figures and set excess hospitalizations to zero in départements with low COVID-19 activity on the election day. Figure 3 plots elections-related excess and actual cumulated hospitalizations at

Figure 3: Election-related excess hospitalizations.



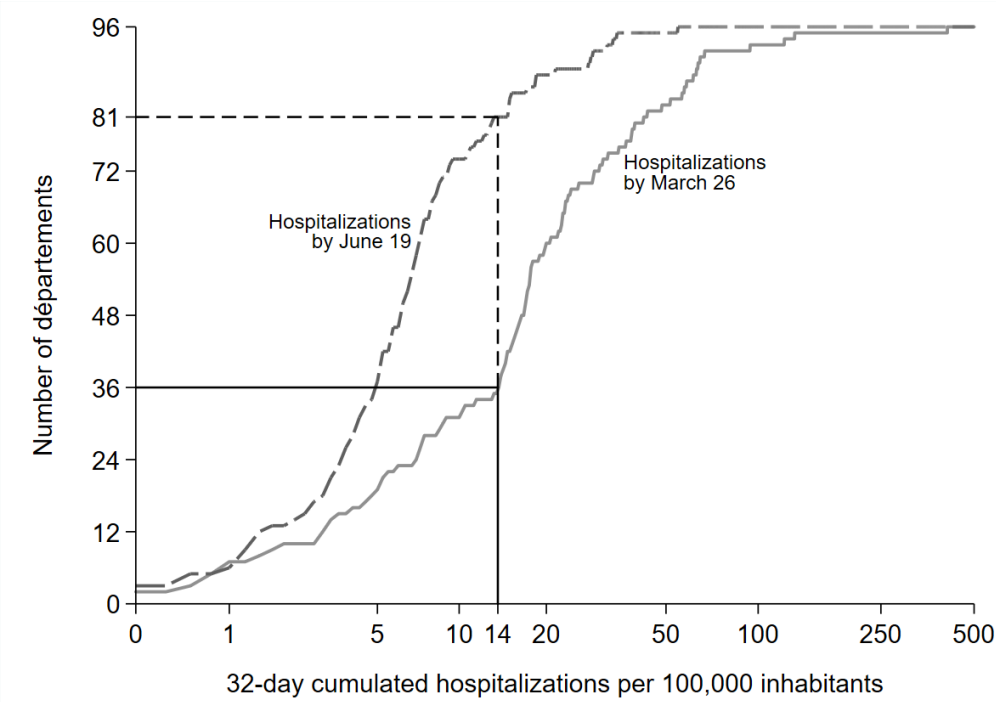
Estimated election-related excess hospitalizations are computed using equation (3). See the text for more details.

the national level. Our estimates suggest that the March 15 municipal elections accounted for 1,811, 1,591 and 2,860 cumulated hospitalizations on March 27, 28 and 29, respectively. These figures represent 9.7%, 7.7% and 12.8% of cumulated hospitalizations by these days, respectively. Less reliable estimates available for April 1 and 2 suggest that elections accounted for 7,884 and 9,496 cumulated hospitalizations by these days, representing 27.9% and 31.7% of actual hospitalizations at these dates. These latter estimates are presumably less solid because of larger prediction and estimation errors as we move away from the end of the calibration period. As such, they must be considered as upper bounds. In contrast, March 27–31 estimates suggests that elections account for about 4,000 hospitalizations, which represents 15% of all cumulated hospitalizations for COVID-19 suspicion in metropolitan France by March 31.

4 Conclusion

According to our analysis, measures implemented on March 15 to prevent contamination in voting stations by the first round of the 2020 French municipal elections were not fully

Figure 4: 32-day cumulated hospitalizations per 100,000 inhabitants on March 26 and June 19.



96 départements of metropolitan France. Distributions of hospitalizations per 100,000 inhabitants cumulated over 32 days until March 26 and June 19, 2020. The vertical line at 14 hospitalizations per 100,000 inhabitants correspond to the bottom third of the distribution for March 26 when excluding the 5 départements for which model (1) cannot be calibrated because of insufficient variation in hospitalizations until March 26.

effective and resulted in about 4,000 additional hospitalizations by the end of March. That is, 15% of hospitalizations accumulated by that time can be considered as direct consequences of the election.

