TAUB CENTER
FOR SOCIAL POLICY STUDIES IN ISRAEL

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Policy Paper No. 05.2021

Jerusalem, October 2021

Taub Center for Social Policy Studies in Israel

The Taub Center was established in 1982 under the leadership and vision of Herbert M. Singer, Henry Taub, and the American Jewish Joint Distribution Committee. The Center is funded by a permanent endowment created by the Henry and Marilyn Taub Foundation, the Herbert M. and Nell Singer Foundation, Jane and John Colman, the Kolker-Saxon-Hallock Family Foundation, the Milton A. and Roslyn Z. Wolf Family Foundation, and the American Jewish Joint Distribution Committee.

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Introduction

After 18 months of struggle with Covid-19, and with more than 7,800 confirmed deaths, the "delta" variant still casting a shadow, and an unknown number of variants still ahead of us, it is time to summarize — for now — key patterns of Covid's trajectory through Israeli society. The particular questions we focus on are how much infections, testing, and hospitalizations have varied across Israel's towns and cities, and across its main subpopulations.[1]

This is, of course, a sensitive topic. First, it taps into the internal "tribal" divisions that, in the eyes of many, represent one of the critical challenges facing Israel. From the earliest days of the epidemic, political players and commentators bayed about elevated levels of infection in Haredi populations. From late summer 2020, concerns were also voiced about elevated levels of infection in Arab and Bedouin communities. In both cases, at least some of the assertions about these differences were framed as "blame discourses." That is, they ascribed at least partial responsibility for the rapid spread of Covid within Israel, and the subsequent closures, to these groups. Needless to say, blaming already unpopular groups is a common phenomenon in epidemics (Herlihy, 1997:64–66; Pullan 1992).

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1 We do not address differences in mortality in this paper since, in an effort to anonymize these data, the government has rendered them unusable in statistical small areas — we detail this problem below.

A second reason that looking at differences across Israel's diverse sectors is sensitive is specific to Haredim. The assertion that levels of infections are higher in Haredi communities, and that these communities have served as a reservoir of infection that has spilled over into other sectors, echoes a more general critique of Haredi attitudes to other sectors.[2] Such assertions also evoke two core motifs in the antisemitic imaginary: the idea that Jews — most visibly represented by Haredim in popular imagination — are diseased; and that they spread disease, wittingly or otherwise.[3]

As in other areas of research at the Taub Center, we do not avoid a topic simply because it is sensitive. Rather, we attempt to treat it neutrally and comprehensively, and in that way to provide a robust empirical cornerstone on which responsible discourse can be built. In this case, treating this question neutrally and comprehensively means doing two things, as reflected in the structure of the paper.

First, we seek to identify the magnitude of these differences between sectors. What statisticians call an "alternative hypothesis" is that higher rates of infection affected only a few towns or cities within each sector and that these were cherry-picked to further political players' personal or professional interests.[4] To compare sectors in a valid manner, we therefore focus not only on variation across all yishuvim associated with a given sector (e.g., all Haredi or Bedouin yishuvim), but we also look at three discrete measures: testing per capita, an indicator of societal response to Covid-19; confirmed infections per capita, an indicator of overall prevalence; and hospitalization per capita, an indicator of the overall impact of the virus on population health.

2 Since only about 50% of Haredi working-age men are in the labor force, of Israel's constituent tribes, Haredi families are the most dependent on the welfare system, earning less income and also receiving more exemptions from local taxes. These economic concerns compound tensions associated with Haredi avoidance of military service.

3 In classical pre-Christian and Christian antisemitism, disease-racked Jews were seen to embody their divine punishment and spiritual diminishment (Schäfer, 1997). Since at least the 12th century, there were also widespread assertions that Jews poisoned wells and, from the Black Death onwards, intentionally spread disease (Wistrich, 2010).

4 Like the Central Bureau of Statistics (CBS), we relate to all types of localities, including towns and cities, as yishuvim.

