

Unintended consequences of lockdowns, COVID-19 and the Shadow Pandemic in India

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Saravana Ravindran¹ & Manisha Shah²

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Violence against women is a problem worldwide, with economic costs ranging from 1% to 4% of global gross domestic product. During the coronavirus disease 2019 lockdowns, the United Nations coined the term the Shadow Pandemic to describe the increase in global violence against women. Here, using variation in the intensity of government-mandated lockdowns in India, we show that domestic violence complaints increase significantly in districts with the strictest lockdown rules. We find similarly large increases in cybercrime complaints. However, rape and sexual assault complaints decrease in districts with the strictest lockdowns, consistent with decreased female mobility in public spaces, public transport and workplaces where they might be at greater risk for rape and sexual assault. Medium-term analysis shows that increases in domestic violence complaints persist 1 year later, while other complaints related to rape, sexual assault and cybercrimes return to pre-lockdown levels.

Globally, one in three women experience intimate partner violence, and the economic costs of this violence range from 1% to 4% of global gross domestic product (GDP)^{1–3}. Studies have shown that violence against women (VAW) has negative impacts on female labour market participation, earnings, mental health, child health and household consumption^{4–9}. UN Women has referred to the rise in VAW during the coronavirus disease 2019 (COVID-19) pandemic and accompanying lockdowns as the ‘Shadow Pandemic’¹⁰. While concerns of rising VAW have largely been based on media reports or surveys that use a pre-lockdown versus post-lockdown comparison, less is known about the changes in the magnitudes and types of VAW and their persistence during the COVID-19 pandemic and lockdowns.

In this Article, we study this issue in a country that has been ranked the world’s most dangerous country for women: India¹¹. Using a combination of temporal and spatial variation in the government-mandated intensity of lockdowns, we quantify the impacts of lockdown using data from complaints made to the National Commission for Women (NCW) in India. India is a unique setting for this study given the variation in the severity of the measures imposed by the national government in various parts of the country. In addition, the data we use are nationally reported complaints at the district level of various types of VAW: domestic violence, cybercrimes, rape and sexual assault.

Our empirical strategy exploits variation in the Indian government’s classification of districts into red, orange and green zones, where red zone districts had the strictest mobility restrictions and green the most lenient. Using district–month level data on complaints, we estimate the impact of lockdowns on VAW. Using a difference-in-differences empirical strategy, we find evidence of a 0.48 standard deviation (s.d.) ($P < 0.001$, 95% confidence interval (CI) 0.232 to 0.733) or 135% increase in domestic violence complaints in May 2020 in districts that saw the strictest lockdown measures (red zone districts) relative to districts that saw the least strict measures (green zone districts). Red zone districts also experienced a 0.71 s.d. ($P < 0.001$, 95% CI 0.417 to 0.999) or 186% increase in cybercrime complaints relative to green zone districts in May 2020. While there have been media reports that different forms of online violence are on the rise, including stalking, bullying, sexual assault and sex trolling¹⁰, we provide evidence for this through the observed increase in cybercrime complaints. Interestingly, rape and sexual assault complaints fell significantly by 0.39 s.d. ($P = 0.003$, 95% CI -0.642 to -0.137) in red zones in May 2020 relative to green zone districts, probably due to decreased mobility in public spaces, public transport and workplaces. These findings are consistent with research highlighting the magnitude of street harassment women in India face¹².

To understand the medium-term impacts of the lockdown measures, we extend our analysis to study the impacts of the lockdowns

¹Lee Kuan Yew School of Public Policy, National University of Singapore, Singapore, Singapore. ²Luskin School of Public Affairs, University of California Los Angeles and NBER, Los Angeles, CA, USA. ✉ e-mail: saravana@nus.edu.sg; ManishaShah@ucla.edu

one year after they were first introduced. We continue to observe large and statistically significant increases in the number of domestic violence complaints in red zone districts relative to green zone districts from May 2020 to February 2021. In contrast, the number of cybercrime, rape and sexual assault complaints return to levels similar to the pre-lockdown period.

We verify the main, shorter-run findings using two independent sources of data: first, we document that the lockdown zone categories changed individual's mobility using Google Community Mobility Reports and show that mobility was most restricted in red zones. Second, we verify that the increase in domestic violence-related complaints received by the NCW during the lockdown period is consistent with an increase in Google search activity for domestic violence-related terms using Google Trends data during this same period.

We also show that attitudes towards domestic violence play an important role in the incidence and reporting of domestic violence during the COVID-19 pandemic and lockdowns in India. This is an important lesson for policy makers as we might not be able to decrease VAW unless we can shift attitudes and social norms around violence. Using data from the National Family Health Survey 4 (2015–2016), we show that districts in which a greater proportion of husbands report that beating wives is justified see greater increases in domestic violence complaints received by the NCW in May 2020 in red zone districts relative to green zone districts. On the other hand, districts in which a greater proportion of wives report that a husband beating his wife is justified see fewer domestic violence complaints received by the NCW in May 2020 in red zone districts relative to green zone districts. This is consistent with a decrease in reporting when women believe that domestic violence against wives is justified.

We contribute to a growing literature on the impacts of lockdowns and stay-at-home policies on VAW during the COVID-19 pandemic (refs. 13–18 use US data; ref. 19 uses Ugandan data; ref. 20 uses Chinese data; ref. 21 uses Peruvian data; ref. 22 has a comprehensive list of related studies). Our study contributes to this literature in three ways. First, our identification strategy builds on the pre-lockdown versus post-lockdown temporal variation used in these studies, but in addition, we exploit federal government-mandated spatial variation in the intensity of lockdowns, as districts were classified into red, orange and green zones the first few months of lockdown. This provides quasi-random variation in the lockdown intensity across 586 Indian districts. Second, we consider a broader set of violence and crimes against women, including cybercrime, rape and sexual assault. Though domestic violence and cybercrime complaints increase quite a bit, we also find that lockdowns decrease complaints related to sexual assault and rape, adding to the nascent literature on female mobility and safety in low-income countries (see, for example, ref. 12; Cheema, A., Khwaja, A. I., Naseer, F. & Shapiro, J. N. (unpublished manuscript); Field, E. & Vyborny, K. (unpublished manuscript)). This is an important finding because, if we were to simply estimate the impact of lockdowns on VAW, we might find null results due to the increase in domestic violence and cybercrimes and the decrease in rape and sexual assault, masking important heterogeneities. Our results suggest that women face a portfolio of danger, and some policies can improve certain types of violence outcomes while exacerbating others. Third, we present a descriptive medium-term analysis 1 year after the start of the lockdown measures. We highlight that, while the increase in cybercrime complaints and decrease in rape and sexual assault complaints fade out 6 months after the end of the lockdown measures, the increase in domestic violence complaints persist 1 year after the start of the lockdowns in India.

Results

Lockdowns: red, orange and green zone classifications

India imposed a nationwide lockdown to contain the spread of COVID-19 in the country on 25 March 2020. While the initial lockdown was

announced for a 21 day period, on 14 April, Indian Prime Minister Modi announced that the nationwide lockdown would be extended owing to the rising number of cases in the country. When announcing the extension of the lockdown, Indian media reported that 'the Union ministry of health and family welfare has classified [the] country's districts in three zones—Red, Orange and Green—based on the severity of [the COVID-19] outbreak in those areas'²³. Districts in the red zone saw the strictest lockdown measures, while orange and green zones saw measures that were less strict. Supplementary Information B details the restrictions in each zone colour category. The red, orange and green zone classifications were widely reported in the Indian media (see, for example, refs. 24 and 25). On 1 May 2020, India's Ministry of Home Affairs officially issued an order that divided all districts into red, orange and green zones under 'Lockdown 3.0', a further 2 week extension of the nationwide lockdown. As the zonal announcements were made in April, we consider April and May as the official 'treatment' months. Beginning in June 2020, lockdown rules became the jurisdiction of state governments and states were allowed to create their own lockdown rules.

The red, orange and green zone classification was based on factors such as the number of COVID-19 cases and the doubling rate of COVID-19 cases²⁶. Supplementary Table 1 presents summary statistics of various district characteristics by zone colour categories. Red zone districts have a larger population and had the fastest doubling rate of COVID-19 cases, with cases doubling every 12 days as of 30 April. In contrast, orange and green zone districts were less populous with longer doubling times. Out of 639 districts, 120 districts were classified into the red zone, 257 into the orange zone, and 262 into the green zone. Extended Data Figure 1 shows a heat map of the spatial variation of the red, orange and green districts.

