Political Belief and Response to COVID-19 Health Risk

Danny Ben-Shahar, Stuart Gabriel, and Roni Golan*

Abstract

We employ comprehensive field data from Israel for March 2020 – August 2021 to study how political belief affects COVID-19 vaccine resistance, virus transmission, and response to closure policy. We identify households that likely hold divergent political beliefs based on statistical area voting patterns in Israel's 2020 national election. These data are matched to a statistical area panel of all vaccination and infection cases in Israel and to socio-economic and demographic controls. Results indicate substantial variation in COVID-19 disease and treatment outcomes among those holding divergent political beliefs and across virus variant epochs. Findings further show that a common public signal about local virus health risk is differentially acted upon depending on political belief. The estimated effects of political belief largely reverse in the wake of diffusion of the COVID-19 Delta variant and among remaining vaccine-resistant population. Results underscore the importance of timely, belief-targeted interventions to damp virus spread.

Key words: political belief; health risk; public policy; COVID-19; vaccine resistance; closure response.

JEL Codes: I18, I12, R00, H12, D91.

* Authors: Danny Ben-Shahar, Coller School of Management, Tel Aviv University, email: bdanny@tauex.tau.ac.il; Stuart Gabriel, UCLA Anderson School of Management, UCLA, email: sgabriel@anderson.ucla.edu; and Roni Golan, Coller School of Management, Tel Aviv University, email: rgolan@tauex.tau.ac.il. We thank Omri Ben-Shahar, Avi Carmeli, Danny Czamanski, David Genesove, Moshe Justman, Niki Kotsenko, Elad Kravi, Amnon Levy, Francis Longstaff, Steve Oliner, Antionette Schoar, Nitzan Tzur-Ilan, and participant of the strategy seminar at Tel Aviv University for helpful comments. We thank the Alrov Institute for Real Estate Research for the financial support.

1. Introduction

Substantial anecdotal evidence suggests the salience of household worldview and political belief in response to emergent COVID-19 health risk and related mitigation efforts. Reports suggest striking disparities among belief groups in disease propagation as well as related challenges to government policymakers seeking to lift vaccine uptake and mitigate virus spread. A 2021 NPR/PBS/Marist survey reveals that a full one-half of Republican men in the U.S. do not plan to get vaccinated, compared to only 6 percent of their Democratic counterparts.[1] A 2021 Pew Research Center survey similarly reports that 45 percent of the 41 million white Christian evangelicals in the U.S. are vaccine resistant.[2] Barrios and Hochberg (2020) and Gollwitzer *et al*. (2020) provide evidence that the share of county voters supporting Trump in 2016 is associated with reduced virus social distancing. Hornsey *et al*. (2020) show that political conservatism is associated with concerns about vaccination and that Donald Trump's anti-vaccine tweets exacerbated concerns about vaccines among Trump supporters. Among other survey findings, Reiter *et al*. (2020) find a greater willingness to get vaccinated among households holding a liberal and moderate political stance whereas Callaghan *et al*. (2020) report vaccine hesitancy among

[1] See Los Angeles Times, "Half of Republican Men say they don't want the vaccine" Doyle MaManus, March 21, 2021. A Kaiser Family Foundation COVID-19 Vaccine Monitor survey published September 28, 2021 reported that 90 percent of Democrats had received at least one COVID-19 vaccinations, compared with 58 percent of Republicans.

[2] See New York Times, "White Evangelical Resistance Is Obstacle in Vaccination Effort," April 5, 2021. The Kaiser Family Foundations COVID-19 Vaccine Monitor survey published September 28, 2021 showed a relatively low 62 percent first-dose vaccination rate among white Christian evangelicals.

African-Americans, women, and conservatives.[3] More recently, in the wake of the 2021 surge in the Delta variant in the U.S., belief effects may have evolved, as states known for political conservatism and vaccine resistance, including Alabama and Mississippi, witnessed marked uptakes in vaccination.[4] Survey research undertaken pre-pandemic similarly indicates an association between political ideology and vaccine uptake.[5]

In the academic literature, numerous studies highlight the importance of political, ideological or religious worldview and belief to household response to risk. In financial markets, numerous studies find that trading and returns differ among investors who hold different worldviews [e.g., Kandel and Pearson (1995); Kaustia and Torstila (2011); Meeuwis *et al*. (2018); and Carlin, Longstaff, and Mantoba (2014)]. Other analyses, including Stulz and Williamson (2002), Kumar *et al*. (2011), and Shu *et al*. (2012) show that religious belief affects investment and financial market outcomes. Studies by Bartels (2002), Gaines *et al*. (2007), and Curtin (2018) show that

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[3] Among other recent papers, Calvillo *et al*. (2020) suggest that conservatives perceive the COVID-19 virus as less threatening; Pedersen and Favero (2020) find that Democrats report greater social distancing under COVID-19; Rothberger *et al*. (2020) and Christensen *et al*. (2020) find that compliance with social distancing is more common among liberals; and van Holm *et al*. (2020) find that liberals and moderates are more likely to abide by COVID-19 government recommendations. Similarly, households express a range of views about COVID-19 vaccination [see, for example, Dror *et al*. (2020); Wang *et al*. (2021); Reiter *et al*. (2020); Earnshaw *et al*. (2020); and Lazarus *et al*. (2020)].

[4] Gamio, Lazaro and Amy Walker, "Where the Delta Wave has Driven Up COVID-19 Vaccinations", New York Times, Aug 26 2021.

[5] Mesch and Schwirian (2015) find that Democrats are more willing to be vaccinated against influenza. Similarly, Baumgaetner *et al*. (2018) show that conservatives are less likely to vaccinate against pertussis, measles, and influenza. Rabinowitz *et al*. (2016) show that liberals are more likely to support pro-vaccination statements, whereas Featherstone *et al*. (2019) find that conservative political orientation is more susceptible to vaccine conspiracy beliefs.

partisan political bias as proxied by party identification shapes individual reaction to political events. Similarly, Mian *et al*. (2015) find that economic expectations vary with partisan affiliation. In public health, Fox *et al*. (2017) find that smoking prevalence varies with state political ideology. Despite the prevalence of media and survey-based reports, we are not aware of prior systematic, population-based assessment of the role of divergent household political belief in response to COVID-19 health risk.[6]

The ongoing COVID-19 pandemic underscores the importance of timely insights regarding the role of political belief in determination of vaccination uptake, virus transmission, and closure policy outcomes. There exists, however, little controlled population-based evidence of how political beliefs affect vaccine resistance and response to emergent virus risk. We know little about how political beliefs associated with vaccine resistance evolve over time and in the wake of more virulent disease variants. Further, we lack well-controlled estimates of the quantitative significance of ideological worldview and political belief to virus transmission. Finally, we are not aware of prior systematic investigation of the extent to which ideological worldview and political belief affect the efficacy of such emergency pandemic mitigation strategies as economic closure. That information appears critical to the design of effective policy for disease control and in light of ongoing substantial vaccine resistance.

In this paper, we examine whether political belief is salient to vaccine uptake, virus transmission, and efficacy of closure policy. Among other things, we seek to ascertain whether

[6] An exception is a recent paper by Desmet and Wacziarg (2021) who find that number of COVID-19 cases was smaller (greater) early on (later) in the pandemic among Trump-leaning counties.

belief is mediated by exposure to immediate virus risk.[7] The analysis is undertaken at the level of the small statistical area (akin to census tracts in the U.S.).[8] Our characterization of political beliefs derives from statistical area voting data from the March 2020 general (parliamentary) elections in Israel.[9] We combine that data with the universe of all vaccination and infection cases in Israel since the outbreak of COVID-19 and extensive statistical area population socio-economic and demographic controls. Further, as 20 percent of eligible population in Israel had yet to receive a first-dose of the vaccine as of the outbreak of the Delta variant in June 2021, we assess robustness of estimated effects of belief on vaccination uptake and virus transmission among remaining vaccine resistant population over the June 15 – August 14, 2021 Delta period. Finally, we examine the response among population characterized by different political beliefs to COVID-19 policy treatment. Here treatment is comprised of national economic closure. As in many nations, nationwide closure was imposed by the Israeli government in response to virus surge.[10]

Israel provides an ideal laboratory to undertake analyses of political belief in COVID-19 health risk, policy treatment, and response. The country is comprised of diverse populations

[7] For purposes of assessing robustness of infection incidence to virus testing regime, we also conducted all statistical tests using COVID-19 hospitalization outcomes. Results were generally robust to hospitalizations. As described below, we include those findings in the appendix.

[8] Israel Central Bureau of Statistics (ICBS) divides Israel into small geographical units known as statistical areas, which are roughly equivalent to U.S. census tracts. Each statistical area includes 3,000–5,000 residents (see ICBS, 2013). As described below, our sample includes 1,350 of the about 1,650 statistical areas in Israel.

[9] See also Bartels (2002), Gaines *et al*. (2007), Curtin (2018) and Meeuvis *et al*. (2018) for discussion of belief divergence among voters for different political parties.

[10] Hsiang *et al*. (2020) find that anti-contagion intervention policies were generally effective in decreasing COVID-19 infection cases.

holding significantly divergent worldview and political belief, including left- and right-wing ideologues, Arab ethnic and religious minorities, and orthodox Jewish groups. Moreover, unlike the U.S., the policy response to COVID-19 virus risk in Israel was not framed as a partisan political cause and was supported by leaders across the political spectrum.[11] Also, provision of universal health care and related availability of comprehensive electronic medical records in Israel allowed full, accurate, and timely tracking of virus incidence and vaccine uptake. While the country was an early adaptor of comprehensive testing and vaccination, it experienced four severe spikes in virus incidence through August 2021. The most recent of those spikes was associated with spread of the Delta variant largely among vaccine resistant populations.[12]

We comprise weekly COVID-19 vaccination and infection panels and estimate belief effects controlling for local virus risk, other statistical area population socio-economic, demographic, housing, geographic access, and civic engagement characteristics, and weekly fixed effects. Findings show that upon exposure to local virus risk, statistical areas associated with conservative beliefs, as compared to liberal areas, are associated, *ceteris paribus*, with greater vaccine resistance and higher odds of virus transmission. Results provide new evidence of salient behavioral differences among those holding divergent political beliefs in transmission of and

[11] In the U.S., the debate surrounding COVID-19 risk and related policy interventions became politically-charged and highly partisan (among others, Gollwitzer *et al*., 2020; Barrios and Hochberg, 2020; and Ash *et al*., 2020).