On May 22, the French government announced that the second round of the municipal elections will take place on June 28 in municipalities in which no list gained majority in the first round. About 16,000,000 voters—mostly in the largest municipalities—are called to vote again. In the more distant future, départemental and regional elections are scheduled for 2021. For sure, anti-contagion policies implemented on March 15 need to be reviewed and improved to prevent these (and future) elections from spreading the current or future epidemics. Still, this study’s results allow us to qualitatively evaluate the likelihood that the 28 June second round will trigger a new COVID-19 wave.

After more than two months of lockdown and severe anti-contagion policies, the epidemic situation in June is not comparable to that in March. While the first round took place at the beginning of the exponential part of epidemics curve, the lockdown essentially amounted

to a reset of infections. Infection levels are thus likely to be much lower in June than they were on March 15.

According to our estimates, départements in the bottom third of the distribution of cumulated hospitalizations per 100,000 inhabitants by March 26 did not experience any worsening of their epidemic trajectory because of the March 15 election. This arbitrary threshold corresponds to 14 cumulated hospitalizations per 100,000 inhabitants in the distribution constructed using hospitalization records since February 24, i.e, 32 days to March 26.

To assess the situation of French départements *vis-à-vis* an election to be organised in June, we use the latest hospitalizations record available by June 19, 2020 and reconstruct the 32-day cumulated number of hospitalizations per 100,000 inhabitants by that date in each département. As shown by Figure 4, 81 out of 96 départements experience lower than 14 reconstructed cumulated hospitalizations by June 19. This suggests that these départements would have been locations where an election won't have accelerated the situation if organized 11 days before, i.e, by June 8.

It is important to keep in mind that (i) the threshold we use has no medical content and should only be understood as a way to compare two situations, and that (ii) our results, and thus our forecasts about end of June 2020, rely on estimates that are average effects by construction and might thus encompass heterogeneous situations. These limits in mind, it is likely that additional départements will cross the above mentioned threshold from here to June 28 if the epidemiological situation continues to improve. As a consequence, it is likely that holding elections on June 28 will not cause a statistically detectable number of new contaminations.

References

- Angrist, Joshua, and Jorn-Steffen Pischke. *Mostly Harmless Econometrics*. Princeton University Press, 2009.
- Bach, Laurent, Arthur Guillouzouic, and Clément Malgouyres. “Does Holding Elections during a Covid-19 Pandemic Put the Lives of Politicians at Risk?” Technical Report halshs-02895359, Institut des Politiques Publiques, 2020.
- Berry, Andrew C., Madhuri S. Mulekar, and Bruce B. Berry. “Wisconsin April 2020 Election Not Associated with Increase in COVID-19 Infection Rates.” Technical report, medRxiv, 2020. <https://www.medrxiv.org/content/early/2020/04/28/2020.04.23.20074575>.
- Bertoli, Simone, Lucas Guichard, and Francesca Marchetta. “Turnout in the Municipal Elections of March 2020 and Excess Mortality during the COVID-19 Epidemic in France.” IZA Discussion Papers 13335, Institute of Labor Economics (IZA), 2020.
- Cai, Qingxian, Deliang Huang, Pengcheng Ou, Hong Yu, Zhibin Zhu, Zhang Xia, Yinan Su, Zhenghua Ma, Yiming Zhang, Zhiwei Li, Qing He, Lei Liu, Yang Fu, and Jun Chen. “COVID-19 in a designated infectious diseases hospital outside Hubei Province, China.” *Allergy* <https://onlinelibrary.wiley.com/doi/abs/10.1111/all.14309>.
- Cassan, Guilhem. “Affirmative action, education and gender: Evidence from India.” *Journal of Development Economics* 136, C: (2019) 51–70.
- Chan, Jasper Fuk-Woo, Shuofeng Yuan, Kin-Hang Kok, Kelvin Kai-Wang To, Hin Chu, Jin Yang, Fanfan Xing, Jieling Liu, Cyril Chik-Yan Yip, Rosana Wing-Shan Poon, Hoi-Wah Tsoi, Simon Kam-Fai Lo, Kwok-Hung Chan, Vincent Kwok-Man Poon, Wan-Mui Chan, Jonathan Daniel Ip, Jian-Piao Cai, Vincent Chi-Chung Cheng, Honglin Chen, Christopher Kim-Ming Hui, and Kwok-Yung Yuen. “A familial cluster of pneumonia associated with the 2019 novel coronavirus indicating person-to-person transmission: a study of a family cluster.” *The Lancet* 395, 10223: (2020) 514 – 523. <http://www.sciencedirect.com/science/article/pii/S0140673620301549>.
- Chen, Guang, Di Wu, Wei Guo, Yong Cao, Da Huang, Hongwu Wang, Tao Wang, Xiaoyun Zhang, Huilong Chen, Haijing Yu, Xiaoping Zhang, Minxia Zhang, Shiji Wu, Jianxin Song, Tao Chen, Meifang Han, Shusheng Li, Xiaoping Luo, Jianping Zhao, and Qin Ning. “Clinical and immunological features of severe and moderate coronavirus disease 2019.” *The Journal of Clinical Investigation* 130, 5: (2020) 2620–2629.
- Chowell, Gerardo, Amna Tariq, and James M. Hyman. “A novel sub-epidemic modeling framework for short-term forecasting epidemic waves.” *BMC Medicine* 17, 164.
- Coulomb, Renaud, and Marc Sangnier. “The impact of political majorities on firm value: Do electoral promises or friendship connections matter?” *Journal of Public Economics* 115, C: (2014) 158–170.