What do the lockdown zone colour categories identify? As we highlight in the section on descriptive results, the lockdown categories directly affected the mobility of individuals, as verified by Google Community Mobility Reports. While the reductions in mobility led to a decrease in commuting via public transit and overall reduced mobility outside the home, they also increased women's day-to-day exposure to potential perpetrators of violence. These are important channels that drive our differential impacts on rape and sexual assault versus domestic violence, respectively. While the lockdown categories were based on the number of COVID-19 cases, we show in the section on main results that our results are robust to controlling for the districtwise monthly mean number of COVID-19 cases, addressing potential concerns that our identification rests on differential COVID-19 caseloads. The lockdowns also led to a loss of economic activity, employment and income (Beyer, R. C., Jain, T. & Sinha, S, unpublished manuscript), and we view these as mechanisms underlying the impacts of the lockdowns on VAW. We return to a discussion of mechanisms in the discussion section.

Descriptive results

Lockdown. The severity of lockdown measures by zone colour categories affects mobility mostly strictly in April and May 2020 in red zone districts, as expected by the policy. Using data from the Google Community Mobility Reports, Extended Data Fig. 2 shows the relationship between mobility and the fraction of a given state's population in March, April and May 2020 in red, orange and green zone districts, respectively. Mobility is defined at the state level in the Google Community Mobility Reports as the percentage change in the number of visitors to places of interest relative to the baseline 5 week period from 3 January to 6 February 2020. The state mean is taken over the percentage change in the number of visitors (who have opted-in to share their Location History for their Google Account) to places of interest broadly categorized under 'grocery and pharmacy', 'parks', 'transit stations', 'retail and recreation' and 'workplaces' for each month to create the Google Mobility Index.

Several findings in this figure are noteworthy. First, although India officially goes into national lockdown in late March 2020, mobility

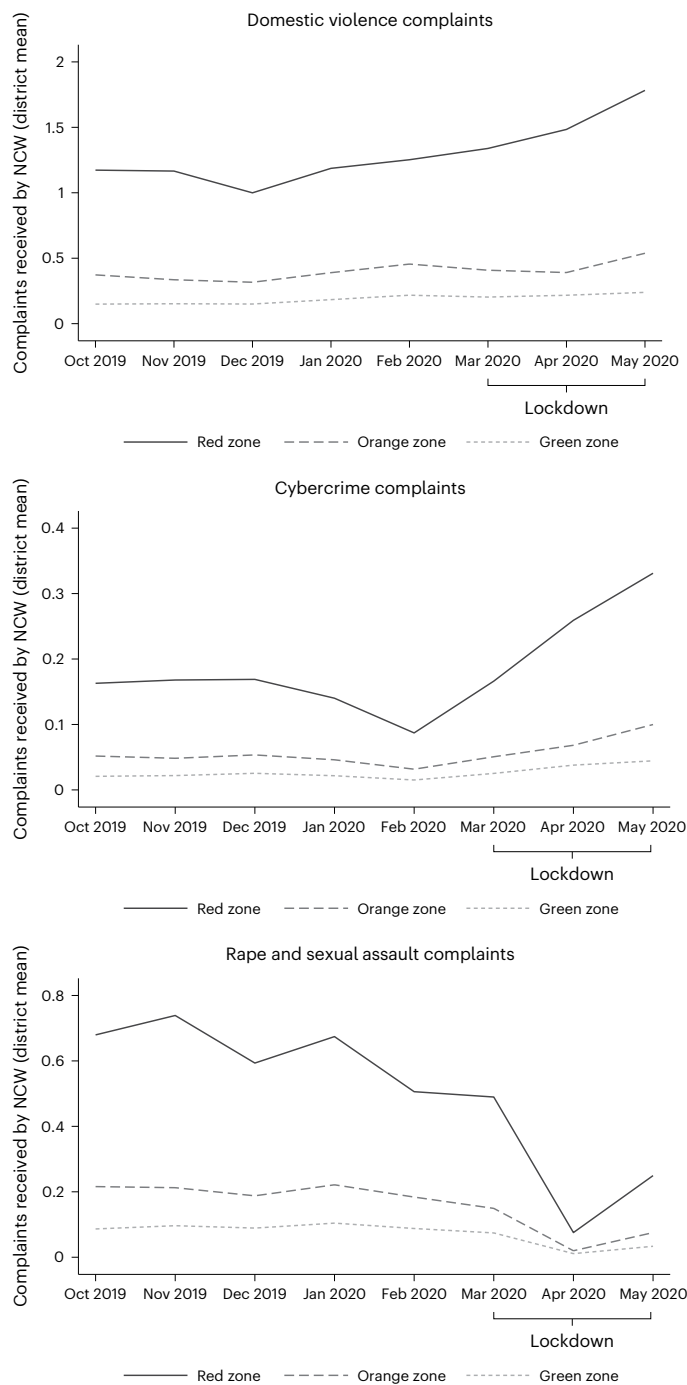


Fig. 1 | Complaints received by the NCW. Source: Complaint & Investigation Cell, NCW, India (accessed 16 March 2021). Notes: The figure plots the district mean number of complaints received by the NCW from October 2019 to May 2020 by lockdown zone colour category (red, orange and green). India imposed a nationwide lockdown on 25 March 2020.

decreases only around 20% during this month, and the decrease is consistent across red, orange and green zones (as expected since no zone announcements have been made yet).

Second, we observe the strongest impacts of the lockdown policy in April and May 2020, the height of the federally mandated lockdown. The middle and bottom panels of Extended Data Fig. 2 show that there is a clear decline in mobility with an increase in the fraction of the state’s population in red zone districts (and corresponding decrease in the fraction of orange or green zone districts) in April and May 2020. In May 2020,

states with a small fraction of districts in red zones saw mobility declines of 30% relative to the baseline period, while states for which all districts were classified as red zone districts in a state saw mobility declines in excess of 70% relative to the baseline period from 3 January to 6 February 2020. The negative correlation between mobility and the fraction of state population in red zone districts is largest in May 2020 (−0.70), followed by April 2020 (−0.65) and March 2020 (−0.61).

Third, Extended Data Fig. 2 shows that states with a larger fraction of population in green zone districts (and hence smaller fraction of orange or red zone districts) saw smaller declines in mobility relative to the baseline period, consistent with the monotonic decline in the severity of mobility restrictions. In May 2020, states with no districts in green zones saw average mobility declines in excess of 70%, while states where all districts were in green zones saw average mobility declines by only 35% (which is similar to the March levels of mobility).

Overall, Extended Data Fig. 2 shows that India went into three distinct levels of lockdown measures following the imposition of lockdowns in the country, with the strictest measures in April and May 2020 in red zone districts, consistent with the policy. We exploit the classification of districts and measures by red, orange and green zones in our empirical strategy, and show the results by month.

VAW. Figure 1 shows the mean monthly number of complaints received by the NCW from October 2019 to May 2020 by district lockdown zone colour categories. We observe a large increase in the number of domestic violence complaints received by the NCW from red zone districts from April to May 2020. In comparison, orange and green zone districts show smaller increases in the number of domestic violence complaints. A similar pattern is observed for cybercrime complaints across red, orange and green zones.

Figure 1 shows the number of rape and sexual assault complaints also falls substantially in red zone districts in both April and May 2020, while orange and green zone districts see much smaller declines. The level of rape and sexual assault complaints remains low in May 2020 across all zone colour categories. These declines are consistent with the decrease in commuting via public transit and overall reduced mobility outside the home.

The large positive deviations in the mean number of domestic violence complaints in April and May 2020 in Fig. 1 align with Google searches for domestic violence-related terms in these months. Figure 2 shows the relative search interest for the terms ‘domestic abuse’ and ‘domestic violence helpline’ in India from 1 January 2019 to 31 May 2020. We note a considerable increase in search activity for domestic violence-related terms in the weeks after India imposed the nationwide lockdown on 25 March. While domestic violence-related searches may not reflect exact complaints made to the NCW, both the NCW and Google Trends datasets highlight an increase in domestic violence-related searches and complaints made in the months after the lockdowns in India.

Notably, some of these patterns are in contrast with official crime statistics for India, which show that the number of violent and serious crimes decreased in 2020 compared to 2019. While recorded incidents of rape decreased by 12.4%, crimes against children also declined by 19.3%, and robberies by 22.4%. Interestingly, crimes related to disobeying orders given by public servants increased 21 times between 2019 and 2020; these were mostly violations of stay-at-home orders due to COVID restrictions²⁷. In addition, there was an increase in cybercrimes by 11.8% in 2020. The National Crime Records Bureau data reveal that the majority of cybercrimes were done for fraud, followed by sexual exploitation, and lastly extortion²⁸. Studies have shown that police resources in 2020 were diverted from crime prevention towards enforcing lockdowns India²⁹. Furthermore, it may be difficult for victims of VAW to visit a police station to file a complaint given the lockdowns. For these reasons, we think the NCW data highlight an important source of data on VAW during this period.