[12] As of February 2021, Israel led the world with a population first-dose vaccination rate of 28 percent, more than 3 times the next highest country (UEA). By mid-June 2021 and at the time of increased transmission of the Delta variant, Israel had achieved a first-dose vaccination rate of 65 percent and was ranked eight in the world despite the highest proportion of children among OECD countries (see https://ourworldindata.org/covid-vaccinations). The high rates of vaccination did not spare the country from the more recent June-August 2021 spike in infections associated with the transmission of the highly-contagious COVID-19 Delta variant.

vaccination response to immediate COVID-19 disease risk. These findings are consistent with and deepen insights surrounding survey-based associations between political conservativism and vaccine resistance [e.g., Mesch and Schwirian (2015), Baumgaetner, Carlisle, and Justwan (2018), Rabinowitz *et al*. (2016), Featherstone, Bell, and Ruiz (2019), Hornsey *et al*. (2020), Reiter *et al*. (2020), and Callaghan *et al*. (2020)].

We also assess durability in patterns of vaccine resistance and virus transmission across areas stratified by political belief in the wake of the outbreak of COVID-19 Delta variant. Such insights are important to targeting of interventions to damp virus resurgence and spread. Relative to the pre-Delta (March – December 2020) period, results for the Delta sample show some reversal in the pattern of vaccination belief effects. In the wake of Delta variant diffusion, conservative areas are associated, *ceteris paribus*, with higher odds of vaccination up-take, whereas the opposite is evidenced for those holding left and center political beliefs. These findings coincide with recent media and survey reports suggesting belief-specific changes in perception of disease risk during the Delta period.[13] They also likely reflect the greater vaccine uptake associated with left-leaning areas prior to the outbreak of the Delta variant, such that remaining unvaccinated population in those areas may be comprised of a relatively larger share of vaccine resistant population.[14]

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[13] See Gamio and Walker, "Where the Delta Variant has Driven Up Vaccinations", New York Times, August 26, 2021 and Kaiser Family Foundation COVID-19 Vaccine Monitor, September 28, 2021 for survey findings regarding vaccination uptake during the Delta period and among vaccine-hesitant areas. Specifically, these reports cite elevated fear of the Delta variant, including concerns about limited ICU availability and proximity to someone who became seriously ill or died of COVID-19 among conservative vaccine-hesitant areas.

[14] The Delta period analysis focuses on the remaining unvaccinated eligible population in Israel (age 12 years and older) who had yet to receive their first dose.

Findings similarly reveal changes in the pattern of estimated political belief effects in determination of infection incidence during the Delta period as compared to earlier in the pandemic. Notably, whereas the left and center political beliefs were associated, *ceteris paribus*, with the lowest odds of infection during the pre-Delta period, those areas instead were associated with relatively higher infection odds in the wake of the transmission of the Delta variant. It may be conjectured that factors including evolution in behavioral response to disease risk as well as variance among belief groups in residual share of vaccine hesitant population may play a role.

Finally, our findings also show heterogenous response among areas characterized by divergent political beliefs to country-wide closure imposed by the Israeli Government in response to virus surge of COVID-19 virus in September–October 2020.[15] Results indicate that while lockdown was effective in decreasing the odds of infection among all areas, the rate of decline in the odds of infection during the closure varied by political belief and was most pronounced in conservative areas. Hence, among areas characterized by conservative beliefs who were less responsive of virus risk, stringent pandemic treatment controls such as economic closure were shown to be more effective.

The remainder of the paper proceeds as follows: Section 2 describes the data and Section 3 presents the empirical model. Section 4 presents results of assessment of the role of political belief on COVID-19 vaccinations and infections for the periods both prior to and in the wake of

[15] Relatedly, Cronin and Evans (2021) find the targeted restriction on entertainment venues, schools, and the like during COVID-19 affected foot traffic specifically in counties with stay-at-home orders. Also, stay-at-home explained a considerable share of the decline in foot traffic associated with activities such as outdoor sports and visits to parks. Similarly, Karaivanov *et al*. (2021) find that face mask mandates, regulations on social gatherings, school closures, and the like were associated with substantial reduction in COVID-19 infection cases.

transmission of the Delta variant, inclusive of a series of robustness tests. Section 5 assesses belief response to COVID-19 closure policy. Finally, Section 6 provides a summary and concluding remarks.

2. Data

We identify households that ex ante likely hold divergent political beliefs based on 1,350 small statistical areas (akin to census tracts) voting outcomes from general (parliamentary) elections held in Israel on the eve of the COVID-19 outbreak in March 2020 (available from the Central Elections Committee).[16] We merge this information with Israeli data including a weekly panel of all vaccination and infection cases from the outbreak of COVID-19 in March 2020 through mid-August, 2021 (available from the Ministry of Health). We further merge that data with a large number of statistical area covariates including those proxying population socio-economic, demographic, housing, and geographic access (available from the Israel Central Bureau of Statistics).

Table 1 provides summary information on statistical area controls from the Israel Central Bureau of Statistics (2013). As shown, average persons per statistical area (Pop) is 4,589. Statistical areas in Israel are densely populated with an average density ($Density$) of 13,177 persons per square kilometer. The population is relatively young and characterized by high birth rates: the average share of Israeli population over the age of 60 ($Age60$) is 0.20 whereas the average share of population under the age of 15 ($Age15$) is 0.24. We use the ICBS socioeconomic index score (SES) to control for statistical area variation in household income and education. The

[16] The sample includes 1,350 of the about 1,650 statistical areas in Israel for which the Ministry of Health provides current infection and vaccination information.

socioeconomic index is computed based on 16 indicators clustered into 4 groups, the latter comprised of standard of living, employment and welfare, schooling and education, and demography (see ICBS, 2013).[17] As shown, the average socioeconomic index score is about 0.22 with standard deviation of 1.01. We also control for geographical proximity of the statistical area to Tel Aviv, the "superstar" city and central business district of Israel (see, e.g., Ben-Shahar et al., 2020). The table also provides summary information on the share of non-voters among the eligible local voting population ($NonVoter$). The latter serves to proxy for reduced civic engagement and social capital (e.g, Putnam, 1993; Putnam, 1995; Uslaner and Brown, 2005; Atkinson and Fowler, 2014), as may adversely affect vaccine uptake and response to policy treatment.

Table 1 also presents summary statistics for statistical areas clustered by distinct ideological worldview and political belief. We proxy for statistical area belief using the distribution of votes among political parties in Israel's March 2020 national parliament elections. We compute votes by party in each of the statistical areas and then use the k-means clustering method (see Forgy, 1965 and Lloyd, 1982) to classify each of the 1,350 statistical areas into one of five political belief

[17] The 16 indicators include: average years of education for population age 25–54; share of population with academic degree age 25–54; share of workers in academic or management positions; share of income earners age 15 and above; share of women age 25–54 not in the workforce; share of workers on the job at least two day per week; share of income earners below minimum wage; share of population with income support ; average per capita income; average number of cars per household; average number of rooms per household; average number of bathrooms per household; share of households with computer and internet connection; median age, dependency ratio, and average number of persons per household. The socioeconomic index is generated by factor analysis that reduces the 16 indicators to 3 main factors that explain 80% of the variation among the statistical areas (see Agmon, 2016).

group.[18] Panel A of Figure 1 presents the average political party vote share by belief cluster including $Right$, dominated by votes for "Likud" and "Yamina" (38 percent of statistical areas in the sample); $Left$, reflecting high share of votes for "Kahol-Lavan" and "HaAvoda-Meretz" (19 percent); $Center$, characterized by roughly equivalent votes for "Likud" and "Kahol-Lavan" (28 percent); non-Jewish $Arab$ minority, as defined by share of votes for the united Arab list "Hareshima Hameshutefet" (5 percent); and highly observant Jewish religious $Orthodox$, dominated by votes for "Yahadut Hatora" and "Shas" (10 percent).[19] As shown in Table 1, $Left$ areas on average exhibit the highest socioeconomic index score, the lowest housing density, and are closest to Tel Aviv. In contrast, $Orthodox$ statistical areas on average exhibit the highest housing density and household size, the youngest population, and the lowest average socioeconomic index score.

3. The Model

To identify the effects of belief systems on COVID-19 vaccinations and infections, we comprise a weekly panel among the 1,350 statistical areas and estimate the following model:

$$Y_{it} = \beta_0 + \vec{\beta}_1 I_i + \beta_2 Infections_{i,t-1} + \vec{\beta}_3 I_i \times Infections_{i,t-1} + \vec{\beta}_4 X_i + \vec{\beta}_5 \tau_t + \varepsilon_{1it}. \qquad (1)$$

[18] Essentially, the k-means procedure partitions *N* observations into *k* sets, minimizing the within-set variance. The *k* number of sets is determined based on the elbow method (see, e.g., Thorndike, 1953 and Goutte et al., 1999).

[19] Following Panel A in Figure 1, we label the political belief groups by $Right$, $Center$, $Left$, $Arab$, and $Orthodox$ based on their respective vote share.

where the outcome term Y_{it} is the log odds (i.e., ln $[p_{it}/(1-p_{it})]$) of either first-dose vaccination uptake or infection in location (statistical area) *i* at time (week) *t* and where p_{it} is the probability of vaccination uptake (infection), computed as the ratio of vaccinations (infections) to eligible (at risk) population for all *i* and *t*. Importantly, eligible population for vaccination changes over time in accordance to public health protocol that allowed vaccination of increasingly younger age groups. Also, we subtract those already vaccinated from the eligible vaccination population. We further assume that those already infected are not subject to infection risk—thus the population under risk of infection declines over time.[20]

The vector I in equation (1) represents a series of political belief fixed-effects based on the k-means classification procedure (described above), including $Right$ (base category); $Left$; $Center$; $Arab$; and $Orthodox$ areas. Other controls include statistical area virus incidence as measured by the log of the number of COVID-19 infection cases in the prior week, $Infections_{t-1}$; interactions of the vector I with $Infections_{t-1}$, which enables estimation of the response by political belief to immediate health risk as proxied by the lagged number of statistical area weekly infections (where $Right \times Infections_{t-1}$ is the base category);[21] and X, a vector of statistical area characteristics including Pop, the population size of the statistical area; $Density$, the ratio

[20] In estimation of the infection equation under the Delta variant, at risk of infection population includes all uninfected and unvaccinated population. As reported below, however, results are generally robust to replacing at risk population with either all population or all uninfected (vaccinated) population.