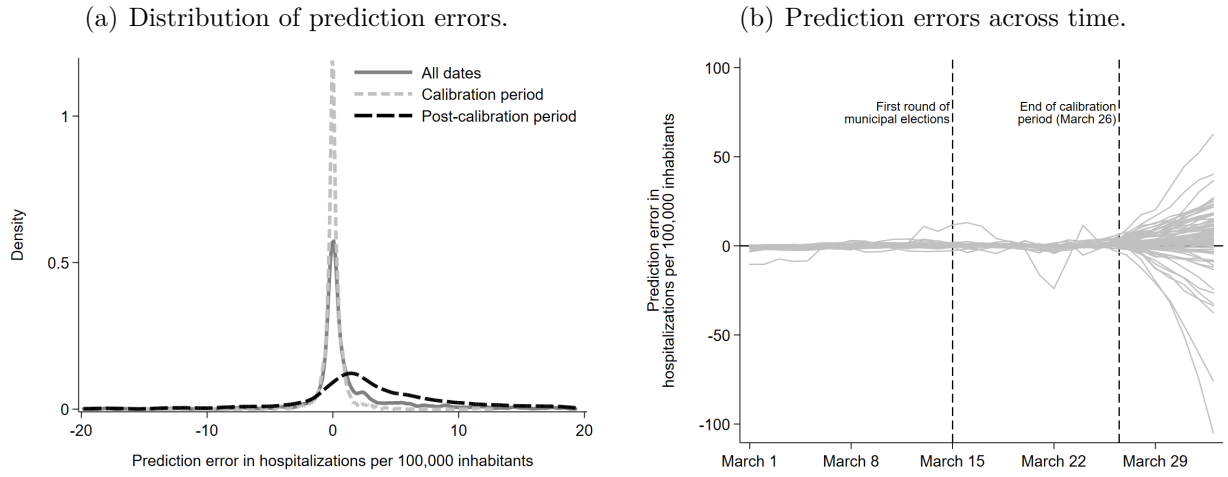
- DellaVigna, Stefano, and Eliana La Ferrara. “Detecting Illegal Arms Trade.” *American Economic Journal: Economic Policy* 2, 4: (2010) 26–57.
- Duflo, Esther. “Schooling and Labor Market Consequences of School Construction in Indonesia: Evidence from an Unusual Policy Experiment.” *American Economic Review* 4, 91: (2001) 795–813.
- Fisman, Raymond. “Estimating the Value of Political Connections.” *American Economic Review* 91, 4.
- Guan, Wei-jie, Zheng-yi Ni, Yu Hu, Wen-hua Liang, Chun-quan Ou, Jian-xing He, Lei Liu, Hong Shan, Chun-liang Lei, David S.C. Hui, Bin Du, Lan-juan Li, Guang Zeng, Kwok-Yung Yuen, Ru-chong Chen, Chun-li Tang, Tao Wang, Ping-yan Chen, Jie Xiang, Shi-yue Li, Jin-lin Wang, Zi-jing Liang, Yi-xiang Peng, Li Wei, Yong Liu, Ya-hua Hu, Peng Peng, Jian-ming Wang, Ji-yang Liu, Zhong Chen, Gang Li, Zhi-jian Zheng, Shao-qin Qiu, Jie Luo, Chang-jiang Ye, Shao-yong Zhu, and Nan-shan Zhong. “Clinical Characteristics of Coronavirus Disease 2019 in China.” *New England Journal of Medicine* 382, 18: (2020) 1708–1720. <https://doi.org/10.1056/NEJMoa2002032>.
- Guidolin, Massimo, and Eliana La Ferrara. “Diamonds Are Forever, Wars Are Not: Is Conflict Bad for Private Firms?” *American Economic Review* 97, 5: (2007) 1978–1993. <https://www.aeaweb.org/articles?id=10.1257/aer.97.5.1978>.
- Hsiang, Solomon, Daniel Allen, Annan-Phan Sebastien, Kendon Bell, Ian Bolliger, Trinetta Chong, Hannah Druckenmiller, Luna Yue Huang, Andrew Hultgreen, Emma Krasowich, Peiley Lau, Jaecheol Lee, Esther Rolf, Jeanette Tseng, and Tiffany Wu. “The effect of large-scale anti-contagion policies on the COVID-19 pandemic.” *Nature* .
- Huang, Chaolin, Yeming Wang, Xingwang Li, Lili Ren, Jianping Zhao, Yi Hu, Li Zhang, Guohui Fan, Jiuyang Xu, Xiaoying Gu, Zhenshun Cheng, Ting Yu, Jiaan Xia, Yuan Wei, Wenjuan Wu, Xuelei Xie, Wen Yin, Hui Li, Min Liu, Yan Xiao, Hong Gao, Li Guo, Jungang Xie, Guangfa Wang, Rongmeng Jiang, Zhancheng Gao, Qi Jin, Jianwei Wang, and Bin Cao. “Clinical features of patients infected with 2019 novel coronavirus in Wuhan, China.” *The Lancet* 395, 10223: (2020) 497 – 506. <http://www.sciencedirect.com/science/article/pii/S0140673620301835>.
- Institut national de la statistique et des études économiques. “Estimation de la population au 1^{er} janvier 2020.”, 2020. <https://www.insee.fr/fr/statistiques/1893198>.
- Institut Pasteur. “COVID-19 Disease (Novel Coronavirus).”, 2020. <https://www.pasteur.fr/en/medical-center/disease-sheets/covid-19-disease-novel-coronavirus>. Accessed on May 19, 2020.
- Li, Qun, Xuhua Guan, Peng Wu, Xiaoye Wang, Lei Zhou, Yeqing Tong, Ruiqi Ren, Kathy S.M. Leung, Eric H.Y. Lau, Jessica Y. Wong, Xuesen Xing, Nijuan Xiang, Yang Wu, Chao Li, Qi Chen, Dan Li, Tian Liu, Jing Zhao, Man Liu, Wenxiao Tu, Chuding Chen, Lianmei Jin, Rui Yang, Qi Wang, Suhua Zhou, Rui Wang, Hui Liu, Yinbo Luo, Yuan Liu, Ge Shao, Huan Li, Zhongfa Tao, Yang Yang, Zhiqiang Deng, Boxi Liu, Zhitao