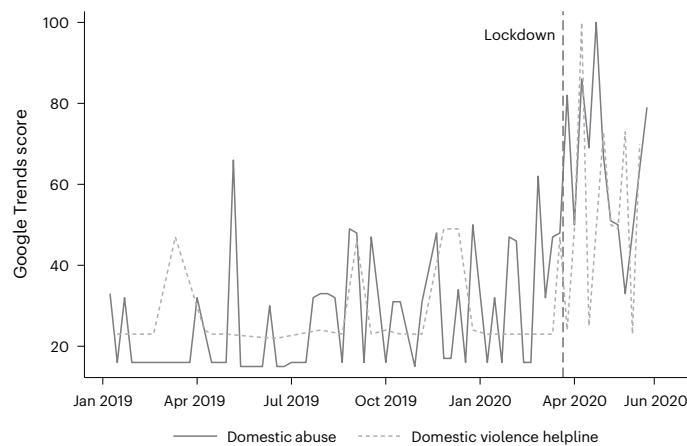


Fig. 2 | Google searches in India for domestic violence-related terms.

Source: Google Trends (accessed 25 October 2021). Notes: The scores represent search interest relative to the highest point on the chart for India on the given date for each search term. A value of 100 is the peak popularity for the search term. A value of 50 means that the search term is half as popular. Scores are plotted from 1 January 2019 to 31 May 2020. India imposed a nationwide lockdown on 25 March 2020.

Main results

Panel A of Table 1 reports the results from estimating equation (1) which combines temporal variation in the lockdowns (across pre- and post-lockdown announcement months) with spatial variation in the intensity of lockdowns across India (across red, orange and green zone districts). Columns 1–3 present the coefficient point estimates for the differential impact of zone categories on the number of complaints received by the NCW for domestic violence, cybercrime, and rape and sexual assault complaints, respectively. Supplementary Table 3 presents the estimates in s.d. units, with the dependent variables transformed to z-scores. We standardize the number of complaints by subtracting the mean number of complaints (across all districts and months) and dividing by the s.d. of the number of complaints so as to create a z-score. The combination of interaction terms, fixed effects and district–year level population controls explain 74–80% of variation in the number of complaints received by the NCW (the adjusted R^2 ranges from 0.738 to 0.797). We also report P values testing whether the difference between the red and orange zone effects is significantly different from zero in April and May 2020.

Consistent with the descriptive evidence in Fig. 1, we observe large and statistically significant increases in the number of domestic violence and cybercrime complaints in red zone districts relative to green zone districts in May 2020. The increase in the number of domestic violence complaints by 0.566 ($P < 0.001$, 95% CI 0.272 to 0.860) on a base of 0.42 complaints across India represents a 135% (0.48 s.d.) increase. Red zone districts had a 0.13 ($P < 0.001$, 95% CI 0.077 to 0.184), or 186% (0.71 s.d.) increase in cybercrime complaints relative to green zone districts in May 2020. Orange zone districts saw a smaller 0.023 ($P = 0.011$, 95% CI 0.005 to 0.041), or 33% (0.13 s.d.) increase in cybercrime complaints relative to green zone districts.

Table 1 also displays statistically significant decreases in rape and sexual assault complaints in red and orange zone districts relative to green zone districts in the months during and after the lockdowns. Column 3 shows significant decreases in the number of rape and sexual assault complaints in these districts in April by 0.455 ($P < 0.001$, 95% CI –0.680 to –0.231), or 0.58 s.d., and by 0.304 ($P = 0.003$, 95% CI –0.501 to –0.107), or 0.39 s.d. in May 2020.

In panel B of Table 1, we re-estimate equation (1) more flexibly, omitting only May 2018 instead of the period January 2018 to September 2019. These results are similar in magnitude and statistical significance to the results presented in panel A of Table 1.

Figure 3 shows event study plots of the differential impact of red versus green zone districts in a given month relative to the monthly mean from January 2018 to September 2019, as well as analogous plots for orange versus green zone districts. All standard errors are clustered by district and 95% CIs are shown. With a few exceptions (cybercrime complaints in red zone districts are lower than green zone districts in January and February 2020), we see overall that the coefficient point estimates for the months before the lockdown was imposed are close to zero, suggesting that the parallel trends identification assumption is likely to hold in this setting.

We re-estimate Table 1 a few additional ways to test the robustness of the main results. We re-estimate equation (1) using per capita measures of the dependent variables. Despite some dilution of the signal and increase in standard errors, we find qualitatively similar results in Supplementary Table 4. Second, we re-estimate the regressions in Table 1 and include state \times month fixed effects so as to compare impacts across districts within the same state in the same month. The results in Supplementary Table 5 show that our results are robust to the inclusion of these fixed effects. Third, we assess the role of COVID-19 prevalence in our estimated effects of the various lockdown levels on VAW in Supplementary Information C.1, and show that our results are robust to adding additional controls. Supplementary Information C provides more detail on additional robustness checks.

The role of attitudes towards VAW

We now explore the role of attitudes towards domestic violence by husbands and wives in the increase in domestic violence complaints received by the NCW during lockdown in India. These attitudes are measured using National Family Health Survey (NFHS) data from 2015 to 2016, several years before the COVID-19 pandemic. Forty-nine per cent of women believe that a husband is justified in beating his wife, while 42% of men report that they are justified in beating their wife.

We re-estimate equation (1) and include an additional interaction term with ‘husband believes it is justified to beat wife’ and ‘wife believes it is justified for husband to beat her.’ This is basically a triple-difference empirical strategy that interacts the month and zone dummies with the district mean of the proportion of husbands and wives who reported in the NFHS-4 survey that a husband is justified in hitting or beating his wife. The estimating equation and results from this regression are presented in Supplementary Table 11. The coefficients from this regression capture the differential impact of districts classified into the red zone relative to the impact of districts classified into the green zone (or the orange zone relative to the green zone), in month i relative to the monthly average from January 2018 to September 2019, for districts where a greater proportion of husbands report that hitting or beating his wife is justified (or where a greater proportion of wives report that hitting or beating by the husband is justified).

Figure 4 shows the coefficients from this regression where the top panel of Fig. 4 plots the triple-interaction sets of coefficients for husbands and the bottom panel for wives. Districts in which a greater proportion of husbands report that hitting or beating his wife is justified experience greater increases in domestic violence complaints received by the NCW in April 2020 in orange zone districts relative to green zone districts (effect size 0.728, $P = 0.025$, 95% CI 0.092 to 1.363). The regression controls for the role of domestic violence attitudes by wives. In the bottom panel of Fig. 4 we observe that districts in which a greater proportion of wives report that a husband hitting or beating his wife is justified see fewer domestic violence complaints received by the NCW in May 2020 in red zone districts relative to green zone districts (effect size –2.151, $P = 0.031$, 95% CI –4.101 to –0.201). This result controls for the attitudes of husbands towards domestic violence.

Overall, these results highlight the role of attitudes towards domestic violence in the incidence and reporting of domestic violence complaints to the NCW. Districts in which a greater proportion of husbands view domestic violence as justified experience increases in complaints

Table 1 | Impact of zonal classification on number of complaints

| | (1) | (2) | (3) |
|--|-------------------|-----------------|-------------------------|
| | Domestic violence | Cybercrime | Rape and sexual assault |
| Panel A: main specification | | | |
| Red zone × May 2020 | 0.566 | 0.130 | -0.304 |
| | 0.272 to 0.860 | 0.077 to 0.184 | -0.501 to -0.107 |
| | [<0.001] | [<0.001] | [0.003] |
| Red zone × April 2020 | 0.290 | 0.065 | -0.455 |
| | -0.109 to 0.690 | -0.003 to 0.133 | -0.680 to -0.231 |
| | [0.154] | [0.062] | [<0.001] |
| Orange zone × May 2020 | 0.094 | 0.023 | -0.065 |
| | -0.006 to 0.194 | 0.005 to 0.041 | -0.121 to -0.008 |
| | [0.064] | [0.011] | [0.025] |
| Orange zone × April 2020 | -0.031 | -0.002 | -0.098 |
| | -0.118 to 0.057 | -0.016 to 0.012 | -0.164 to -0.032 |
| | [0.488] | [0.783] | [0.004] |
| Red zone - orange zone (May 2020) | 0.472 | 0.107 | -0.239 |
| P value | [0.001] | [<0.001] | [0.025] |
| Red zone - orange zone (April 2020) | 0.321 | 0.067 | -0.358 |
| P value | [0.114] | [0.058] | [0.003] |
| Adjusted R ² | 0.769 | 0.793 | 0.728 |
| District FEs | ✓ | ✓ | ✓ |
| Month-year FEs | ✓ | ✓ | ✓ |
| Dependent variable mean | 0.42 | 0.07 | 0.26 |
| Observations | 15,563 | 15,563 | 15,563 |
| Panel B: flexible form | | | |
| Red zone × May 2020 | 0.615 | 0.130 | -0.460 |
| | 0.289 to 0.942 | 0.070 to 0.190 | -0.777 to -0.143 |
| | [<0.001] | [<0.001] | [0.005] |
| Red zone × April 2020 | 0.339 | 0.065 | -0.611 |
| | -0.078 to 0.757 | -0.009 to 0.139 | -0.954 to -0.269 |
| | [0.111] | [0.085] | [<0.001] |
| Orange zone × May 2020 | 0.108 | 0.023 | -0.093 |
| | -0.005 to 0.221 | 0.003 to 0.044 | -0.186 to 0.000 |
| | [0.062] | [0.023] | [0.049] |
| Orange zone × April 2020 | -0.017 | -0.002 | -0.126 |
| | -0.110 to 0.076 | -0.018 to 0.014 | -0.227 to -0.025 |
| | [0.713] | [0.838] | [0.015] |
| Red zone - orange zone (May 2020) | 0.508 | 0.107 | -0.367 |
| P value | [0.002] | [<0.001] | [0.030] |
| Red zone - orange zone (April 2020) | 0.357 | 0.0666 | -0.485 |
| P value | [0.094] | [0.081] | [0.008] |
| Adjusted R ² | 0.774 | 0.797 | 0.738 |
| District FEs | ✓ | ✓ | ✓ |
| Month-year FEs | ✓ | ✓ | ✓ |
| Dependent variable mean | 0.42 | 0.07 | 0.26 |
| Observations | 15,563 | 15,563 | 15,563 |