Second, we need to consider the counter-claims of these sectors' defenders. Some have pointed to the effects of poverty on group levels of infection. Poverty is associated with crowding within a given household and neighborhood, which raises the likelihood of infection. Poverty also increases the need to work — which often pulls people into contact with others — and reduces the incentive to be tested where a positive test result means mandatory quarantine. Each of these would also raise the likelihood of more widespread patterns of infection.

Others have pointed to differences in access to testing, and to differences in other health services that have affected the prevalence of health conditions — especially heart disease and diabetes — that we now know increase the likelihood of experiencing a severe case of Covid. Others, still, have pointed to the effects of age structure: the elderly are at much greater risk of death from Covid, so areas with a greater concentration of elderly may have experienced higher levels of conformity with preventative measures like mask-wearing and social distancing, or higher levels of testing as people became more wary of infecting elderly neighbors.

To fairly address differences in levels of testing, infections, and hospitalizations across sectors, analyses must therefore control for the effects of poverty, population density, and age structure, alongside related variables — detailed below — that improve our identification of these relationships. Inserting such controls also allows us to gauge how much the effects of poverty, population density, and age structure remain once we adjust for sectoral differences.

This study of sectoral differences in Covid-19 complements two others that appeared in early 2021, one by the Bank of Israel (BOI, 2021) in its annual report on 2020 (see especially pp. 252–257), and the other by a team of epidemiologists and public health researchers (Muhsen et al.,2021). In addition to the fact that we use a much longer series of data, this study also differs from those preceding studies in important ways. First, we include a long descriptive section in which we eyeball patterns of testing, infection, and hospitalizations both across *and* within yishuvim. Only then do we proceed to a multivariate analysis. Second, where the focus of the BOI study was on individual-level probability of infection and hospitalization, this one, like that of Muhsen et al., is on differential rates across yishuvim. We think that this provides a fuller representation of inequality in terms of access to services, both because of "program placement" issues (i.e., politically favored towns or areas receive more public investment and services), and because it allows us to discuss variation within a given sector in a fuller way. Third, we define sectors differently. Whereas both BOI and Muhsen et al. combine Bedouin and non-Bedouin into a single Arab sector, we distinguish them, which facilitates a finer-grained focus on sectoral differences. In fact, this approach allows us to confirm that there were significant differences in per capita levels of testing, infection and hospitalization between Israel's Bedouin and non-Bedouin Arab communities.

Finally, our multivariate regression analyses are structured quite differently to those reported in Muhsen et al. (2021). Their estimates do not account for variation across yishuvim in Covid testing or variation in age structure — only in their model of mortality is there a control for median age. Likewise, they attempt to identify the effects of yishuv socio-economic status (henceforth SES) on cumulative incidence without controlling for factors that are associated with SES (like population density, measures of inequality and other factors discussed below). As a result, their estimates are highly susceptible to "omitted variable bias."

Three main sets of results emerge from this analysis. First, net of controls for population sector, low-SES towns and cities in Israel experienced lower rates of Covid testing but higher rates of Covid infection and hospitalization. On the other hand, these relationships with SES were not linear. For example, testing rates were highest in medium SES communities, not the highest SES. Second, cumulative infection rates were also higher in both larger and more densely populated yishuvim — the latter was also positively associated with higher rates of hospitalization — though they were lower in yishuvim with an older age structure.

Third, adjusting for a range of yishuv-specific characteristics, including poverty and population density, explains some sectoral differences, including more than 90% of the differences in cases per capita between Arab, Druze and non-Haredi Jewish yishuvim, and a large share of the differences in hospitalization rates. But even after adjusting for differences in these yishuv-specific characteristics, some very substantial sectoral differences in Israel remain. Most notably, after those adjustments, the relative risk of confirmed **infections** in Haredi communities was 2.4 times as high as in non-Haredi Jewish yishuvim. The relative risk of infection was also 1.2 and 1.3 times higher in Arab (non-Bedouin) and Druze yishuvim, respectively, than in non-Haredi Jewish yishuvim. This was in spite of more widespread **testing** in Jewish yishuvim — Haredi and non-Haredi — than in all other types: testing was 26% lower in Arab yishuvim and 50% lower in the Bedouin sector after adjusting for effects of SES and other factors. Finally, levels of **hospitalizations** in non-Haredi Jewish yishuvim are a little more than half of the levels seen in Arab, Druze and Haredi yishuvim.