- Ma, Yanping Zhang, Guoqing Shi, Tommy T.Y. Lam, Joseph T. Wu, George F. Gao, Benjamin J. Cowling, Bo Yang, Gabriel M. Leung, and Zijian Feng. “Early Transmission Dynamics in Wuhan, China, of Novel Coronavirus-Infected Pneumonia.” *New England Journal of Medicine* 382, 13: (2020) 1199–1207.
- MacKinlay, A. Craig. “Event Studies in Economics and Finance.” *Journal of Economic Literature* 35, 1: (1997) 13–39.
- Ministère de l’Intérieur. “Elections municipales 2014 - Résultats 1er tour.”, 2014. <https://www.data.gouv.fr/fr/datasets/elections-municipales-2014-resultats-1er-to-0> and <https://www.data.gouv.fr/fr/datasets/elections-municipales-2014-resultats-1er-tour>.
- . “Elections municipales 2020 - Résultats.”, 2020. <https://www.data.gouv.fr/fr/datasets/elections-municipales-2020-resultats>.
- Odoxa. “Les Français et le coronavirus.” March 12, 2020. <http://www.odoxa.fr/sondage/covid-19-ne-provoque-de-panique-risque-bien-de-plomber-participation-aux-elections-municipales>.
- OpenStreetMap. “Contours des départements français issus d’OpenStreetMap.”, 2018. <http://www.data.gouv.fr/fr/datasets/contours-des-departements-francais-issus-d-openstreetmap>.
- Roosa, K., Y. Lee, R. Luo, A. Kirpich, R. Rothenberg, J.M. Hyman, P. Yan, and G. Chowell. “Real-time forecasts of the COVID-19 epidemic in China from February 5th to February 24th, 2020.” *Infectious Disease Modelling* 5: (2020a) 256 – 263. <http://www.sciencedirect.com/science/article/pii/S2468042720300051>.
- Roosa, Kimberly, Yiseul Lee, Ruiyan Luo, Alexander Kirpich, Richard Rothenberg, James M. Hyman, Ping Yan, and Gerardo Chowell. “Short-term Forecasts of the COVID-19 Epidemic in Guangdong and Zhejiang, China: February 13–23, 2020.” *Journal of Clinical Medicine* 9, 2.
- Santé publique France. “Données des urgences hospitalières et de SOS médecins relatives à l’épidémie de COVID-19.”, . <https://www.data.gouv.fr/fr/datasets/donnees-des-urgences-hospitalieres-et-de-sos-medecins-relatives-a-lepidemie-de-covid-19>.
- Wang, Dawei, Bo Hu, Chang Hu, Fangfang Zhu, Xing Liu, Jing Zhang, Binbin Wang, Hui Xiang, Zhenshun Cheng, Yong Xiong, Yan Zhao, Yirong Li, Xinghuan Wang, and Zhiyong Peng. “Clinical Characteristics of 138 Hospitalized Patients With 2019 Novel Coronavirus-Infected Pneumonia in Wuhan, China.” *JAMA* 323, 11: (2020) 1061–1069. <https://doi.org/10.1001/jama.2020.1585>.
- Zeitoun, Jean David, Matthieu Faron, Sylvain Manternach, Jerome Fourquet, Marc Lavielle, and Jeremie Lefevre. “Reciprocal association between participation to a national election and the epidemic spread of COVID-19 in France: Nationwide observational and dynamic modeling study.” Technical report, medRxiv, 2020. <https://www.medrxiv.org/content/early/2020/05/19/2020.05.14.20090100>.