Source: Complaint & Investigation Cell, NCW, India (accessed 16 March 2021). Notes: The sample consists of district-month level number of complaints from January 2018 to May 2020. Panel A presents coefficients $\{\beta_{i,t}\}$ and $\{\beta_{i,o}\}$ from ordinary least squares (OLS) estimation of equation (1) for April and May 2020. Panel B reports coefficients $\{\beta_{i,t}\}$ and $\{\beta_{i,o}\}$ from OLS estimation of equation (1) for April and May 2020, but omitting May 2018, instead of January 2018 to September 2019. All regressions include district fixed effects and month-year fixed effects, as well as district-year level population controls. Standard errors are clustered by district. For each estimate we present, we provide the coefficient estimate first, with the 95% CI underneath it in parentheses and the relevant P value underneath the CI in square brackets. All statistical tests are t-tests and two-tailed, without adjustment for multiple comparisons.

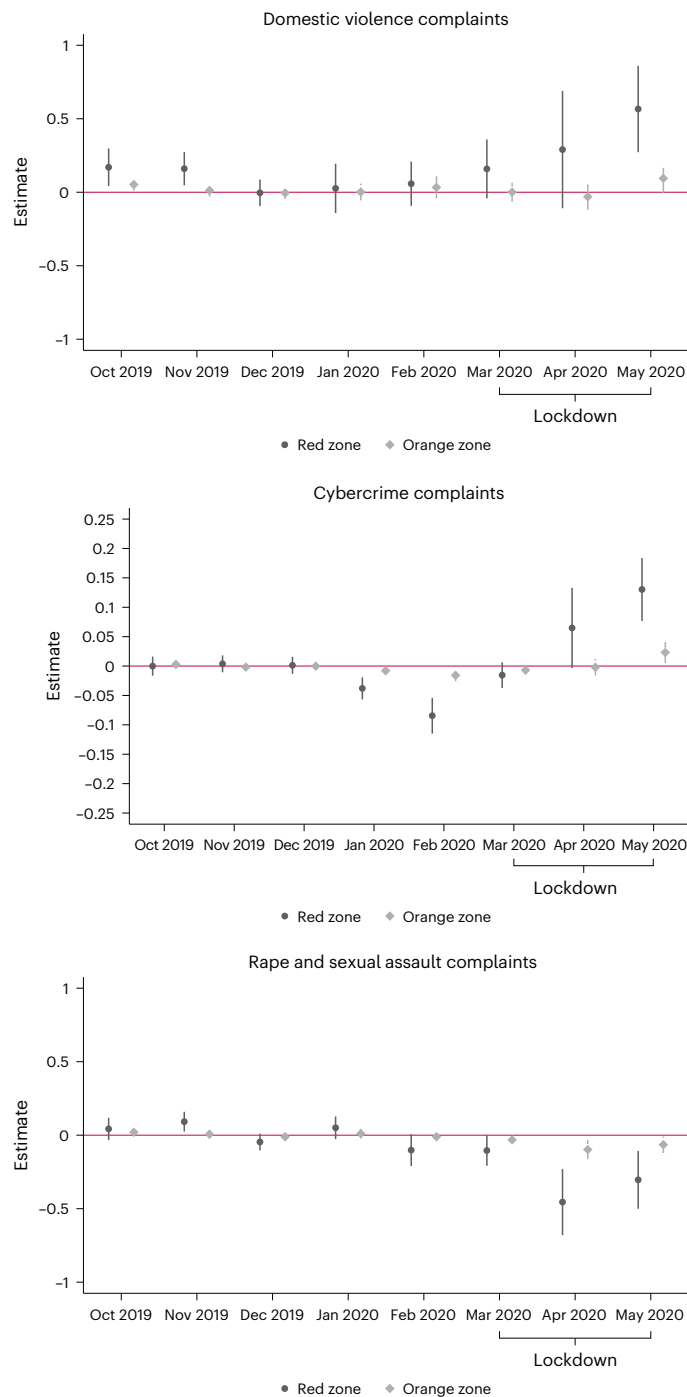


Fig. 3 | Event study plots of differential number of complaints received by zone. Source: Complaint & Investigation Cell, NCW, India (accessed 16 March 2021). Notes: $n = 15,563$ district-month level observations for each of the three subplots (domestic violence, cybercrime, and rape and sexual assault). The figure plots coefficients $\{\beta_{i,r}\}$ and $\{\beta_{i,o}\}$ from OLS estimation of equation (1). The black circles depict $\{\beta_{i,r}\}$, the differential impact of red versus green zone districts in month i relative to the monthly mean from January 2018 to September 2019 (the omitted months). The grey diamonds depict $\{\beta_{i,o}\}$, the differential impact of orange versus green zone districts in month i relative to the monthly mean from January 2018 to September 2019. The 95% CI bars are shown, and the centre of each interval (black circle or grey diamond) is the corresponding point estimate from OLS estimation of equation (1). All statistical tests are two-tailed.

during the lockdown, while districts in which a greater proportion of wives view domestic violence as justified experience decreases in complaints during the lockdown relative to their comparison groups.

Medium-term impacts

We extend our analysis to study the impacts of the lockdowns in India up to a year after they were first introduced. India relaxed its lockdown measures in phases, and Supplementary Information B provides more detail on the phased relaxation.

Extended Data Fig. 3 shows the relationship between mobility and the fraction of a given state's population in red zone districts from June 2020 to February 2021. Mobility increases over time, and by February 2021, mobility in red zone districts is similar to the baseline reference period from 3 January to 6 February 2020.

The analysis presented in this section should be interpreted with caution, as state governments and local bodies were given autonomy for the demarcation of zone colour categories under the phased relaxation of lockdown measures. Furthermore, lockdown measures were implemented below the district level, such as in containment areas and buffer zones. As we use the central government's zone classification for districts announced in April 2020, we interpret our results as reflecting the medium-term impacts of the central government's lockdown measures from April to May 2020.

Extended Data Fig. 4 shows the mean monthly number of complaints received by the NCW from October 2019 to February 2021 by district lockdown zone colour categories. Domestic violence complaints continue to increase in red zone districts to July 2020 beyond the initial increase seen during the lockdown months of April to May 2020. While the number of domestic violence complaints subsequently decreases slightly, it remains at a higher level from August 2020 to February 2021 in comparison with the pre-lockdown months.

The number of cybercrime complaints also continues to increase in red zone districts to July 2020. By November 2020, the number of complaints decreases to pre-lockdown levels (with the exception of an increase in January 2021). Similarly, the number of rape and sexual assault complaints increase after the decrease in April to May 2020 during the lockdowns and reach pre-lockdown levels by November 2020 (with the exception of an increase in July 2020).

Extended Data Fig. 5 shows event study plots of the differential impact of red versus green zone districts in a given month relative to the monthly mean from January 2018 to February 2021 as well as analogous plots for orange versus green zone districts. We observe large and statistically significant increases in the number of domestic violence complaints in red zone districts relative to green zone districts from May 2020 to February 2021 (effect size range 0.517 to 1.399, P range <0.001 to 0.005).