[21] Anecdotal evidence suggests that persons holding particular religious beliefs may prioritize adherence to belief norms relative to infection risk. In the U.S., for example, Catholic and Evangelical groups expressed reticence to receive the Johnson & Johnson vaccine, which was developed with abortion-derived fetal cell lines. See *New York Times*, April 1 2021.

between the number of people in statistical area and the geographic size in square-meters; $Age60$, the share of population over the age of 60; $Age15$, the share of population under the age of 15; $PersonHH$, the average number of persons per household; $RoomsHH$, the average number of rooms per standard person; $ProximityTA$, the standardized proximity of the statistical area from Tel Aviv; the share of non-voters among the population eligible for voting in the statistical area, $NonVoter$; and SES, the socioeconomic index score of the statistical area. Finally, the estimating equations include a vector τ of time (week) fixed-effects, β_0 and β_2 are estimated parameters, $\vec{\beta}_1$ and $\vec{\beta}_3 - \vec{\beta}_5$ are vectors of estimated parameters, and ε_1 is a random disturbance term.

4. Effect of Political Belief on Vaccinations and Infections

As shown in Panel B of Figure 1, over successive pandemic virus waves through August 2021, about 10 percent of the Israeli population was infected. Also, following the commencement of the vaccination campaign in December 2020 through August 2021 almost 83 percent of eligible population age 16 and over had received at least one dose of the vaccine (only the Pfizer vaccine is available in Israel). Panels C–D in Figure 1 show salient differences in *uncontrolled* virus infection and vaccination rates over the sample period and among political belief groups. Summary information indicates elevated infection rates and low vaccination uptake among orthodox Jewish and to a lesser degree right-leaning and Arab areas whereas the left-leaning group exhibited the highest (lowest) uncontrolled rate of vaccinations (infections).

We report results from the estimation of equation (1) separately for COVID-19 vaccination and infection outcome terms as well as examine robustness thereof to the recent Delta variant surge. Also, we assess robustness of belief findings to continuous versions of those controls and to replacement of the one-week lagged infection control term with lagged hospitalizations and two-week lagged infection control. As described below, the estimated belief effects are largely robust to those model specifications. Hence those results are relegated to the appendix.

Vaccinations

Table 2 presents results of panel estimation of equation (1) on the log odds of first-dose vaccination among 1,350 statistical areas (of the about 1,650 statistical areas in Israel) over the 19 weeks from the commencement of the vaccination campaign on December 20, 2020 through April 25, 2021.[22] Column 1 presents benchmark outcomes controlling only for political belief group fixed-effects (vector I; $Right$ serves as the base group).[23] As shown, statistical areas characterized by $Orthodox$ beliefs exhibit the lowest likelihood of vaccination uptake, followed by $Arab$, $Right$, $Center$, and $Left$.[24]

[22] We end the weekly vaccination sample on April 25 2021, about 5 months after the start of the vaccination campaign, as the number of daily doses per capita and infection cases per 1 million persons had dropped to 0.12 and 5, respectively. By the end of April 2021, about 78 percent of eligible population at the age 16 and over had received at least one dose of the Pfizer vaccine. However, in the wake of the Delta variant in June 2020, the number of infections surged once again. Hence we test for robustness of estimates on infection cases and vaccination uptake for the period June 15 – August 14, 2021 in the wake of the Delta variant.

[23] Full results from the estimation of log odds of first-dose vaccination, inclusive of control terms, is omitted from Table 2 for the sake of brevity and appear in Appendix Table A1. We use weighted least squares procedure in all estimations, whereby the weight is determined by eligible population (respectively for vaccinations and infections) in i and t.

[24] The estimated belief coefficients are different from one another at the 1 percent level with the exception of the insignificant difference between the coefficients for $Right$ and $Arab$.

In column 2, we re-estimate that model including all controls (described above) exclusive of the lagged infection terms. Results here differ from both uncontrolled estimates (column 1 and Figure 1 Panel C) and from findings of survey-based literature (discussed earlier). Results (column 2) indicate that the effect of political belief on the likelihood of local area vaccine uptake is sensitive to the inclusion of local population covariates. Specifically, controlling for socio-economic status, population density, civic engagement as proxied by share of non-voters, age distribution, housing, and other factors, the effect of political belief on the likelihood of vaccine uptake is insignificantly different among areas characterized by divergent political beliefs. This specification, however, does not control for local infection risk.

In column 3 of Table 2, we evaluate the extent to which estimates of the effects of political belief on vaccine uptake are mediated by risk of exposure to COVID-19 as proxied by local infection risk. We do so by including $Infections_{t-1}$ and the vector of interaction terms $I \times Infections_{t-1}$ on the right-hand side of the log odds of vaccination equation (1) (together with other socio-economic and demographic controls). Summing the coefficients on $Infections_{t-1}$ and the interaction term $I \times Infections_{t-1}$ indicates that, during the early pandemic period, *ceteris paribus*, a 1 percent increase in weekly lagged local number of infection cases is associated with a 0.52, 0.32, 0.28, 0.17, and 0.12 percent increase in the odds of vaccination take-up among statistical areas characterized by $Left$, $Arab$, $Center$, $Right$, and $Orthodox$ worldviews, respectively (all significant at the 1 percent level). Also, the interactive political belief effect coefficients (associated with the vector $I \times Infections_{t-1}$) are largely different from one another at the 1 or 5 percent level (with the exception of the coefficients for $Center$ and $Arab$).

Panel A in Figure 2 depicts the projected odds of vaccination uptake associated with 1-week lagged infection risk by political belief (the exponent of the sum of $\hat{\beta}_0 + \hat{\vec{\beta}}_1 I + \hat{\beta}_2 Infections_{t-1} + \hat{\vec{\beta}}_3 I \times Infections_{t-1}$ for all I—holding all other control terms equal to zero), where $Infections_{t-1}$ ranges from 1st–99th percentile of its sample distribution (over the period December – April 2021). All things equal, while areas on the $Left$ exhibit a damped rate of vaccination uptake for low levels of health risk ($Infections_{t-1}$), vaccination response among those areas rises perceptibly as local health risk increases. In marked contrast, conservative areas holding $Orthodox$ and $Right$ political beliefs appear largely impervious to localized and immediate COVID-19 infection risk. As such, $Left$ and $Orthodox/Right$ areas represent two ends of a response (to health risk) distribution; in the former case, initial low level of vaccine uptake is mediated and informed by increasingly elevated disease risk, whereas the opposite finding is evidenced in the case of areas holding conservative beliefs. Indeed, areas holding $Orthodox$ and $Right$ worldviews demonstrate damped responsiveness in vaccine uptake even when confronted by ever-increasing local infection risk, suggesting related challenges to vaccination campaigns in management and control of the pandemic. We see similar divergence, albeit to a lesser extent, between $Arab$ and $Center$ areas. At low levels of disease incidence, vaccine uptake among $Arab$ areas is similar to that of those holding $Center$ beliefs; however, the former exhibit higher levels of vaccination in response to rising health risks.

Note that the estimated vector of $I \times Infections_{t-1}$ political belief interaction terms is robust to the inclusion of a full set of interactions of $Infections_{t-1}$ with socio-economic, age, and density controls. Specifically, we supplement the right-hand side of the log odds of vaccination equation with interactions of $Infections_{t-1}$ with SES, $Age60$, $Age15$, and $Density$. Results (not presented and available upon request) are robust to this model specification. Further, results throughout are largely robust to continuous specification of belief terms and to the replacement of $Infections_{t-1}$ with either $Hospitalizations_{t-1}$ or $Infections_{t-2}$. Results of estimation of those alternative hospitalization and lagged infection models are presented in Tables A2–A3 of the appendix.

Findings of estimation of odds of vaccination by political belief over the early COVID-19 pandemic period show that statistical areas associated with conservative beliefs, as compared to liberal areas, are associated, *ceteris paribus*, with greater vaccine resistance upon exposure to local virus risk. These findings are consistent with survey-based results on the association between political conservativism and vaccine resistance [e.g., Mesch and Schwirian (2015), Baumgaetner, Carlisle, and Justwan (2018), Rabinowitz, Latella, Stern, and Jost (2016), Featherstone, Bell, and Ruiz (2019), Hornsey *et al*. (2020), Reiter *et al*. (2020), and Callaghan *et al*. (2020)]

Note further that among controls (Columns 2–3 in Table A1), socio-economic status index (SES) is positively associated with odds of vaccine uptake (significant at the 1 percent level), whereas the coefficient on $NonVoter$ implies that a 1 basis point increase in the share of non-voters among eligible population is associated with 1.2–1.5 percent reduction in the odds of vaccination incidence (significant at the 1 percent level). The latter result suggests that higher levels of political disengagement or disaffection among local population may adversely affect the success of vaccination campaigns.

Infections

In columns 4–6 of Table 2 we repeat the panel estimation of equation (1), replacing the dependent variable log odds of statistical area weekly vaccinations with the log odds of weekly

COVID-19 virus infections for the March 15 – December 20, 2020 period.[25] Empirical findings provide evidence of salient effects of political belief on virus propagation. Specifically, in column 4, we include only belief fixed effects (i.e., vector I; $Right$ serves as the base group). As shown, statistical areas in the $Left$ group exhibit the lowest *average* infection likelihood, followed by the $Center$, $Right$, $Arab$, and $Orthodox$ belief groups. In column 5, we include the full set of controls exclusive of the lagged local infection terms.[26] In both columns 4 and 5, the political belief fixed effects coefficients are generally different from one another at the 1 percent level.[27] While the pattern of belief effects on disease incidence as shown in column 5 is generally similar to that shown in column 4, the estimated magnitudes are damped upon inclusion of controls.