Supplementary material

A Prediction Errors

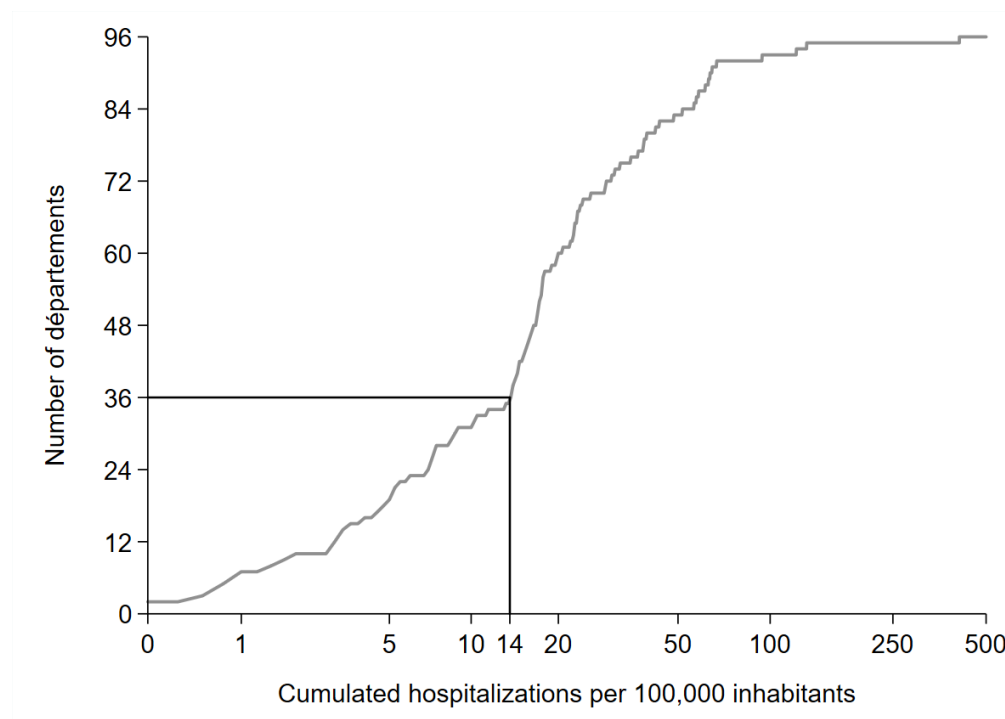
Figure S1: Prediction errors.