The event study plots for cybercrime complaints also highlight large and statistically significant increases in the number of complaints in red zone districts relative to green zone districts from May to October 2020 and December 2020 to January 2021 (effect size range 0.022 to 0.246, P range <0.001 to 0.044). The number of rape and sexual assault complaints show large and statistically significant decreases from April to October 2020, with the exception of the month of July 2020, where the point estimate is statistically indistinguishable from zero (effect size range -0.480 to -0.114 , P range <0.001 to 0.021). By November 2020, red zone districts do not exhibit statistically different numbers of rape and sexual assault complaints relative to green zone districts.

Overall, the impacts of the lockdowns on cybercrime, rape and sexual assault complaints fade out approximately 6 months after the end of the central government-mandated lockdowns in May 2020. However, domestic violence complaints continue to increase after the introduction of lockdown measures and remain significantly different from the pre-lockdown period up to 1 year after the lockdowns were first imposed.

Discussion

We establish an increase in domestic violence and cybercrime during the COVID-19 lockdowns in India, with increases most concentrated in districts that saw the strictest lockdown measures. In addition, we show

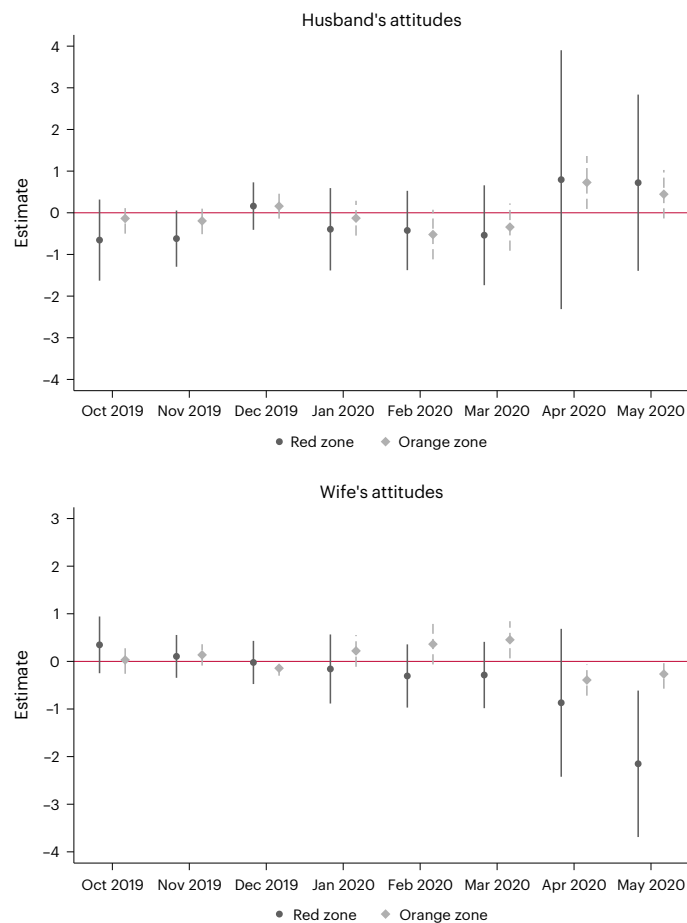


Fig. 4 | The role of attitudes towards domestic violence. Sources: NFHS-4 (2015–2016) and Complaint & Investigation Cell, NCW, India (accessed 16 March 2021). Notes: $n = 15,563$ district–month level observations for each of the two subplots (husband's attitudes and wife's attitudes). The figure in the top panel plots coefficients $\{\beta_{i,rb}\}$ and $\{\beta_{i,ob}\}$ from the OLS-estimated equation in Supplementary Table 11. The black circles depict $\{\beta_{i,rb}\}$, while the grey diamonds depict $\{\beta_{i,ob}\}$. The figure in the bottom panel plots coefficients $\{\beta_{i,rw}\}$ and $\{\beta_{i,ow}\}$ of the OLS-estimated equation in Supplementary Table 11. The black circles depict $\{\beta_{i,rw}\}$ and the grey diamonds depict $\{\beta_{i,ow}\}$. The 95% CI bars are shown, and the centre of each interval (black circle or grey diamond) is the corresponding point estimate from the OLS-estimated equation in Supplementary Table 11. All statistical tests are two-tailed.

that rape and sexual assault complaints fell, consistent with decreased mobility in public spaces, public transport and workplaces. Districts in which a greater proportion of husbands viewed domestic violence as justified saw larger increases in domestic violence complaints during the lockdown. The increase in domestic violence persisted for at least 1 year after the start of the lockdowns in India.

There are a number of limitations to our study. First, the NCW and NFHS datasets are not always consistent in collecting credible data from several states in India. These include mismatches between data on domestic violence on women from states such as Bihar, Uttar Pradesh and Madhya Pradesh with other indicators of women empowerment in those states. Underreporting of VAW is almost always a potential concern (see, for example, ref. 30). We acknowledge that there may have been potential changes in reporting during the lockdowns. In fact, Poblete-Cazenave, R. (unpublished manuscript) finds evidence of a 60% reduction in reported crimes to the police as a result of the lockdowns in Bihar, India. Lastly, we cannot rule out the possibility of some displacement of rape and sexual assault from public spaces outside homes to rape by family members inside homes. While marital

rape is vastly underreported in India since it is not considered a crime, it could be increasing during the lockdown period.

Second, while these lockdowns were occurring there were also increased COVID cases, income and consumption loss due to job insecurity, and overall increased economic insecurity and poverty-related stress, as well as increases in food insecurity and declines in female mental health as a result of COVID-19 containment policies³¹. While an analysis of the relative importance of possible channels is beyond the scope of the paper, such channels are likely to play an important role in our setting.

Our findings that attitudes towards domestic violence play an important role in the incidence and reporting of domestic violence during the lockdowns highlight that additional policy interventions are needed to reverse the trends in VAW³². Behaviour change communication interventions have been shown to be effective in reducing physical violence in Bangladesh³³. Similarly, Shah, Seager, Montalvo and Goldstein (unpublished manuscript) find that a soccer intervention to empower and change social norms targeting boys and young men decreases adolescent female reports of intimate partner violence. A school-based intervention in India that engaged adolescents in classroom discussions about gender equality saw programme participants reporting more gender-equitable behaviour. Social norms and attitudes around violence are important drivers of both violent behaviour and reporting³⁴.

While lockdowns may be an effective way of controlling disease spread, they also come with costs. Our study highlights that the lockdowns also caused a 'Shadow Pandemic' in which VAW increased at home and on online platforms. The large and persistent increase in domestic violence has important economic costs that could exacerbate the negative impacts of the lockdowns on female labour market participation, income and household consumption.

Methods

We used a two-tailed α of 0.05 for all statistical tests and, when estimating our models, assume normally distributed errors; we do not formally test this because we are unable to directly observe properties of the error term. As we use observational data, where data collection and aggregation were conducted by (separate) third parties, our analysis did not require any additional human subjects ethical review. For the same reason, our sample sizes were determined by data availability rather than prospective sample size or power calculations. We also note that the statistical inferences presented in Supplementary Tables 3–7 represent alternative presentation and robustness checks, rather than statistical inferences that could in themselves provide a test of our hypotheses, and therefore a correction for multiple hypothesis testing is not warranted.

We combine a number of administrative and survey datasets for this study. The primary dataset we employ in this paper is public-access administrative records on district–month level complaints received by the NCW across India over the period January 2018 to May 2020. NCW data are disaggregated by categories of complaints, which we broadly group into (1) domestic violence, (2) cybercrime and (3) rape and sexual assault complaints.

NCW public-access administrative records are seen as a reliable source of data on VAW in the country and have been used by academics and media outlets to understand trends in VAW during the COVID-19 pandemic (see, for example, refs. 35 and 36). We also use Google data and NFHS data from 2015 to 2016. Supplementary Information A provides more details on the datasets used. The data distribution was assumed to be normal, but this was not formally tested.

We stress that the NCW and NFHS datasets are not always consistent in collecting credible data from several states in India. These include mismatches between data on domestic violence on women from states such as Bihar, Uttar Pradesh and Madhya Pradesh with other indicators of women empowerment in those states. Furthermore, underreporting of VAW is almost always a potential concern (see, for example, ref. 30).

We employ a difference-in-differences empirical strategy to study the differential impact of complaints in districts most affected by the lockdown measures relative to districts least affected by the measures. Using the quasi-random government classification of districts into red, orange and green zones, we exploit the panel structure of the district–month–year level data and run the following specification for district d in month m of year y :

$$Y_{dmy} = \alpha + \gamma_d + \lambda_{my} + \sum_{i=1}^8 \beta_{i,r} \theta_i \times \text{RedZone}_{d,i} + \sum_{i=1}^8 \beta_{i,o} \theta_i \times \text{OrangeZone}_{d,i} + \mathbf{X}_{dy} \delta + \varepsilon_{dmy} \quad (1)$$

where Y_{dmy} refers to the number of complaints received by the NCW in district d in month m of year y , γ_d are district fixed effects, and λ_{my} are month–year fixed effects. The district fixed effects capture time-invariant characteristics of districts including level differences across districts in attitudes towards domestic violence and reporting of VAW. Month–year fixed effects flexibly control for country-wide trends in complaints made to the NCW over time. The combination of fixed effects used allows us to use variation within a given month and year across districts, in addition to variation within a given district over time. \mathbf{X}_{dy} is district–year level population.