These findings are important for at least two reasons. The first is that they help us explain national trends, in part by allowing us to evaluate competing narratives about the trail that coronavirus has beaten through the different parts of Israeli society.

The second is that they have implications for policy interventions, since they direct our attention to two classic problems in public health that come into especially sharp relief when a new infectious disease is spreading: how to address behavioral non-compliance; and how to address problems of access to basic services. Covid's spread through Israel this past year suggests — as we show below — that the first of these was more of a problem in the Haredi sector, and the second was more of a problem in the Arab and Bedouin sectors. When Israel confronts the next epidemic, or a resurgence of an aggressive new Covid variant, this difference between behavioral non-compliance and problems of access needs to be borne in mind.

Data

We use Covid data released through the government's Covid-19 portal.[5] It includes daily and cumulative measures of testing, infections, and hospitalizations by town from the beginning of the pandemic up to September 29, 2021.[6] We combine these with several other town-specific characteristics measured in 2018, that is, prior to the outbreak of the epidemic. We describe each below, but the three principal ones are:

1. A Central Bureau of Statistics (CBS) measure of the town's general socioeconomic status (SES), known as the eshkol. It runs from 1 to 10, where low scores reflect poor yishuvim and high scores wealthy yishuvim.[7]

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5 Government portal, COVID-19 Dataset.

6 Above approximately 18,000 residents, the data on these yishuvim is reported for a number of statistical areas ("agas") within the town. In the larger cities, each agas includes around 6,800 people. To generate totals for the whole town, we sum scores for all agasim within the town.

7 This is a composite of income, wealth, education, employment and other demographic characteristics, constructed by the Central Bureau of Statistics. For specific information, refer to CBS, 2019.

2. Population density, that is, the number of people per square kilometer.
3. The percent of the yishuv's population that is aged at least 65.

Our dataset includes 205 yishuvim in Israel. All yishuvim with more than 10,000 people, as of mid-2020, are in the data. So, too, are 67 yishuvim with less than 10,000 people for which data on population density, the eshkol, and the Gini coefficient (a measure of income inequality) are also available. Together, the data include yishuvim with 8.02 million people, about 88% of Israel's population in mid-2020.[8]

Using each yishuv's total population in mid-2020 — as it appears in the Covid-19 files — we generated measures of cumulative cases, tests, and hospitalizations per 100,000 residents up to April 8, 2021. We then categorized each of the 205 yishuvim into one of seven groups, based on the town's dominant population:

1. Jewish (less than 25% Haredi): 108 yishuvim
2. Arab (excluding Bedouin): 53 yishuvim
3. Druze: 16 yishuvim
4. Bedouin: 11 yishuvim
5. Haredi (over 90% Haredi): 9 yishuvim
6. Mixed Jewish/Arab (at least 10% Arab): 5 yishuvim
7. Mixed Haredi/non-Haredi (Haredim are 25%–90%): 3 yishuvim

The full listing of these yishuvim by category is in Appendix 1. Note that the boundaries around some of these categories are clearer and cleaner than others. For example, the population in yishuvim categorized as either Haredi or Bedouin are almost 100% Haredi or Bedouin. In contrast, the general Jewish category includes many yishuvim with a non-negligible Haredi population. Examples include Ashdod, Netivot, Givat Ze'ev, Tiberias. Likewise, the Druze sector also includes Majar (a.k.a. Mu'ar), which is roughly 50% Arab, and