Figures (a) and (b) plot the prediction errors of model (1) calibrated until March 26. Predictions are computed up to 7 after the end of the calibration period. See section 2 for more details. Figure (a) excludes prediction errors out of the $[-20, 20]$ range.

B Cumulated number of hospitalizations per 100,000 inhabitants on March 26

Figure S2: Distribution of cumulated hospitalizations per 100,000 inhabitants on March 26.



96 départements of metropolitan France. The vertical line at 14 hospitalizations per 100,000 inhabitants correspond to the bottom third of the distribution when excluding the 5 départements for which model (1) cannot be calibrated because of insufficient variation in hospitalizations until March 26.

C Detailed regression results

Table S1: Estimates of the effect of turnout on excess hospitalizations.

	Coefficient (standard error) [p-value]	
	Effect of turnout	Additional effect of turnout for départements with advanced epidemics
March 25	1.228 (4.360) [0.780]	5.209 (6.730) [0.445]
March 26	3.376 (5.030) [0.507]	5.077 (7.566) [0.507]
March 27	-0.316 (6.809) [0.963]	20.333 (9.083) [0.032]
March 28	-4.135 (7.796) [0.599]	27.940 (10.080) [0.009]
March 29	-7.078 (12.094) [0.562]	37.020 (17.341) [0.041]
March 30	-3.117 (17.049) [0.856]	36.360 (25.434) [0.163]
March 31	-4.044 (22.145) [0.856]	47.031 (34.232) [0.179]
April 1	-4.416 (25.192) [0.862]	60.980 (40.144) [0.139]
April 2	-6.745 (27.230) [0.806]	76.521 (43.732) [0.090]

Estimates of β_t and γ_t from equation (2) from March 25 onwards. See section 2 for more details. See Figure 2 in the main text for a graphical representation. P-values of two-sided tests in brackets. Standard errors clustered at the day and département level between parentheses. The sample is made of 3,003 observations (91 départements \times 33 days). *Département with advanced COVID-19 epidemics by March 15* are départements in the top two thirds of the distribution of cumulated hospitalizations for COVID-19 suspicion by March 26.

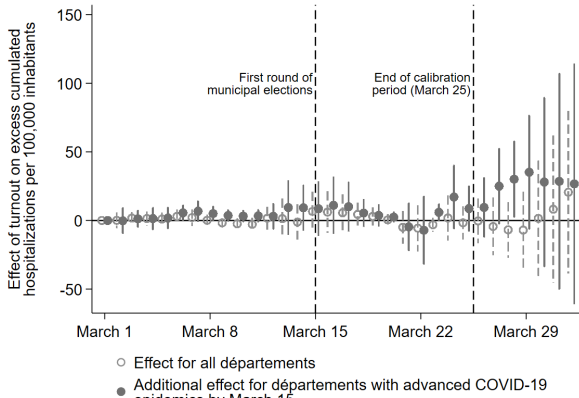
D Results using 10 days as time from infection to hospitalization

Figure S3 displays results obtained using 10 days, rather than 11 days, as lag from infection to hospitalization. March 25 is thus used in lieu of March 26 as the date at which the calibration period ends and as the day at which we distinguish between départements with low or high epidemics by the time of the municipal elections. As the prediction model is calibrated on a shorter period, model (1) is successfully estimated for only 88 out of the 96 départements. The 8 left-aside départements account for 4.0% of the French population.