$\text{RedZone}_{d,i}$ and $\text{OrangeZone}_{d,i}$ are dummy variables equal to 1 for districts in red and orange zones, respectively, and 0 otherwise. θ_i refers to month dummies corresponding to the months October 2019 ($i = 1$) to May 2020 ($i = 8$). $\{\beta_{i,r}\}$ and $\{\beta_{i,o}\}$ are the coefficients of interest. The coefficients $\{\beta_{i,r}\}$ capture the impact of districts classified into the red zone relative to the impact of districts classified into the green zone, in month i relative to the monthly average from January 2018 to September 2019 (the omitted months). Similarly, the set of coefficients $\{\beta_{i,o}\}$ capture the impact of districts classified into the orange zone relative to the impact of districts classified into the green zone, in month i relative to the monthly average from January 2018 to September 2019. The district fixed effects absorb the time-invariant differences between red (orange) and green zone districts, and the estimated coefficients are relative to the average difference between red (orange) and green zone districts over the months January 2018 to September 2019 (the omitted months). We also present results from a fully flexible specification that omits only May 2018 instead of the period January 2018 to September 2019. All standard errors are clustered by district. All tests used are two-tailed.

A key identification assumption for the difference-in-differences strategy is that, absent the lockdowns, complaints in red, orange and green zone districts should have evolved similarly over time. Our empirical strategy allows us to assess the validity of this assumption by studying the differential red-versus-green and orange-versus-green zone impacts on complaints before the start of the lockdowns from October 2019 to February 2020. The differential impacts in these pre-lockdown months should be close to zero if the parallel trends assumption holds in this setting.

The final replication code and datasets are available in the OpenICPSR COVID-19 Data Repository under the following project citation: Ravindran, Saravana, and Shah, Manisha. Data and Code for: Unintended Consequences of Lockdowns: COVID-19 and the Shadow Pandemic. Ann Arbor, MI: Inter-university Consortium for Political and Social Research [distributor], 2022-03-20. <https://doi.org/10.3886/E165302V1>.

Reporting summary

Further information on research design is available in the Nature Portfolio Reporting Summary linked to this article.

Data availability

All data underlying the study are publicly available without restrictions. NCW data: http://ncwapps.nic.in/frmComp_Stat_Overview.aspx. NFHS

data: https://dhsprogram.com/data/dataset/India_Standard-DHS_2015.cfm?flag=0. Google COVID-19 Community Mobility Reports data: <https://www.google.com/covid19/mobility/>. Google Trends data: <https://trends.google.com/>. The final replication datasets are available in the OpenICPSR COVID-19 Data Repository under the following project citation³⁷: Ravindran, Saravana, and Shah, Manisha. Data and Code for: Unintended Consequences of Lockdowns: COVID-19 and the Shadow Pandemic. Ann Arbor, MI: Inter-university Consortium for Political and Social Research [distributor], 2022-03-20. <https://doi.org/10.3886/E165302V1>.

Code availability

Stata/MP was used for data analysis. The final replication code and datasets are available in the OpenICPSR COVID-19 Data Repository under the following project citation^{37–47}: Ravindran, Saravana, and Shah, Manisha. Data and Code for: Unintended Consequences of Lockdowns: COVID-19 and the Shadow Pandemic. Ann Arbor, MI: Inter-university Consortium for Political and Social Research [distributor], 2022-03-20. <https://doi.org/10.3886/E165302V1>.

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Author contributions

S.R. and M.S. jointly conceived the research, put together the data, conducted the analyses and wrote the manuscript.

Competing interests

The authors declare no competing interests.

Additional information

Extended data is available for this paper at <https://doi.org/10.1038/s41562-022-01513-5>.

Supplementary information The online version contains supplementary material available at <https://doi.org/10.1038/s41562-022-01513-5>.

Correspondence and requests for materials should be addressed to Saravana Ravindran or Manisha Shah.