8 Data on the eshkol and Gini coefficient were unavailable for 55 yishuvim in the Ministry of Health file. These were all much smaller yishuvim: their average population in 2019 was 2,821, as opposed to 39,146 for those with data. The largest of these excluded yishuvim had 4,837 people (Talmon). In addition, data on total yishuv area were unavailable for three yishuvim, Geva Benyamin (Adam) and Kochav Yaakov in Mate Binyamin, and Sha'arei Tikva in the Shomron, making population density measures impossible to estimate. They were therefore assigned the mean population density of yishuvim of their size. With or without these three, results are substantively identical.

Kfar Kama, which is Circassian, not Druze. The Arab category also reflects the heterogeneity of that sector. It includes yishuvim that are predominantly Muslim, predominantly Christians (of varied denominations), and also one Alawite town (Ghajar) that, as described below, is a notable Covid-19 outlier.

It is also important to note a key limitation of the publicly released Covid files that may marginally affect our estimates of hospitalizations by sector, though not our estimates of cases or tests. Specifically, in order to anonymize the data, the government codes any statistical area (agas) in which there are 1–14 events — tests, cases, hospitalizations, or deaths — as having "less than 15." Only above that can we see the area's true number. Since, as noted in footnote 6, statistical areas within cities have around 6,800 residents — with almost 40 yishuvim in the sample having a smaller population than this — this "less than 15" rule does not affect local cumulative estimates of cases and tests, since those are high in all areas of the country. However, given that the mean cumulative rate of hospitalizations by September 2021 was 444 per 100,000 people, this limitation does suggest that we are missing hospitalization cases in smaller areas.[9] More generally, this anonymization procedure completely undermines any analysis of deaths across sectors in these data — this is the reason that we do not cover that at all, notwithstanding the centrality of that measure for understanding the impact of the pandemic in Israel.[10]

General patterns

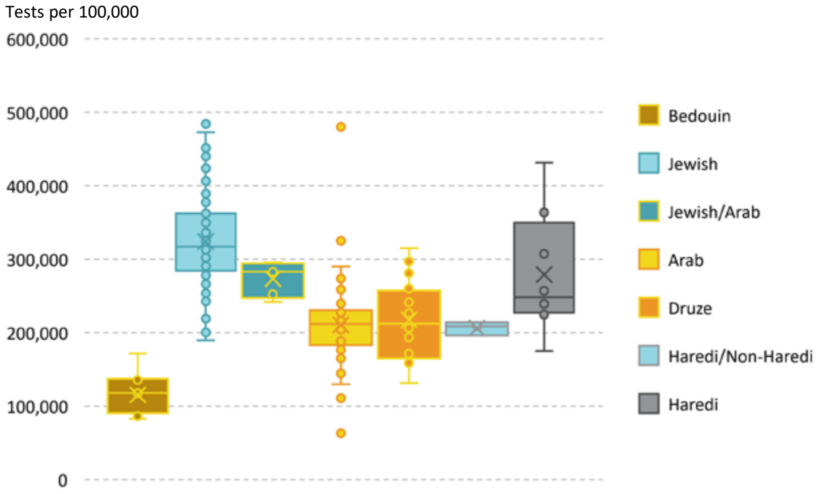
A. Testing

We describe general patterns using "box plots," focusing on per capita measures of tests, confirmed cases, and hospitalizations across all 205 yishuvim in the sample. With each box plot, the "X" in the middle of the box is the mean value, the horizontal line indicates the median, the upper and lower edges of the box cover the interquartile range (IQR) — that is, the range from the 25th–75th percentile value — and the vertical line extending from the end of each box is a measure of variance (1.5 X IQR). Isolated data points beyond those vertical lines are outliers.

9 For example, in a yishuv with 5,000 residents, "less than 15" could range from a low hospitalization rate of 20 per 100,000 residents (1 person hospitalized) to a high of 280 per 100,000 hospitalized (14 people hospitalized).