In column 6, we assess the extent to which the estimated effects of political belief on virus transmission are mediated by exposure to infection risk proxied by lagged statistical area infection cases. As above, we include $Infections_{t-1}$ and the vector of $I \times Infections_{t-1}$ interaction terms. As shown, *ceteris paribus*, statistical areas on the $Left$ are associated with the lowest likelihood of disease transmission in response to lagged infection cases. Summing the coefficients on $Infections_{t-1}$ and the interaction term $I \times Infections_{t-1}$, a 1 percent increase in the number of weekly lagged infections is associated with a 0.01, 0.11, 0.17, 0.18, and 0.40 percent rise in the

[25] The analysis of infection cases ends on December 20, 2020 due to detection at that time of the more contagious Alpha and Beta virus variants (British and South African, respectively) in Israel. As described above, odds of infection during the March 15 – December 20, 2020 sample are computed as the ratio of infection cases to all uninfected population for all statistical area *i* and period (week) *t*.

[26] The results on the socio-economic and demographic controls from the estimation of the log odds of infection equation (1) appear in Appendix Table A1

[27] The exceptions here are the couplets $Arabs/Right$ in column 4 and $Arabs/Left$ and $Arabs/Center$ in column 5, which are insignificantly different from one another.

odds of infection among areas holding $Left$, $Center$, $Arab$, $Right$, and $Orthodox$ views, respectively (all significant at the 1 percent level). Also, the belief and infection incidence interactive coefficients (associated with the vector $I \times Infections_{t-1}$) are different from one another at the 1 percent level (except for the insignificant difference between the $Arab/Right$ pair).

Panel B in Figure 2 plots the projected odds of infection associated with political belief by 1-week lagged local infection risk (sum of $\hat{\beta}_0 + \hat{\vec{\beta}}_1 I + \hat{\beta}_2 Infections_{t-1} + \hat{\vec{\beta}}_3 I \times Infections_{t-1}$ for all I—holding other controls equal to zero), where $Infections_{t-1}$ range from the 1st–99th percentile of the sample distribution (over the period March – December 2020). As shown, at low levels of infection, *ceteris paribus*, there is little difference in infection propagation by political belief. Further, the odds of infection inevitably rise over the course of the pandemic regardless of political belief. That said, areas on the $Left$ exhibit the lowest disease transmission in response to increasing exposure to the virus, followed by those holding $Center$, $Arab$, $Right$, and $Orthodox$ beliefs. Here $Left$ and $Orthodox$ areas represent two ends of an infection response (to local disease risk) distribution. All else equal, while infection risk among the $Left$ is much informed by increasing localized exposure to disease, such is not the case among areas characterized by conservative $Orthodox$ and $Right$ beliefs. In the *Orthodox* and *Right* areas, we find sharply elevated likelihood of disease transmission as infection rates rise, suggesting damped responsiveness among those holding conservative beliefs even when confronted by growing and immediate local health risks.

We assess the robustness of estimated interactive political belief and lagged infections results for the period between closures of the Israeli economy (May 10 – September 24, 2020).[28] Outcomes (column 7 of Table 2) are generally robust across the full and sub-sample periods, as the sums of the coefficients on $Infections_{t-1}$ and $I \times Infections_{t-1}$ for all I are insignificantly different from one another across the two samples.[29] Also, as noted earlier, the estimated $I \times Infections_{t-1}$ belief interaction terms are robust to (*a*) the inclusion of a full set of interactions of $Infections_{t-1}$ with SES, $Age60$, $Age15$, and $Density$ controls (results available upon request); (*b*) continuous specification of political belief terms (see Table A2 in the appendix); and (*c*) the replacement of $Infections_{t-1}$ with either $Hospitalizations_{t-1}$ or $Infections_{t-2}$ (see Table A3 in the appendix).

Finally, note among the controls (Columns 5–6 in Table A1), the coefficient on socio-economic status (SES) is negatively associated with odds of infection (significant at the 1 percent level),[30] whereas the average number of persons in the household ($PersonHH$) is positively associated with odds of infection (significant at the 1–5 percent level).

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[28] In response to virus surge, national economic closure was imposed by the Israeli government during the April 4 – May 4, 2020 and September 25 – October 17, 2020 periods.

[29] As noted earlier, results on the estimated vector of $I \times Infections_{t-1}$ belief interaction terms are robust to (*a*) the inclusion of a full set of interactions of $Infections_{t-1}$ with SES, $Age60$, $Age15$, and $Density$ controls (those results are not presented and available upon request); (*b*) continuous specification of political belief terms (see Table A2 in the appendix); and (*c*) the replacement of $Infections_{t-1}$ with either $Hospitalizations_{t-1}$ or $Infections_{t-2}$ (see Table A3 in the appendix).

[30] The negative correlation between socio-economic status and COVID-19 infection cases is consistent with the recent outcomes of Mena *et al*. (2021).

Delta Variant

While the COVID-19 Delta variant was first detected in Israel as early as mid-April 2020, infections continued to trend down over ensuing months. By mid-June 2021, however, virus infections in Israel began to trend up with the Delta variant being the dominant strain. We therefore commence our analysis of COVID-19 vaccinations and infections for the Delta period on June 15, 2021. By that time, almost 80 percent of the eligible population (above 12 years) had received at least a first-dose of the (Pfizer) vaccine. Despite the high overall level of population vaccination, Israel experienced a marked surge in infections, emanating in large measure from the remaining 20 percent of eligible unvaccinated population. In this section, we assess the robustness of our estimated effects of political belief on vaccination and infection among remaining unvaccinated population and in the wake of recent Delta virus wave. Those findings suggest the importance of timely and politically nuanced interventions to help curb virus spread.

Table 3 presents results of re-estimation of the log odds of first-dose vaccination and infection panel models in equation (1) among the 1,350 statistical areas in our sample over the 8 weeks subsequent to the outbreak of the fourth (Delta) virus wave in Israel from June 15, 2021 through August 14, 2021. Columns 1–6 in Table 3 are equivalent to columns 1–6 reported in Table 2.[31] As in the case of earlier virus waves and as shown in column 1, and consistent with previous uncontrolled results, during the Delta wave statistical areas characterized by $Left$ and $Center$

[31] As above, a full rendering of results inclusive of control terms is omitted from Table 3 for the sake of brevity and instead appear in Appendix Table A4.

beliefs are associated with the highest likelihood of vaccination uptake, followed by $Right$, $Orthodox$, and $Arab$ areas.[32]

In column 2 of Table 3, we re-estimate the odds of vaccination including the (above described) controls exclusive of the lagged infection terms. Results here differ both from uncontrolled estimates (column 1) and findings of the pre-Delta period. Specifically, results (column 2) indicate that upon controlling for statistical area socio-economic and demographic characteristics, political belief remains a significant determinant of the average likelihood of vaccine uptake. However, during the Delta period, vaccination odds are lowest among areas on the $Left$, followed by those characterized by $Arab$, $Center$, $Right$, and $Orthodox$ beliefs.[33] Also, as before, the share of non-voters among eligible population in the statistical area is negatively associated with the odds of vaccination incidence (a 1 basis point increase in non-voters is associated with about 2.1 percent reduction in the odds of vaccination up-take; significant at the 1 percent level).

In column 3 of Table 3, we re-estimate the vaccination model, further controlling for local virus exposure as represented by the 1-week lagged number of local virus infections ($Infections_{t-1}$) and its interaction with the political belief fixed effects ($I \times Infections_{t-1}$, where $Right$ serves as the base group). Summing the coefficients on $Infections_{t-1}$ and $I \times Infections_{t-1}$ indicates, *ceteris paribus*, that a 1 percent increase in weekly lagged local

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[32] The estimated belief coefficients are different from one another at the 1 percent level (with the exception of the $Arab/Orthodox$ pair whose difference is significant at the 5 percent level and the $Left/Center$ pair whose difference is insignificant.

[33] The estimated belief effect coefficients are different from one another at the 1–5 percent level with the exception of the $Arab/Left$, $Arab/Center$, and $Arab/Right$ pairs whose difference is insignificant.

number of infection cases is associated with a 0.28, 0.19, 0.07, –0.06, and –0.29 percent increase in the odds of vaccination take-up among statistical areas characterized by $Arab$, $Orthodox$, $Right$, $Center$, and $Left$ worldviews, respectively.[34] These outcomes, as discussed below, represent some reversal of the pattern of estimated belief sensitivity to local virus exposure observed for the pre-Delta period.

In columns 4–6 of Table 3 we repeat the panel estimation of equation (1), where the dependent variable is now the log odds of statistical area weekly virus infections for the 8-week sample of the Delta variant surge (June 15, 2021 through August 14, 2021).[35] Initially, in column 4, we include only belief fixed effects (once again, $Right$ serves as the base group). As shown, contrary to results for the pre-Delta variant sample, statistical areas on the $Left$ exhibit the highest average infection likelihood, followed by those characterized by $Center$, $Right$, $Arab$, and $Orthodox$ beliefs.[36] In column 5 we re-estimate the odds of infection model including the full set of controls (exclusive of the lagged local infection terms). As might be expected, the estimated

[34] All coefficient summations associated with $Infections_{t-1}$ and the vector $I \times Infections_{t-1}$ are different from one another at the 1 percent level, with the exception of the $Right/Orthodox$ pair whose difference is significant at the 5 percent level and the $Arab/Orthodox$ pair whose difference is insignificant.

[35] For the period of the Delta sample, the odds of infection is computed as the ratio of infection cases to all uninfected and unvaccinated population for all statistical areas *i* and periods (week) *t*. Results reported in columns 4–6 are generally robust to replacing that definition of infection odds with alternative formulations including either the ratio of infection cases to all population or the ratio of infection cases to all uninfected (however, vaccinated) population. Also, the results on the socio-economic and demographic controls from the estimation of the log odds of infection equation appear in Appendix Table A1

[36] All estimated belief coefficients are different from one another at the 1 percent level with the exception of the $Arab/Orthodox$ pair whose difference is insignificant.

effect of $Left$ belief on the odds of infection is highly sensitive to the inclusion of local socio-economic and demographic controls. In fact, upon control for those factors, the odds of infection associated with $Left$ are lower than those of the $Right$ and $Center$.[37] In addition, contrary to results for the pre-Delta period and consistent with Sheikh *et al*. (2021), the socio-economic index (SES) of the statistical area is now positively associated with virus infection incidence (significant at the 1 percent level).