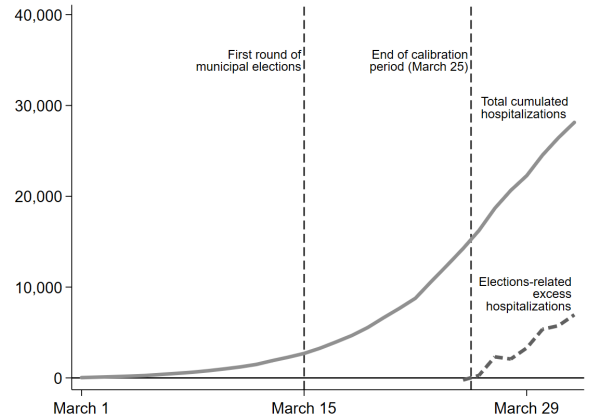
Figure S3(a) presents coefficients of interest when estimating equation (2) using March 25 both as the end of the calibration period for model (1) and as the date at which the categorization between high and low infection départements is done using the bottom third of the distribution of hospitalizations per 100,000 inhabitants. Although less precisely estimated, the patterns of coefficient over the days after the end of the calibration period is similar to that found using March 16. Figure S3(b) displays the corresponding total excess hospitalizations associated with the elections.

Figure S3: Estimates using 10 days as time from infection to hospitalization.

(a) Relationship between electoral turnout and excess hospitalizations, 10-day lag from infection to hospitalization.



(b) Election-related excess hospitalizations, 10-day lag from infection to hospitalization.