10 In their analysis of sectoral differences in Covid deaths, Muhsen et al. (2021) took a different approach. They restricted their analysis to 65 yishuvim.

Figure 1. Cumulative testing per 100,000 in 205 yishuvim, by sector



Source: Alex Weinreb, Taub Center | Data: Government portal, Covid-19 Dataset

As of September 29, 2021, Israel's overall cumulative rate of Covid tests since the beginning of the pandemic had reached 270,000 per 100,000 people, or 2.7 tests per person. Yet as shown in Figure 1, rates varied significantly across sectors and within each sector.

Overall, testing rates in Bedouin yishuvim were the lowest by far, averaging a mere 115,000 tests per 100,000 people. All but one Bedouin yishuv, the relatively small Basmat Tab'un, were among the lowest 15 yishuvim in terms of testing (alongside four Arab and one Druze yishuv). In Rahat, the largest city in the Bedouin sector, testing reached 85,000 per 100,000 people.

Testing per capita was a little lower in the five mixed Jewish/Arab towns in the sample. All fell in a narrow range between 242,000–296,000 tests per 100,000 people. The average was marginally lower in Haredi yishuvim — 264,000 tests per 100,000 — but there was also very substantial variation around that mean. Kfar Habad — averaging 4.3 tests per person—had one of the highest testing rates in the country. Kiryat Ye'arim, which was credited with taking relatively aggressive steps to curb infection during the first wave in April 2020, was also high. Yet rates in Beitar Illit, a predominantly Hasidic Haredi city that also boasts the highest fertility rates (and youngest age structure) of any Israeli yishuv, were very low: only 150,000 tests per 100,000.

Testing levels were also lower than the national average in Arab yishuvim, averaging 210,000 per 100,000 people. Here, too, there was substantial variation around that mean. The second highest testing levels in the country — exceeding 480,000 per 100,000 people — were in Abu Gosh and Me'ilya. Aylboon, Dvurya, and Abu Snaan rounded out the top five, all with more than 260,000 tests per 100,000 people. Yet, unlike in the Jewish sector, nothing appears to unite these "top testers" in the Arab sector: Abu Gosh is a relatively wealthy yishuv to the west of Jerusalem; Me'ilya is in the upper Galil and is one of only two yishuvim in Israel with a Melkite-Eastern Catholic majority; Aylboon, Dvurya, and Abu Snan are all in the Galil, though the first is majority Christian, the second Muslim; and the last mixed Muslim, Christian, and Druze.

Testing rates in the Druze sector were very similar to those in the Arab sector: 217,000 per 100,000 people. Interestingly, variation within this sector appears to be strongly correlated with location, though that also reflects particular communities' relationship to the state. Average testing rates in Druze yishuvim in the Galil are 239,000 per 100,000 people; in the Golan they are 153,000 per 100,000 people. This looks similar to the pattern of lowest testing levels in the Arab sector: a mere 63,000 per 100,000 residents in Ghajar, which, as noted earlier, is the only Alawite yishuv in Israel.