Finally, in column 6, we once again supplement the infections odds equation with additional controls for $Infections_{t-1}$ and $I \times Infections_{t-1}$. Summing the coefficients on $Infections_{t-1}$ and $I \times Infections_{t-1}$, results again indicate that the pattern of response to infection risk across political belief groups is different from that observed for the pre-Delta variant sample. Specifically, *ceteris paribus*, a 1 percent increase in the number of local weekly lagged infections is now associated with a 0.52, 0.49, 0.43, 0.14, and 0.03 percent rise in the odds of infections in statistical areas holding $Right$, $Center$, $Left$, $Orthodox$, and $Arab$ beliefs.[38] In contrast to prior estimates, $Right$ areas are now associated with the highest likelihood of disease transmission in response to lagged infection cases, whereas the lowest disease odds in response to virus risk is associated with those holding $Orthodox$ and $Arab$ worldviews.

In sum, findings for the Delta period show that estimates of $Arab$ and $Orthodox$ worldview and belief (and to a somewhat lesser extent – $Right$) are associated, *ceteris paribus*, with higher odds of vaccination up-take, whereas the opposite was evidenced for those holding

[37] The estimated differences in odds of infection between all groups is significant at the 1 percent level with the exception of the $Arab/Orthodox$ pair whose difference is insignificant.

[38] The estimated difference between each pair of belief coefficients is significant at the 1 percent level, with the exception of the $Right/Center$ and $Arab/Orthodox$ pairs that are insignificantly different from one another.

$Left$-leaning and (to a lesser extent) $Center$ political beliefs. This is a reversal of the pattern of vaccination uptake during the pre-Delta period—whereby $Left$ and $Center$ ($Right/Orthodox$) areas were associated with relatively higher (lower) odds of first-dose vaccine uptake. The estimated changes in the pattern and significance of the political belief coefficients are consistent with recent anecdotal evidence of elevated vaccination uptake among previously vaccine resistant groups and may reflect belief-specific changes in perception of disease risk over the course of the pandemic and in the wake of the diffusion of the Delta variant.[39] These results also arguably reflect the greater odds of vaccine uptake among the $Left$ prior to the outbreak of the Delta variant, such that the remaining unvaccinated $Left$-leaning population under the Delta variant may be comprised of a larger share of vaccine resistant population, as compared to the substantially larger remaining unvaccinated shares of conservative population holding $Right$ and $Orthodox$ political beliefs.

5. Event Study: Political Belief Response to COVID-19 Closure

The pandemic infections panel also enables assessment of heterogeneity among political beliefs in response to virus policy treatment. Here we examine treatment outcomes associated

[39] See Gamio and Walker, "Where the Delta Variant has Driven Up Vaccinations", New York Times, August 26, 2021. The article reports on a pronounced increase in vaccinations in states where immunization levels were below the national average of 61 percent. Many of those states have witnessed disproportionately elevated adverse effects of the Delta variant. The authors quote vaccination campaign leaders who cite increased fear of the virus (Delta variant) as the primary factor for the increase in vaccinations in those areas. Further, survey results published in the September 28, 2021 Kaiser Family Foundation COVID-19 Vaccine Monitor cites "the Delta variant," "concern about reports of local hospitals and ICUs filling up with COVID-19 patients," and "someone they know got seriously ill or died from COVID-19," as major reasons for vaccination among those recently vaccinated.

with a country-wide closure imposed by the Israeli Government in response to virus surge during September 25 – October 17, 2020.[40] During the lockdown period, widespread and stringent nationwide population restrictions were implemented including a stay-at-home order; shut down of schools, universities, and non-essential retail and workplaces; and only limited provision of public transportation.[41] Policy treatment was national and not specific to belief group. Consider the following estimated equation:

$$Y_{it} = \gamma_0 + \vec{\gamma}_1 I_i + \gamma_2 Infections_{i,t-1} + \vec{\gamma}_3 I_i \times Infections_{i,t-1} + \gamma_4 t + \vec{\gamma}_5 I_i \times t + \vec{\gamma}_6 X_i + \varepsilon_{2it}, \tag{2}$$

where the dependent variable, Y_{it}, is the log odds of infection in week t and statistical area i. The estimation of equation (2) differs from that of equation (1) in two ways. First, we estimate equation (2) only for the closure period and restrict the sample for weeks t = (0, 1, 2, …4), where t = 0 is the week when the closure commences. Further, we omit τ (weekly fixed-effects) and supplement equation (2) with the vector $I_i \times t$, a series of interaction terms between the political belief fixed-effect and a time trend, so as to estimate divergent infection response paths to closure by belief system. Also, γ_0, γ_2, and γ_4 are estimated parameters, $\vec{\gamma}_1$, $\vec{\gamma}_3$, and $\vec{\gamma}_5 - \vec{\gamma}_6$ are vectors of estimated parameters, ε_2 is a random disturbance term, and all other variables are as discussed above.

[40] Israel imposed two other closures, from April 4 – May 4, 2020 and from January 8 – February 7, 2021. We omit assessment of behavioral response to those closures, as the former was associated with low morbidity rates in other than the Orthodox group, whereas response to the third closure reflects in part evolution in both the virus itself (increased prevalence of British and South African variants in Israel) and in vaccination take-up.

[41] While the above date represents the official timeframe of the closure, entrance to and exit from closure was gradual; further, the population limitations imposed before, during, and after the closure were identical across statistical areas.

Column 8 in Table 2 presents results of event study panel estimation of the infections model for the closure treatment period. Consistent with the outcomes in the previous section, response to lagged infections (i.e., the sums of the coefficients on $Infections_{t-1}$ and $I \times Infections_{t-1}$) varies by political belief. As shown above for the pre-Delta period, $Orthodox$ areas, *ceteris paribus*, exhibit the highest odds of disease transmission in response to lagged infection risk followed by those characterized by $Arab$, $Right$, $Center$, and $Left$ worldviews.[42]

Moreover, results indicate that while pandemic economic lockdown was effective in decreasing the likelihood of infection cases among all belief groups (as the sum of coefficients on t and the vector $I_i \times t$ are all negative and significant at the 1 percent level), the *rate of decline* in the likelihood of infections during closure varied by belief. The estimated response to government-imposed closure by political belief is plotted in Panel C of Figure 2. The plots compute the sum $\bar{Y}_{i0} I_i + \hat{\gamma}_2 t + \vec{\hat{\gamma}}_3 I_i \times t$ for all I and t = 0, 1,…, 4 as follow from the estimation results in column 8 of Table 2—translated to odds terms—where $\bar{Y}_{i0} I_i$ is the political belief group average odds of infections (across statistical areas) at the beginning of the closure. As shown, the decline in infection odds during closure was most precipitous among $Orthodox$ areas, followed by those characterized by $Right$, $Center$, $Left$, and $Arab$ beliefs. Further, the pair-wise difference between any pair of beliefs in the decline in odds of infection during closure is significant at the 1 percent level. Findings of heterogeneity in closure effects among political belief groups are generally robust to continuous specification of the belief effects (see Table A2 in the appendix); and to the replacement of $Infections_{t-1}$ with either $Hospitalizations_{t-1}$ or $Infections_{t-2}$ (see

[42] The estimated difference between each pair of belief coefficients is significant at the 1 percent level with the exception of the $Arab$/$Right$ and $Arab$/$Center$ pairs that are insignificantly different from one another.

Table A3 in the appendix).[43] In sum, results suggest that imposition of rigorous state-mandated closure policy treatment was most effective among the conservative groups (*Orthodox* and *Right*), those groups least likely to be vaccinated in response to infection risk.

6. Conclusion

We show that political belief is salient to household response to COVID-19 health risk. Using comprehensive voting data from Israel, we identify households that ex ante likely hold divergent political beliefs and estimate the effects of worldview and belief on COVID-19 virus and disease related outcomes. Our findings show salient differences across belief groups in vaccine uptake, virus transmission, and response to national closure policy. We further establish that divergent worldview groups update beliefs heterogeneously when confronted by immediate and localized virus risk. Among left-leaning groups, for example, the estimated effects of political belief are mediated by emergent health risk. In contrast, belief effects among conservative groups are durable in the face of virus exigency, so as to limit the reach of public vaccination efforts. Consistent with recent anecdotal evidence, results show some reversal in the pattern of estimated belief effects in vaccination uptake in mid-2021, as may reflect belief-specific changes in perception of disease risk in the wake of the diffusion of the Delta variant. Finally, results show

[43] For robustness, we re-estimate equation (2) for the lockdown period, replacing the political belief-fixed effects with continuous specification of belief terms. Results are presented in Table A2 in the appendix. As shown, coefficients on the interaction term of the continuous belief variable with t are consistent with the fixed-effects specification and significant at the 1 percent level, suggesting robust differences in the likelihood of infection response to closure by political belief. Also, as shown in Table A3 in the appendix, results are further robust to the replacement of $Infections_{t-1}$ with either $Hospitalizations_{t-1}$ or $Infections_{t-2}$.

that stringent pandemic treatment controls such as economic closure are more effective among those groups holding durable beliefs in the face of immediate virus risk.

Overall, results add to a growing body of literature suggesting that a common public signal about risk (in our case, virus infections) or related policy treatment is differentially interpreted and acted upon depending on worldview and political belief. The estimated belief effects may derive from political or ideological imperative or from bias in information processing, as discussed by Stulz and Williamson (2003), Kumar *et al*. (2011), and Shu *et al*. (2012). Also, our findings are consistent with literature showing the importance of political beliefs to interpretation of news and in response to political and economic events [see, e.g., Bartels (2002), Gaines *et al*. (2007), and Meeuwis *et al*. (2018)]. Further, results underscore the importance of timely, targeted messaging and treatment among belief groups so as to enhance policy efficacy and related disease control. Future research should assess the external validity of results as belief effects may be of first order importance to ongoing COVID-19 variant transmission and to response formulation among decision-makers globally.