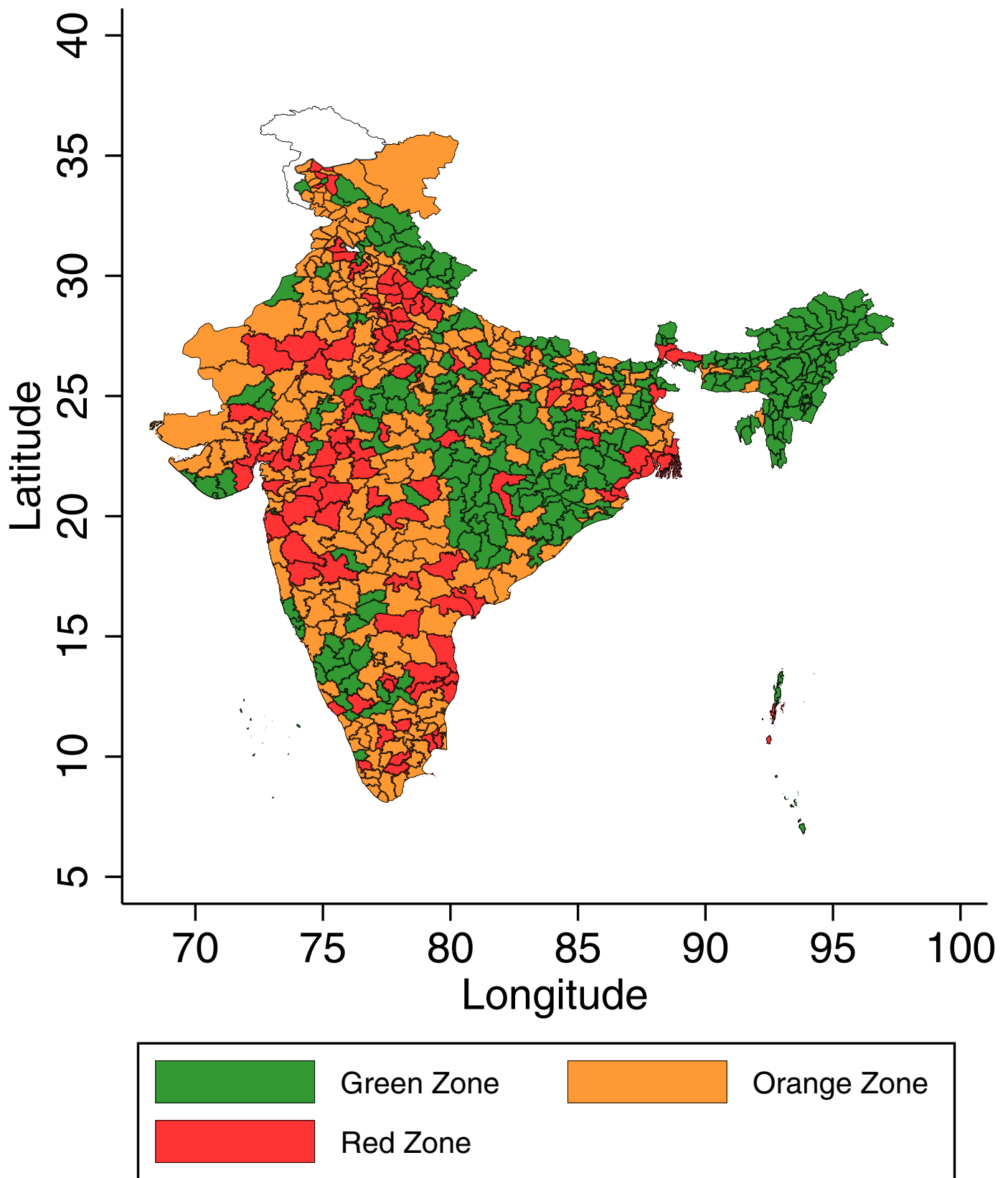
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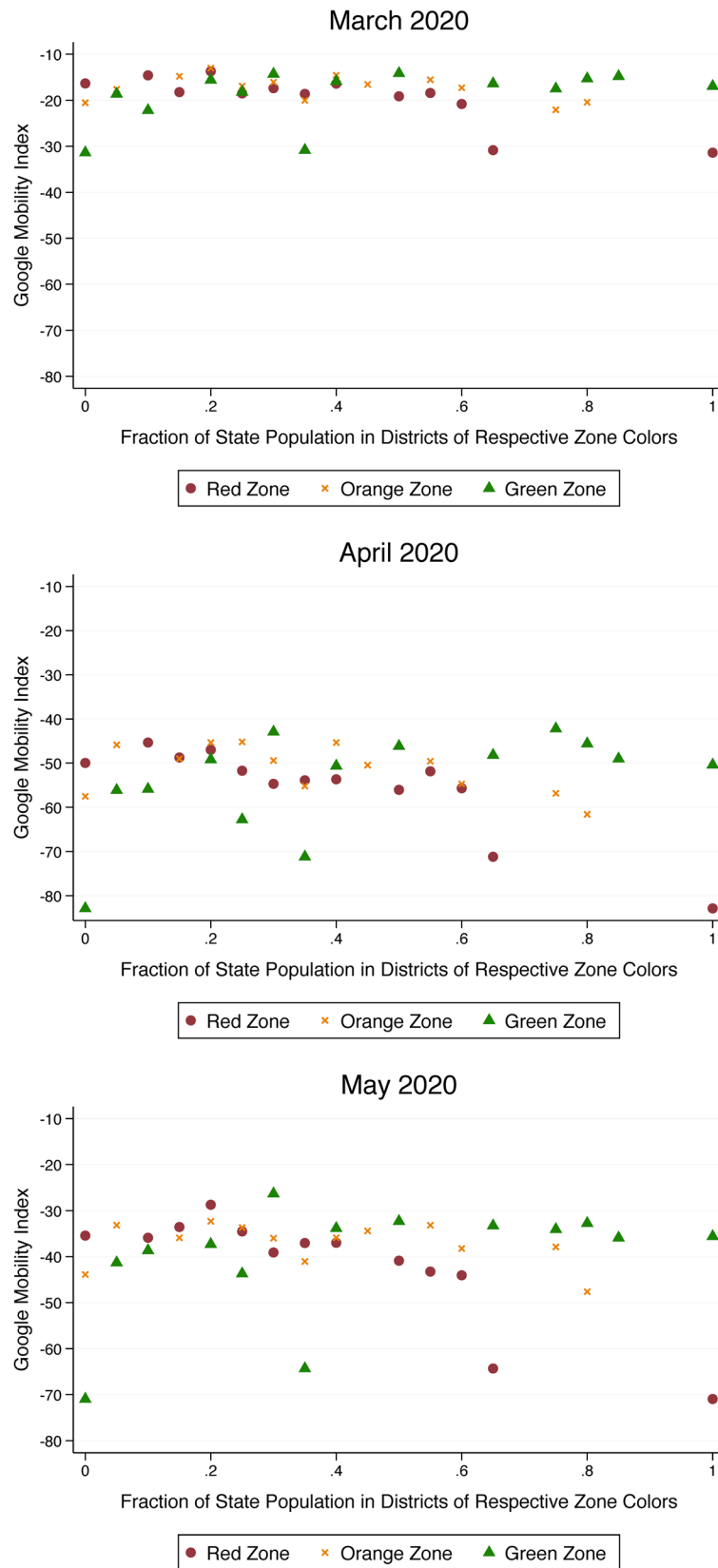
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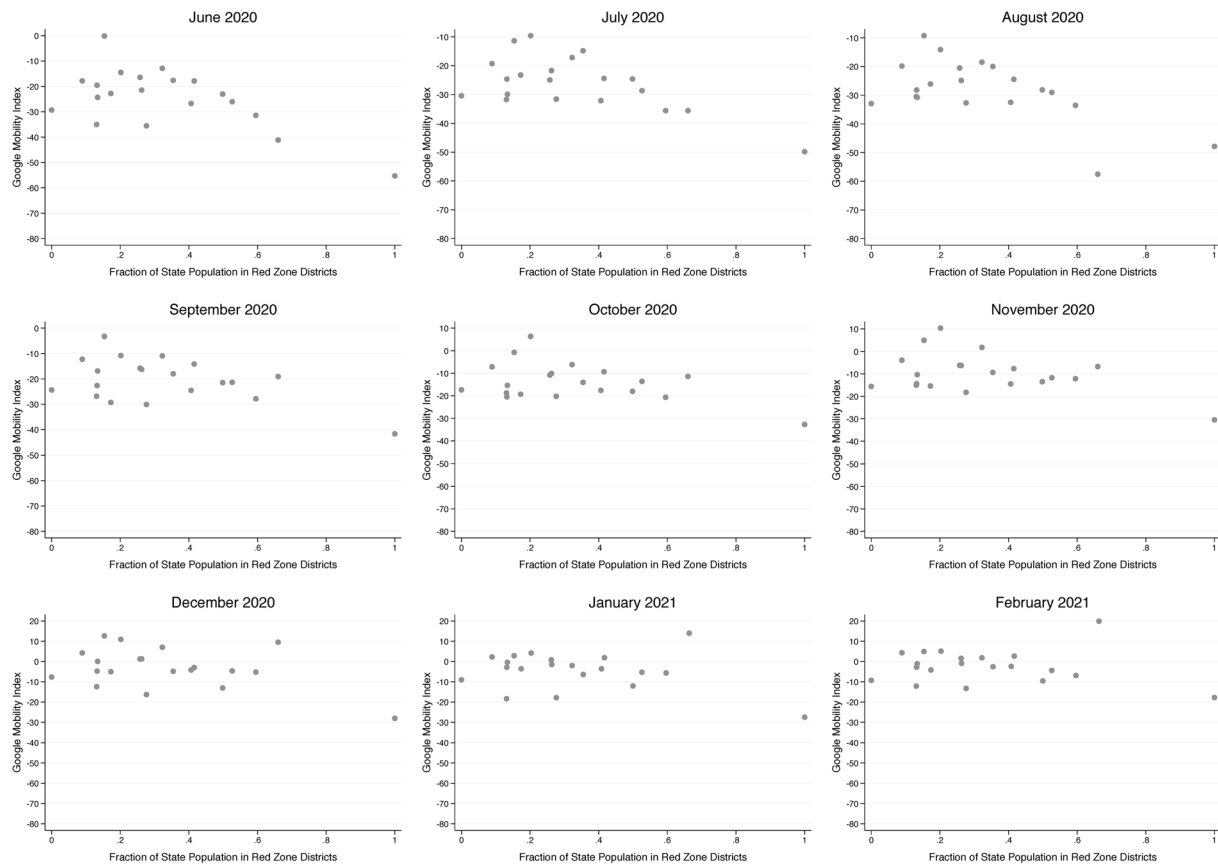


Extended Data Fig. 1 | Spatial Distribution of Red, Orange & Green Lockdown Districts. Source: Ministry of Home Affairs, India (May 1, 2020), as reported by India Today (May 1, 2020). 2011 Census district boundaries used, as obtained from the DataMeet Github Open Repository.



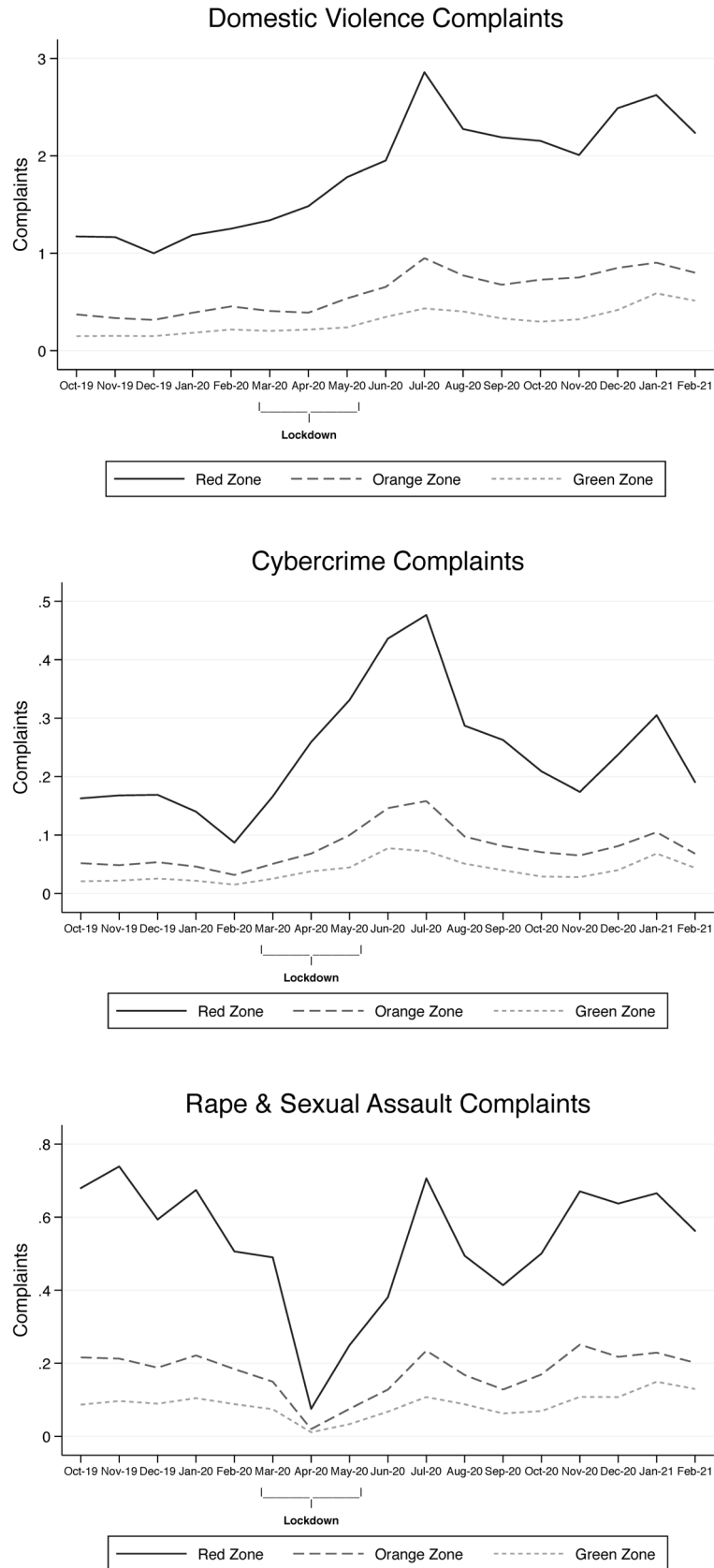
Extended Data Fig. 2 | Correlations Between Fraction of State Population in Red, Orange, or Green Lockdown Districts & Google Mobility Index. Source: Google Community Mobility Reports (accessed June 9, 2020). Notes: Mobility is defined in the Google Community Mobility Reports as the percentage change in mobility relative to the baseline 5-week period from January 3 - February 6,