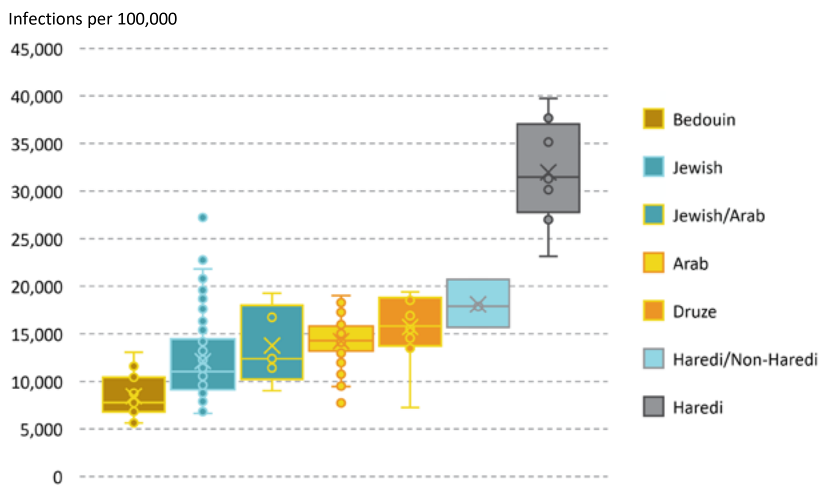
B. Infections

Variation in confirmed infections (Figure 2) had a somewhat similar pattern. Here, too, we see that the cumulative percent infected was lowest in the Bedouin sector — around 8.4% — and highest in the Haredi sector — around 31.0%. In fact, not a single yishuv in either of these sectors overlapped with the national (unweighted) mean of 13.7%.

The Haredi sector, in particular, was an outlier. Out of the 205 yishuvim in the sample, the top six in terms of confirmed infections were in the Haredi sector. Rekhasim and Beitar Illit led the pack with 39.7% and 37.7% infection rates, respectively. In Bnei Brak, the largest yishuv in the sector, 30.1% of the population were infected. The lowest levels of infection in this sector (22.7%) were in Emanuel, the smallest Haredi yishuv. Overall, all nine Haredi yishuvim in our sample had higher confirmed infection levels than 193 of the 196 non-Haredi yishuvim in the sample. In a global comparison, if the Haredi yishuvim were a sovereign state, its level of infection would have been more than twice as high as that of any other country in the world. This is in spite of the fact that a number of Haredi yishuvim had low or average testing levels —

the multivariate analysis in the following section confirms that testing levels are an important explanatory factor for understanding confirmed infections.

Figure 2. Cumulative infections per 100,000 in 205 yishuvim, by sector



Source: Alex Weinreb, Taub Center | Data: Government portal, COVID-19 Dataset

Outside the core Haredi sector, infection levels were also highly correlated with the percent of the population that is Haredi. We see this in Figure 3, which shows the confirmed infection rate by percent of the yishuv's children of primary-school age that were in Haredi schools as of May 2020, with attention limited to Jewish or mixed towns that are not Haredi (groups 1, 6 and 7 above).[11] The data show that the 10 yishuvim with the lowest infection rates had zero percent of students in Haredi primary schools. The 10 with the highest infection rates had 45.6% of students in Haredi primary schools.

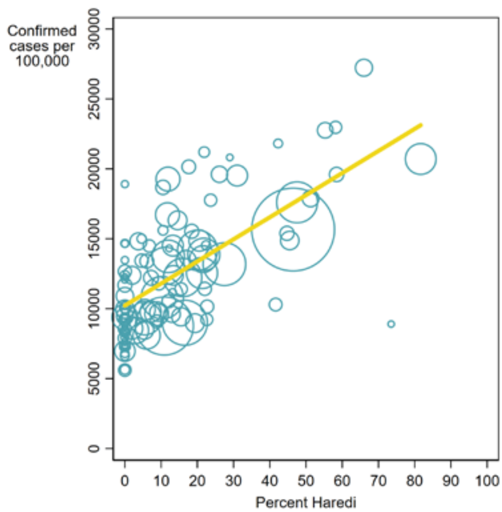
11 These data are from the Ministry of Education's Student Dataset. It lists the school and school type attended by every child in Israel. Since survey data are not available at the yishuv level below around 50,000 residents, this is the easiest and most accurate way to identify variation in Haredi residential patterns (note: to identify the number of households in a given yishuv that are Haredi, these data would need to be adjusted for the percent of childless households of different types, and households with co-resident children not in school).

More formally, a bivariate regression (weighted by town population, as represented by the different sized circles in Figure 3) shows that for every additional percent of the yishuv's children that, as of May 2020, were in a Haredi educational stream — in non-Haredi towns — there were 131 additional confirmed Covid cases per 100,000 residents. This single variable statistically accounts for 41% of the variability (R^2) in final Covid infection rates in April 2021. That is a high R^2 for a bivariate regression in a sample size exceeding 100.