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Table 1: **Variables Description and Summary Statistics**

Variable	**Description**	**Mean**	**Std**	**Min**	**Max**	**Right**	**Center**	**Left**	**Arab**	**Orthodox**
Infections	Total number of weekly infections	4.6	12.2	0	544	3.9	3.0	2.0	5.1	16.2
Vaccinations	Total number of weekly vaccinations	195.4	169.9	0	2,334	185.9	215.7	226.0	200.6	114.6
Ln(OddsInfect)	Log odds of weekly infections	-6.17	1.89	-6.90	6.90	-6.12	-6.25	-6.42	-6.15	-5.73
Ln(OddsVac)	Log odds of weekly vaccinations	-4.79	3.72	-6.90	6.90	-4.94	-4.76	-4.55	-5.02	-4.74
Right	Dummy variable equals 1 for right-leaning cluster	0.38	0.48	0	1					
Center	Dummy variable equals 1 for center cluster	0.28	0.45	0	1					
Left	Dummy variable equals 1 for left-leaning cluster	0.18	0.38	0	1					
Orthodox	Dummy variable equals 1 for Orthodox Jewish cluster	0.10	0.30	0	1					
Arabs	Dummy variable equals 1 for Arab cluster	0.049	0.217	0	1					
RightCont	Share of votes for right-leaning parties	0.37	0.18	0	0.89	0.53	0.41	0.24	0.04	0.11
OrthodoxCont	Share of votes for Orthodox Jewish parties	0.17	0.24	0	0.98	0.16	0.07	0.02	0.01	0.85
ArabsCont	Share of votes for United Arab List									
NonVoter	Share of non-voters among those eligible to vote	0.34	0.09	0.10	0.86	0.37	0.35	0.3	0.38	0.27
Pop	Population size	4,589	2,465	1,974	27,768	4,279	4,454	4,393	5,796	5,917
Density	Population density (Pop divided by geographic area in square kilometers)	13,177	10,223	39.3	66,159	10,827	13,555	12,107	6,888	26,198
SES	Socioeconomic index score	0.22	1.01	-3.13	2.53	-0.11	0.63	1.52	-0.75	-1.59
ProximityTA	Distance to Tel Aviv (index)	0.68	0.93	-4.97	1.48	0.44	0.79	1.16	-0.06	0.77
Age60	Share of population over the age of 60	0.20	0.07	0	0.49	0.21	0.23	0.21	0.12	0.08
Age15	Share of population under the age of 15	0.24	0.08	0.05	0.65	0.24	0.22	0.21	0.27	0.43
PersonHH	Average number of persons in the household	3.18	0.83	1.50	7.10	3.13	2.94	2.74	3.82	4.66
RoomsHH	Average number of rooms per person	1.52	0.26	0.58	2.44	1.51	1.61	1.75	1.25	1.1

Notes: Table 1 presents summary statistics for the entire sample and sample stratified by ideological clusters.

Table 2: **Results from the Estimation of Equations (1) and (2) – Log Odds of $Vaccination$ and $Infection$**

Column	**(1)**	**(2)**	**(3)**	**(4)**	**(5)**	**(6)**	**(7)**	**(8)**
Outcome Term	**Vac**	**Vac**	**Vac**	**Infect**	**Infect**	**Infect**	**Infect**	**Infect**
Constant	-2.523	-2.482	-2.946	-6.671	-6.394	-6.638	-6.511	-5.950
	(0.024)	(0.333)	(0.325)	(0.005)	(0.097)	(0.071)	(0.089)	(0.179)
Left	0.520	-0.073	-0.517	-0.154	-0.065	0.089	0.50	-0.161
	(0.065)	(0.091)	(0.097)	(0.007)	(0.017)	(0.014)	(0.015)	(0.071)
Center	0.250	0.014	-0.159	-0.077	-0.031	0.050	0.040	-0.016
	(0.046)	(0.046)	(0.054)	(0.007)	(0.010)	(0.008)	(0.008)	(0.085)
Orthodox	-0.456	0.011	0.253	0.462	0.229	-0.259	-0.211	-0.318
	(0.075)	(0.122)	(0.128)	(0.020)	(0.028)	(0.023)	(0.025)	(0.137)
Arab	-0.152	0.119	-0.152	0.001	-0.056	-0.021	-0.050	-0.775
	(0.100)	(0.108)	(0.201)	(0.020)	(0.022)	(0.016)	(0.015)	(0.116)
$Infections_{t-1}$			0.177			0.179	0.165	0.272
			(0.018)			(0.008)	(0.009)	(0.016)
$Left{\times}Infections_{t-1}$			0.343			-0.168	-0.129	-0.167
			(0.044)			(0.014)	(0.014)	(0.027)
$Center{\times}Infections_{t-1}$			0.106			-0.071	-0.072	-0.065
			(0.018)			(0.010)	(0.010)	(0.030)
$Orthodox{\times}Infections_{t-1}$			-0.050			0.217	0.216	0.235
			(0.017)			(0.011)	(0.014)	(0.030)
$Arab{\times}Infections_{t-1}$			0.150			-0.010	0.011	-0.028
			(0.060)			(0.015)	(0.021)	(0.039)
t								-0.301
								(0.007)
$Left{\times}t$								0.149
								(0.011)
$Center{\times}t$								0.043
								(0.011)
$Orthodox{\times}t$								-0.121
								(0.015)
$Arab{\times}t$								0.227
								(0.024)
Controls	No	Yes	Yes	No	Yes	Yes	Yes	Yes
N	25,650	25,650	25,650	51,300	51,300	51,300	27,000	6,750
# of weeks	19	19	19	39	38	38	20	5
Prob(F)	0	0	0	0	0	0	0	0
R2-overall	0.039	0.058	0.178	0.113	0.126	0.468	0.481	0.747

Notes: Columns 1–3 (4–6) present results from the estimation of vaccination (infection) equations for the period December 20, 2020 – April 25, 2021 (March 15 – December 20, 2020). Column 7 presents results from the estimation of the infection equation for the period May 10 – September 24, 2020. Column 8 presents results from the estimation of infection equation (2) for the period closure period September 25 – October 17, 2020.

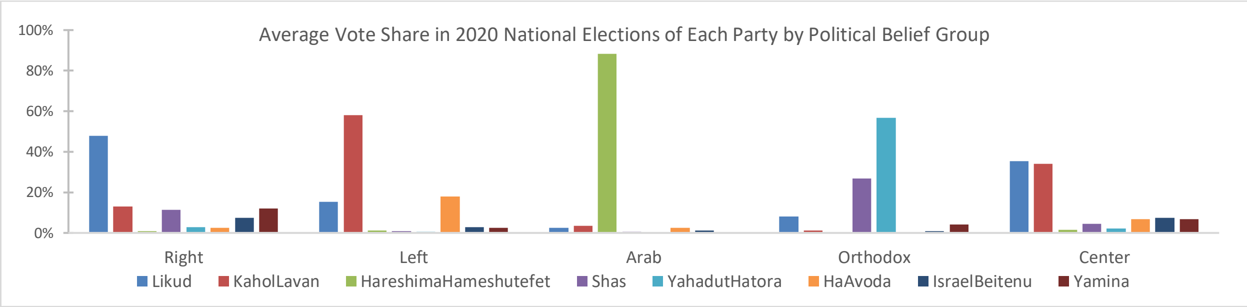
Table 3: Results from the Estimation of Equations (1) – Log Odds of $Vaccination$ and $Infection$ for Delta Sample

Column	**(1)**	**(2)**	**(3)**	**(4)**	**(5)**	**(6)**
Outcome Term	**Vac**	**Vac**	**Vac**	**Infections**	**Infections**	**Infections**
Constant	-4.336	-5.096	-5.226	-6.22	-6.869	-7.023
	(0.039)	(0.431)	(0.426)	(0.017)	(0.157)	(0.124)
Left	0.406	-0.362	-0.044	0.303	-0.148	-0.004
	(0.103)	(0.116)	(0.117)	(0.034)	(0.045)	(0.032)
Center	0.330	-0.059	0.038	0.181	-0.039	-0.003
	(0.069)	(0.046)	(0.063)	(0.032)	(0.031)	(0.021)
Orthodox	-0.335	0.295	0.262	-0.556	-0.148	0.074
	(0.091)	(0.145)	(0.146)	(0.024)	(0.052)	(0.042)
Arab	-0.697	-0.121	-0.208	-0.501	-0.202	0.122
	(0.161)	(0.137)	(0.140)	(0.039)	(0.041)	(0.050)
$Infections_{t\text{-}1}$			0.067			0.519
			(0.026)			(0.019)
$Left \times Infections_{t\text{-}1}$			-0.360			-0.086
			(0.035)			(0.024)
$Center \times Infections_{t\text{-}1}$			-0.131			-0.028
			(0.032)			(0.023)
$Orthodox \times Infections_{t\text{-}1}$			0.119			-0.383
			(0.050)			(0.051)
$Arab \times Infections_{t\text{-}1}$			0.211			-0.489
			(0.066)			(0.077)
Controls	No	Yes	Yes	No	Yes	Yes
N	10,800	10,800	10,800	10,800	10,800	10,800
# of weeks	8	8	8	8	8	8
Prob(F)	0	0	0	0	0	0
R2-overall	0.066	0.234	0.236	0.107	0.141	0.536

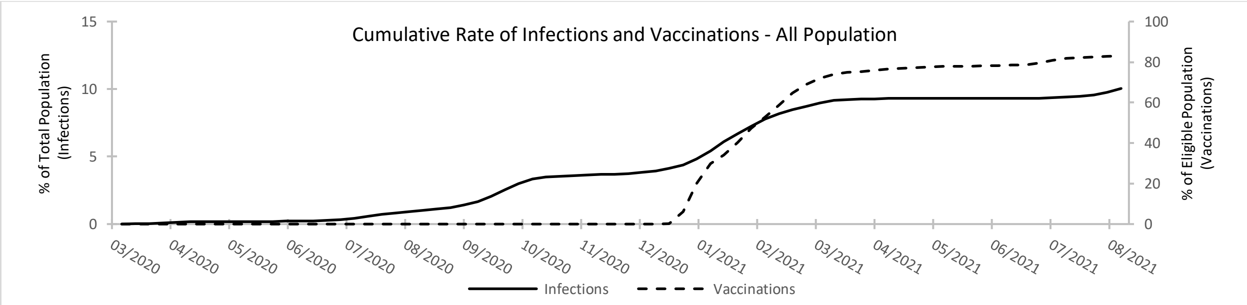
Notes: Table 3 presents results obtained from the panel estimation of Equations (1) with the 8-week sample of the fourth (Delta) wave, June 15, 2021 to August 14, 2021.