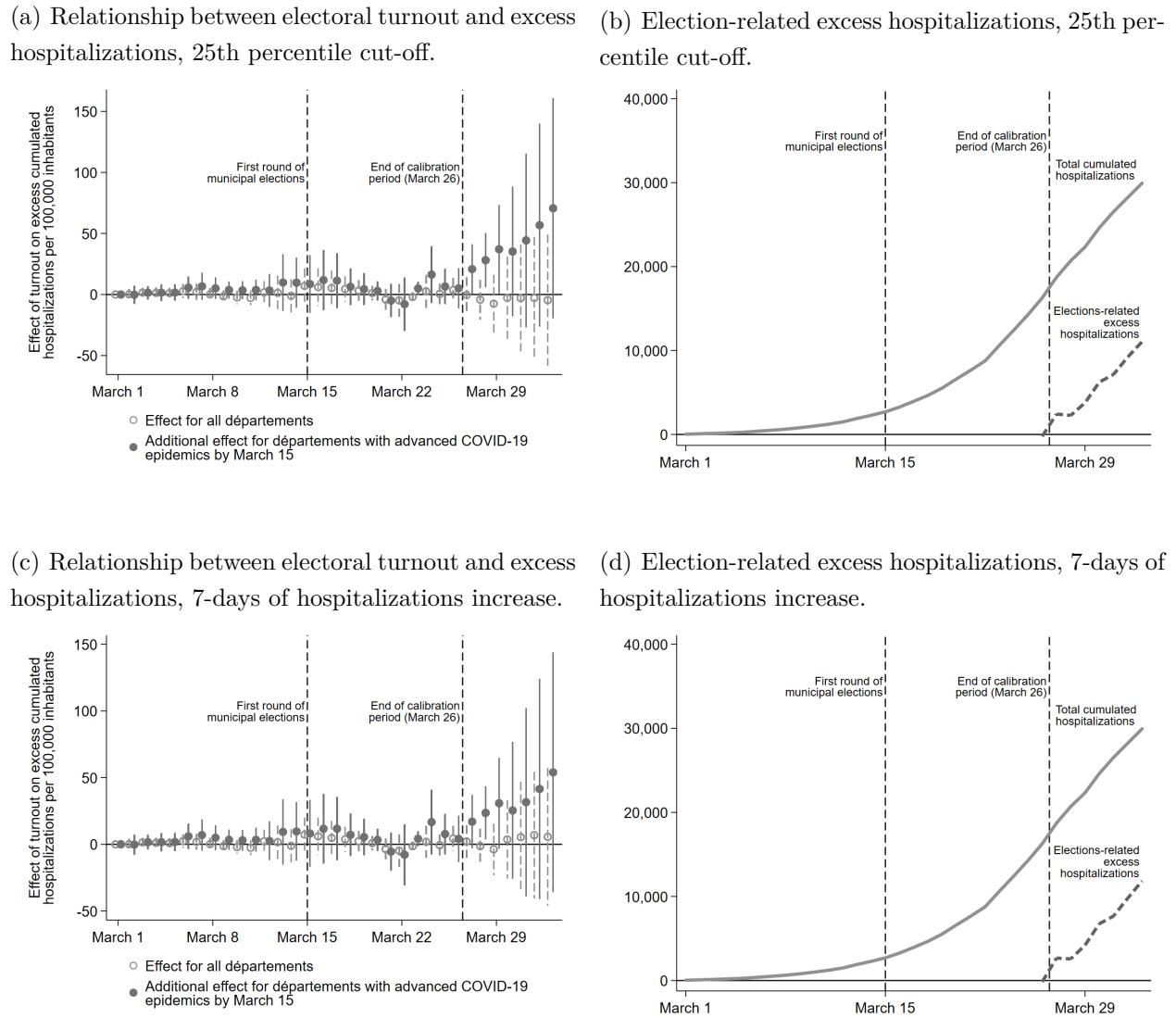


Figures (a) and (b) mimic Figures 2 and 3 from the main text but use March 25 in lieu of March 26. Vertical lines are 95% confidence intervals.

E Alternative definitions of advanced epidemic stage

Figure S4(a) presents the estimated coefficients of equation (2), using the 25th percentile of the distribution of cumulated hospitalizations per 100,000 inhabitants across départements on March 26 to construct the group of départements considered as at advanced stage of the epidemics by March 15. Figure S4(b) plots the corresponding total excess hospitalizations associated with the elections. Figure S4(c) and (d) further display results obtained when identifying départements with advanced epidemics activity as départements which that experienced more than 7 days of increase in hospitalization until March 26.

Figure S4: Estimates using alternative definitions of advanced epidemic stage by March 15.

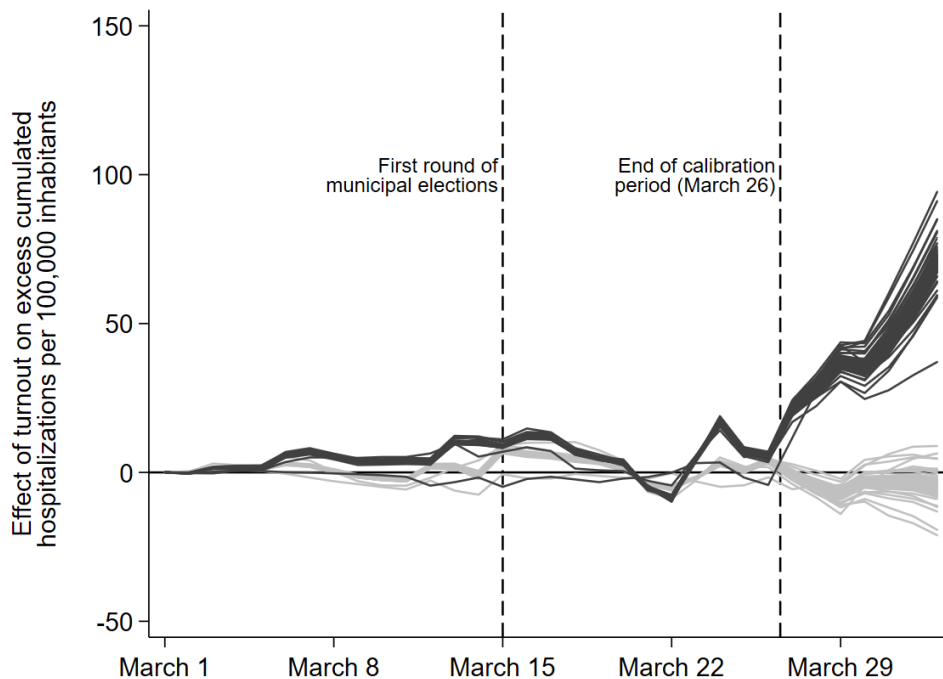


Figures (a) and (c) mimic Figure 2 from the main text. Vertical lines are 95% confidence intervals. Figures (b) and (d) mimic Figure 3 from the main text.

F Results removing départements one-by-one

Figure S5 reproduces the results of Regression 2, but omitting each département one by one, to check if an outlier département is not driving all results. It can be seen that this is not the case.

Figure S5: Relationship between electoral turnout and excess hospitalizations.



Series of estimates of β_t and γ_t from equation (2) (see section 2). Each line corresponds to a series of coefficients obtained when excluding a given département from the sample. *Département with advanced COVID-19 epidemics by March 15* are départements in the top two thirds of the distribution of cumulated hospitalizations for COVID-19 suspicion by March 26.