Variation in infection levels in the Arab sector — higher than average overall, despite the lower rates of testing — provides a different set of associations. The five yishuvim with the highest infection levels — all above 17% — were Kfar Qasim, Abu Gosh, Ma'ale Iron, Deir Hanna, and Majd al-Krum. They have no obvious shared characteristics. The first is in the Sharon, The second is to the west of Jerusalem, and the remaining three are in different areas of the North. In contrast, the two least infected Arab yishuvim — Gisr A'Zarka and Ghajar, each with infection levels below 8% — are more geographically, and potentially also socially, peripheral. Gisr A'Zarka, one of the poorest municipalities in Israel, is the only remaining Arab town on Israel's coast. Ghajar sits on the Lebanese border — literally, since it is divided by the border — and is the only Alawite yishuv in Israel. There are hints in these low infection levels of the protective value of community-level social isolation.

Interestingly, the confirmed infection levels in Bedouin yishuvim were more than 40% lower than that of Arab and Druze yishuvim, though as we show in multivariate models below, this is at least partly the result of lower levels of testing seen in Figure 1.

Figure 3. Confirmed Covid cases per 100,000 in non-Haredi yishuvim, by percent of children of primary school age registered at a Haredi school



Source: Alex Weinreb, Taub Center | Data: Government portal, COVID-19 Dataset; Ministry of Education, Student Inventory

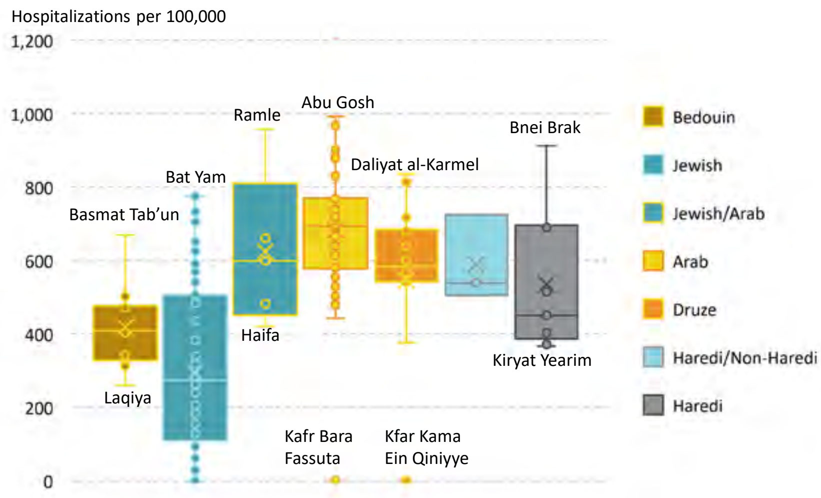
C. Hospitalizations

Variation in per capita rates of hospitalization (Figure 4) tap into a different perspective on the impact of Covid on Israeli society. Whereas confirmed cases per capita is sensitive to the number of tests conducted, hospitalizations typically only include the minority of cases that progress into a severe clinical stage. The most notable risk factors for this type of progression are age, preexisting heart disease and diabetes, and obesity.

The patterns in Figure 4 are largely consistent with the distribution of risk factors across Israel's different sectors. This is also the reason that hospitalization patterns across sectors look so different from tests and cases shown in Figures 1 and 2. In particular, notwithstanding the much higher rates of infection in Haredi yishuvim, Arab yishuvim had much higher average rates of hospitalizations. Of the top 20 yishuvim in terms of rates of Covid hospitalization in Israel, 14 were Arab yishuvim. Abu Gosh topped the list in terms of hospitalization: 1.2% of the population had been hospitalized.

Of the remaining five non-Arab yishuvim in this top 20, two were Jewish (Bat Yam and Kiryat Ata), one was Haredi (Bnei Brak), and one was a mixed Jewish-Arab city (Ramle).