Figure 1: Cumulative Rates of COVID-19 Infections and Vaccinations (Total and by Political Belief Group) and Average Vote Rate for Political Parties by Political Groups

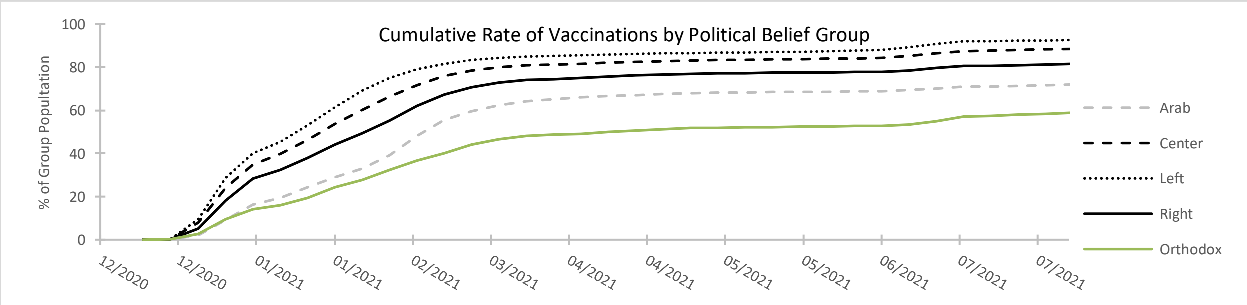
(A)



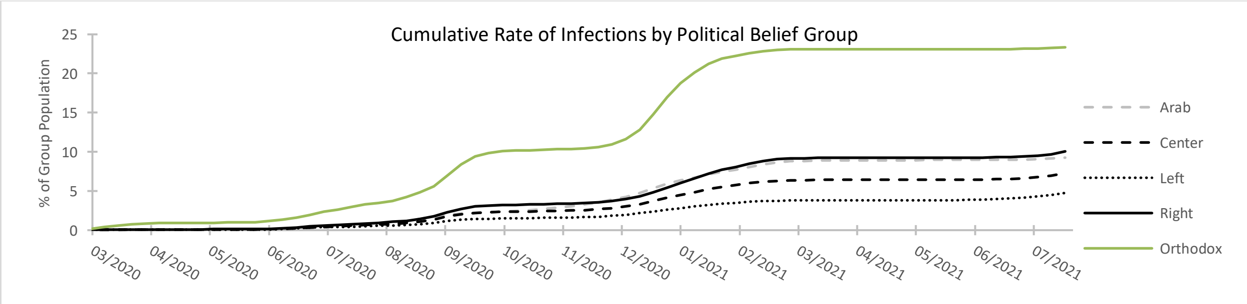
(B)



(C)



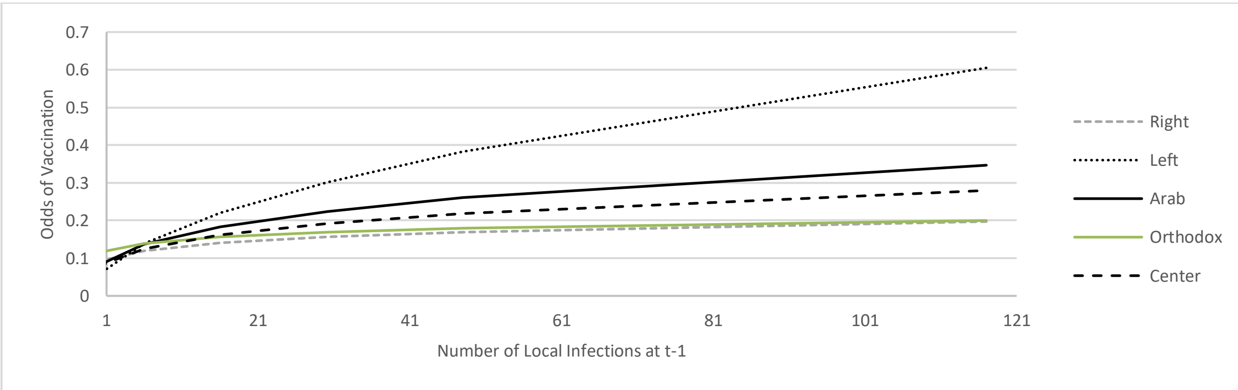
(D)



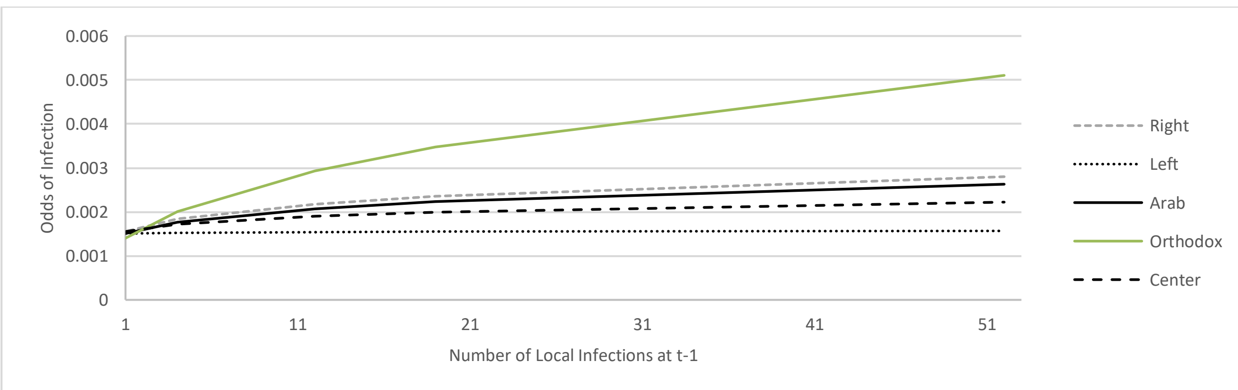
Notes: Figure A shows the average vote share in the 2020 national elections of each party by political worldview and belief; Figure B shows cumulative rates of COVID-19 vaccinations and infections for the entire population; Figure C shows cumulative rates of vaccination by belief group; and Figure D shows cumulative rates of infection by belief group.

Figure 2: Estimated Belief Group Odds of Vaccination and Infection by Lagged Infections (Panels A and B, respectively) and Odds of Infection Response to Policy Closure (Panel C)

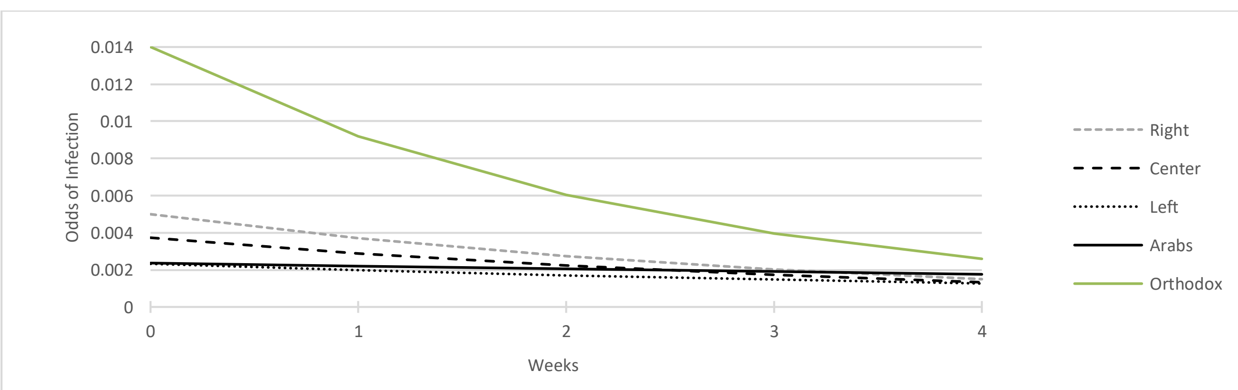
(A)



(B)



(C)



Notes: Figures A and B respectively present estimated political belief group average vaccination and infection odds by $Infections_{t-1}$, where the latter ranges from 1st – 99th percentile of its sample distribution. Figure C presents the sum $\bar{Y}_{i0}I_i + \hat{\gamma}_2 t + \vec{\hat{\gamma}}_3 I_i \times t$ for all I and t=0,1,…,4 from estimates in column 8 of Table 2—in odds terms—where $\bar{Y}_{i0}I_i$ is the group average odds of infections at the beginning of the closure.