2020. The state mean is taken over the categories 'Grocery & pharmacy', 'Parks', 'Transit stations', 'Retail & recreation', and 'Workplaces' for the months of March, April, and May 2020, respectively, to create the Google Mobility Index. Google calculates mobility based on data from users who have opted-in to Location History for their Google Account.



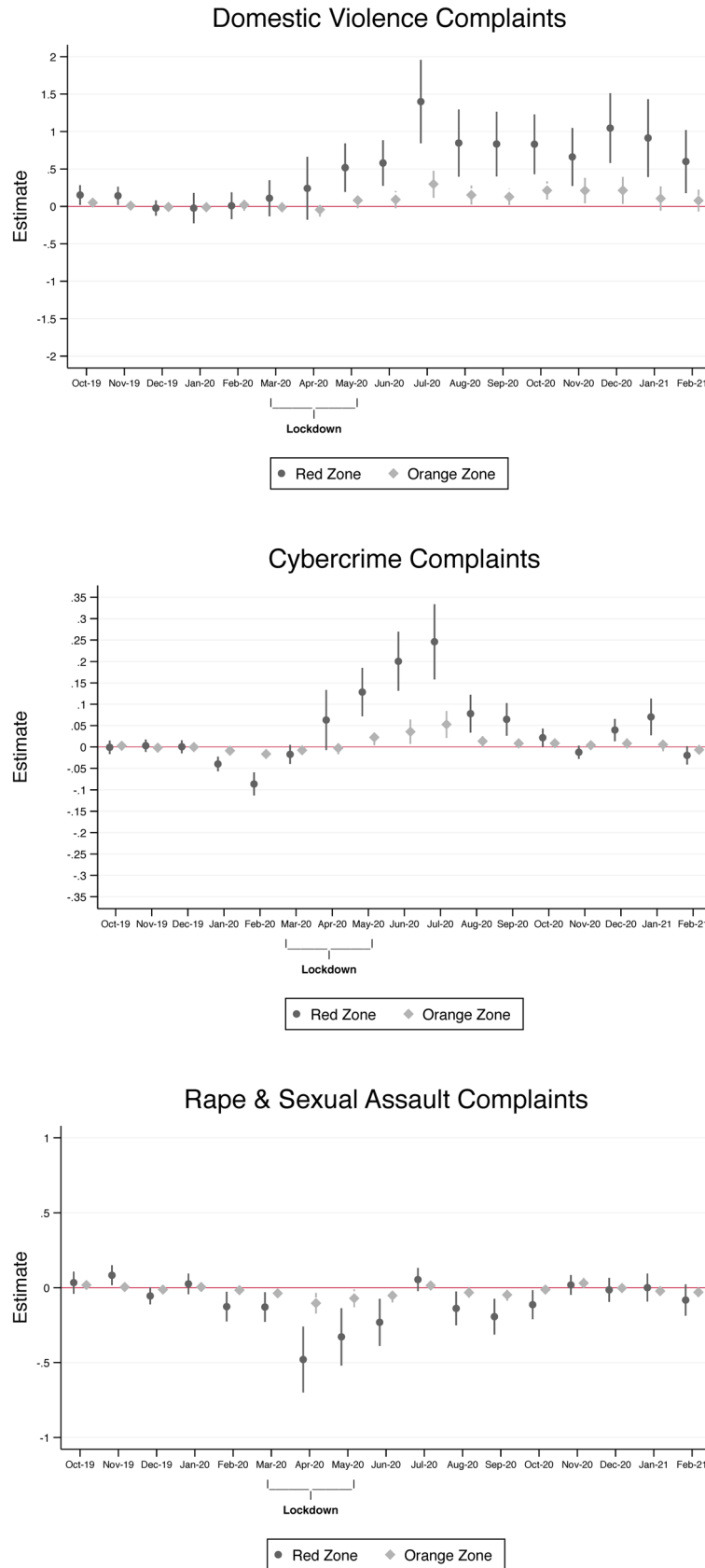
Extended Data Fig. 3 | Correlations Between Fraction of State Population in Red Lockdown Districts & Google Mobility Index. Source: Google Community Mobility Reports (accessed March 19, 2021). Notes: Mobility is defined in the Google Community Mobility Reports as the percentage change in mobility relative to the baseline 5-week period from January 3 - February 6, 2020. The state

mean is taken over the categories 'Grocery & pharmacy', 'Parks', 'Transit stations', 'Retail & recreation', and 'Workplaces' for the months of June 2020 - February 2021 to create the Google Mobility Index. Google calculates mobility based on data from users who have opted-in to Location History for their Google Account.



Extended Data Fig. 4 | Complaints Received by the National Commission for Women (Medium-Term Impacts to February 2021). Source: Complaint & Investigation Cell, National Commission for Women, India (accessed March 16, 2021). Notes: The figure plots the district mean number of complaints received

by the NCW from October 2019 - February 2021 by lockdown zone color category (red, orange, and green). India imposed a nationwide lockdown on March 25, 2020.



Extended Data Fig. 5 | See next page for caption.

Extended Data Fig. 5 | Event Study Plots of Differential Number of Complaints Received by Zone (Medium-Term Impacts to February 2021). Source: Complaint & Investigation Cell, National Commission for Women, India (accessed March 16, 2021). Notes: $n = 20,384$ district-month level observations for each of the three subplots (domestic violence, cybercrime, and rape and sexual assault). The figure plots coefficients $\{\beta_{i,r}\}$ and $\{\beta_{i,o}\}$ from OLS estimation of Equation (1). The black circles depict $\{\beta_{i,r}\}$, the differential impact of red

versus green zone districts in month i relative to the monthly mean from January 2018–September 2019 (the omitted months). The gray diamonds depict $\{\beta_{i,o}\}$, the differential impact of orange versus green zone districts in month i relative to the monthly mean from January 2018–September 2019. 95% confidence interval bars are shown and the center of each interval (black circle or gray diamond) is the corresponding point estimate from OLS estimation of Equation (1). All statistical tests are two-tailed.

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| | |
|-------------------|--|
| Study description | Quantitative non-experimental study with repeated cross-sectional data. |
| Research sample | Indian population (including rural and urban areas). Primary dataset is public-access administrative records on district-month level complaints received by the National Commission for Women (NCW) across India. |
| Sampling strategy | Non-experimental, non-survey data. No sample size calculation was performed as the NCW dataset covers the Indian population (including rural and urban areas). The NFHS dataset is the largest nationally representative dataset in India with data on attitudes towards violence against women. The sample sizes (in the tens of thousands) is sufficient for the undertaken study. |
| Data collection | Our primary dataset is public-access administrative records on district-month level complaints received by the National Commission for Women (NCW) across India. No instrument is available for the NCW data as this is district-level aggregated complaints data. The researcher was blinded to the study hypothesis. |
| Timing | January 2018 - February 2021. |
| Data exclusions | No data was excluded from the analysis. |
| Non-participation | Non-experimental, non-survey data. |
| Randomization | Non-experimental, non-survey data. Regression controls include district fixed effects, month-year fixed effects, and district-year level population. |

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