Appendix Tables

Table A1: Results of Control Variables included in the Estimation of Equations (1) and (2)

Column	**(1)**	**(2)**	**(3)**	**(4)**	**(5)**	**(6)**	**(7)**	**(8)**
Outcome Term	**Vac**	**Vac**	**Vac**	**Infections**	**Infections**	**Infections**	**Infections**	**Infections**
Pop		-4e-06	-2.6e-05		-5e-06	-1.6e-05	-1.6e-05	-3e-05
		(8e-06)	(8e-06)		(2e-06)	(3e-06)	(2e-06)	(6e-06)
Density		-9e-06	8e-06		2e-06	0.0	0.0	1e-06
		(3e-06)	(3e-06)		(1e-06)	(0.0)	(0.0)	(1e-06)
SES		0.349	0.407		-0.090	-0.055	-0.066	-0.172
		(0.049)	(0.047)		(0.011)	(0.008)	(0.009)	(0.021)
ProximityTA		-0.015	-0.022		0.013	0.010	0.009	0.052
		(0.021)	(0.020)		(0.004)	(0.003)	(0.004)	(0.009)
*Age*60		0.702	0.813		-0.124	-0.183	-0.238	0.048
		(0.460)	(0.456)		(0.071)	(0.073)	(0.066)	(0.157)
*Age*15		0.928	0.981		-0.296	-0.196	-0.299	-0.064
		(0.526)	(0.497)		(0.121)	(0.104)	(0.116)	(0.253)
PersonHH		0.049	0.047		0.025	0.016	0.013	0.035
		(0.037)	(0.035)		(0.010)	(0.007)	(0.008)	(0.018)
RoomsHH		0.129	0.159		-0.007	0.014	0.021	0.062
		(0.150)	(0.146)		(0.035)	(0.029)	(0.028)	(0.051)
NonVoter		-1.542	-1.212		-0.705	-0.371	-0.602	-0.867
		(0.305)	(0.301)		(0.133)	(0.101)	(0.113)	(0.189)
Controls	No	Yes	Yes	No	Yes	Yes	Yes	Yes
N	25,650	25,650	25,650	51,300	51,300	51,300	27,000	6,750
# of weeks	19	19	19	39	38	38	20	5
Prob(F)	0	0	0	0	0	0	0	0
R2-overall	0.039	0.058	0.178	0.113	0.126	0.468	0.481	0.747

Notes: Table A1 provides estimates of *X* vector control variables from equations (1) and (2) omitted from Table 2 for purposes of brevity.

Table A2: Results from the Estimation of Equations (1) and (2) – Replacing Belief Fixed-Effects with Continuous Belief Terms

Column	**(1)**	**(2)**	**(3)**	**(4)**	**(5)**	**(6)**	**(7)**	**(8)**
Outcome Term	**Vac**	**Vac**	**Vac**	**Infect**	**Infect**	**Infect**	**Infect**	**Infect**
Constant	-1.944	-2.320	-3.236	-6.876	-6.496	-6.517	-6.409	-6.216
	(0.073)	(0.375)	(0.370)	(0.007)	(0.113)	(0.082)	(0.100)	(0.202)
RightCont	-0.608	-0.148	0.249	0.154	0.133	-0.023	0.011	0.769
	(0.142)	(0.188)	(0.218)	(0.016)	(0.038)	(0.029)	(0.031)	(0.163)
OrthodoxCont	-1.145	-0.293	0.393	0.755	0.687	-0.232	-0.142	0.749
	0.103	(0.305)	(0.299)	(0.021)	(0.063)	(0.053)	(0.053)	(0.205)
ArabCont	-0.826	-0.090	0.068	0.227	0.205	-0.056	-0.056	-0.161
	(0.135)	(0.236)	(0.316)	(0.023)	(0.049)	(0.038)	(0.037)	(0.153)
$Infections_{t-1}$			0.515			-0.051	-0.021	0.077
			(0.041)			(0.018)	(0.018)	(0.028)
$RightCont \times Infections_{t-1}$			-0.422			0.250	0.177	0.204
			(0.068)			(0.029)	(0.033)	(0.051)
$OrthodoxCont \times Infections_{t-1}$			-0.403			0.480	0.434	0.431
			(0.042)			(0.020)	(0.021)	(0.045)
$ArabCont \times Infections_{t-1}$			-0.201			0.236	0.212	0.155
			(0.081)			(0.023)	(0.028)	(0.045)
t								-0.082
								(0.013)
$RightCont \times t$								-0.308
								(0.027)
$OrthodoxCont \times t$								-0.377
								(0.018)
$Arab \times t$								0.013
								(0.030)
Controls	No	Yes	Yes	No	Yes	Yes	Yes	Yes
N	25,650	25,650	25,650	51,300	51,300	51,300	27,000	6,750
# of weeks	19	19	19	39	38	38	20	5
Prob(F)	0	0	0	0	0	0	0	0
R2-overall	0.043	0.058	0.181	0.125	0.132	0.465	0.482	0.756

Notes: Table A2 presents results from estimations of Equations (1) and (2), replacing the belief fixed-effects with continuous belief terms including: $RightCont$, $OrthodoxCont$, and $ArabCont$, where those terms represent the share of votes in each statistical area for right-leaning, orthodox, and united Arab parties, respectively.

Table A3: Results of Estimation of Equations (1) and (2) – Replacing $Infections_{t-1}$ with either $Hospitalization_{t-1}$ or $Infections_{t-2}$

Column	**(1)**	**(2)**	**(3)**	**(4)**	**(5)**	**(6)**	**(7)**	**(8)**
Outcome Term	**Vac**	**Infect**	**Infect**	**Infect**	**Vac**	**Infect**	**Infect**	**Infect**
Constant	-2.506	-6.403	-6.347	-4.782	-3.047	-6.539	-6.415	-5.568
	(0.329)	(0.090)	(0.106)	(0.263)	(0.328)	(0.081)	(0.099)	(0.205)
Left	-0.156	-0.047	-0.044	-0.697	-0.309	0.064	0.014	-0.277
	(0.089)	(0.016)	(0.015)	(0.051)	(0.097)	(0.014)	(0.015)	(0.069)
Center	-0.014	-0.020	-0.025	-0.241	-0.060	0.037	0.019	-0.034
	(0.047)	(0.008)	(0.009)	(0.042)	(0.053)	(0.008)	(0.009)	(0.072)
Orthodox	0.019	0.145	0.154	0.677	0.382	-0.177	-0.164	-0.113
	(0.121)	(0.027)	(0.031)	(0.085)	(0.130)	(0.023)	(0.027)	(0.151)
Arab	0.001	-0.070	-0.110	-1.096	-0.172	-0.013	-0.060	-1.042
	(0.131)	(0.020)	(0.022)	(0.097)	(0.217)	(0.018)	(0.017)	(0.135)
Z	0.037	0.129	0.082	0.124	0.195	0.117	0.095	0.184
	(0.021)	(0.014)	(0.023)	(0.022)	(0.018)	(0.007)	(0.008)	(0.017)
Left×*Z*	0.599	-0.213	-0.167	-0.041	0.215	-0.151	-0.118	-0.161
	(0.139)	(0.031)	(0.050)	(0.045)	(0.047)	(0.013)	(0.014)	(0.028)
Center×*Z*	0.098	-0.076	-0.075	0.002	0.055	-0.063	-0.066	-0.070
	(0.040)	(0.029)	(0.033)	(0.051)	(0.019)	(0.009)	(0.010)	(0.029)
Orthodox×*Z*	0.011	0.308	0.293	0.029	-0.110	0.185	0.212	0.211
	(0.048)	(0.028)	(0.042)	(0.042)	(0.017)	(0.028)	(0.015)	(0.036)
Arab×*Z*	0.255	0.010	0.126	0.006	0.147	-0.023	0.009	0.009
	(0.106)	(0.036)	(0.062)	(0.073)	(0.065)	(0.016)	(0.021)	(0.044)
t				-0.375				-0.377
				(0.006)				(0.007)
Left×*t*				0.191				0.192
				(0.010)				(0.010)
Center×*t*				0.054				0.054
				(0.010)				(0.011)
Orthodox×*t*				-0.113				-0.167
				(0.016)				(0.015)
Arab×*t*				0.237				0.268
				(0.026)				(0.025)
Controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
N	25,650	51,300	27,000	6,750	25,650	49,950	27,000	6,750
# of weeks	19	38	20	5	19	37	20	5
Prob(F)	0	0	0	0	0	0	0	0
R2-overall	0.070	0.173	0.199	0.702	0.147	0.324	0.352	0.720

Notes: Table A3 presents results obtained from re-estimating equations (1) and (2), replacing $Infections_{t-1}$ with either $Hospitalization_{t-1}$ or $Infections_{t-2}$. The variable Z represents $Hospitalization_{t-1}$ and $Infections_{t-2}$ in columns 1–4 and 5–8, respectively. Column 1 and 2 (5 and 6) respectively present outcomes from the estimation of the vaccination and infection equations (1) for the full sample; column 3 (7) presents results from the estimation of the infection equation (1) for the period May 10 – September 20 2020, between the first and second rounds of closure; and column 4 (8) presents results from the estimation of equation (2) for the closure period sample. For the sake of brevity, results for the control vector X are omitted and available upon request.

Table A4: Results of Control Variables included in the Estimation of Equations (1) for Delta Variant Sample

Column	**(1)**	**(2)**	**(3)**	**(4)**	**(5)**	**(6)**
Outcome Term	**Vac**	**Vac**	**Vac**	**Infections**	**Infections**	**Infections**
Pop		7e-06	5e-06		2e-06	-1.7e-05
		(1.2e-05)	(1.2e-05)		(4e-06)	(5e-06)
Density		-8e-06	8e-06		-3e-06	-2e-06
		(3e-06)	(3e-06)		(1e-06)	(1e-06)
SES		0.599	0.592		0.210	0.094
		(0.066)	(0.067)		(0.023)	(0.018)
ProximityTA		-0.232	-0.019		0.136	0.075
		(0.025)	(0.024)		(0.014)	(0.009)
*Age*60		3.527	3.451		0.392	0.991
		(0.503)	(0.498)		(0.260)	(0.219)
*Age*15		2.694	2.751		-0.000	0.097
		(0.540)	(0.531)		(0.242)	(0.195)
PersonHH		0.111	0.123		0.059	0.045
		(0.049)	(0.048)		(0.017)	(0.013)
RoomsHH		0.004	0.030		0.209	0.118
		(0.179)	(0.178)		(0.074)	(0.059)
NonVoter		-2.132	-2.074		0.180	-0.010
		(0.304)	(0.302)		(0.096)	(0.008)
Controls	No	Yes	Yes	No	Yes	Yes
N	10,800	10,800	10,800	10,800	10,800	10,800
# of weeks	8	8	8	8	8	8
Prob(F)	0	0	0	0	0	0
R2-overall	0.066	0.234	0.236	0.107	0.141	0.536

Notes: Table A4 provides estimates of *X* vector control variables from the estimation of equations (1) for Delta sample (June 15 – August 14, 2021), omitted from Table 3 for purposes of brevity.