Figure 4. Cumulative hospitalizations per 100,000 population in 205 yishuvim, by sector



Source: Alex Weinreb, Taub Center | Data: Government portal, COVID-19 Dataset

Differential risk factors across sectors appear to explain this variability. For example, the risk of hospitalization in the Haredi population was much lower in general than implied by the infection levels because only a small percentage of Haredi population in these yishuvim is aged at least 65: a mere 1.0% in Modi'in Illit, 1.3% in Beitar Illit, 2.0% in El'ad (the national average is 14%). In Bnei Brak, in contrast, 8.2% of the population is aged at least 65. As a result, and in conjunction with the high incidence of infections in Bnei Brak, Covid hospitalization rates there were among the highest in the country: 0.9% of its population had been hospitalized.

The high rates of hospitalization in Arab yishuvim, in contrast, reflected both the high rates of Covid infection at older ages relative to other sectors (BOI, 2021, p.255), but also the higher prevalence of preexisting health conditions — especially Type II Diabetes and obesity — thought to be around three times as high in the Arab as in the Jewish sector. These high rates offset the fact that, relative to the non-Haredi Jewish population, a relatively low percentage of the Arab population is elderly.

Finally, the higher-than-expected rates of hospitalization in the Bedouin sector relative to the non-Haredi Jewish sector (0.42% of the population versus 0.29%, respectively) reflected both higher prevalence of preexisting conditions, and also the fact that low testing levels — seen in Figure 1 — hide infections more than in any other population in Israel.

D. Summary

The general pattern of Covid testing, infections, and hospitalizations — thus far unadjusted for other yishuv characteristics like SES, population density, and percent elderly — points to a number of things. First and foremost, it confirms that the Haredi population experienced coronavirus differently. The cumulative rate of infection in Haredi yishuvim was 2.5 times as high as in all non-Haredi communities. There was also virtually no overlap in infection levels between Haredi and non-Haredi yishuvim: only three of 196 non-Haredi yishuvim had infection rates that overlapped with those of the nine exclusively Haredi yishuvim.

Second, and not surprising given that Covid-19 is an infectious disease, this distinct Haredi experience appeared to extend to non-Haredi yishuvim in which there is also a substantial Haredi population. Figure 3, for example, documents that infections in non-Haredi Jewish yishuvim can be largely explained by the percent of the population that is Haredi. Consistent with this, there were at least hints of diffusion from yishuvim or cities with large Haredi populations into neighboring communities. For example, infection levels were 30% higher in Ramat Gan and Givat Shmuel, which border Bnei Brak, than in Givatayim or Ramat Hasharon, which do not, even though the percent of children in Haredi schools are virtually identical across both pairs (around 5.5% in both Ramat Gan and Ramat Hasharon, and close to 0% in Givat Shmuel and Givatayim). And hospitalization rates were 2.5 as high in Ramat Gan and Gan Shmuel as in Ramat Hasharon and Givatayim. It is difficult to explain these patterns of spatial clustering in any other way than through the spillover of the coronavirus from highest-prevalence areas, in this case Haredi neighborhoods or yishuvim, to neighboring communities.

Third, assertions that the Bedouin sector as a whole experienced high levels of Covid infection are not accurate. On the contrary, on average the Bedouin sector experienced the *lowest* levels of infection. In part, as we show in the next section, that is an artifact of low levels of testing — half that of the Arab sector. But even the hospitalization data show much less impact: median levels of hospitalization in Bedouin communities were higher than those of non-Haredi Jewish yishuvim — though there was a lot of overlap in the interquartile range — but both mean and median Bedouin hospitalization levels were lower than those of five other sectors, with no overlap in the interquartile range of Arab and Druze sectors.

Finally, in the absence of data on Covid mortality by yishuv, differences in high rates of hospitalization provide us with the best measure of the epidemic's impact on Israel's population health. On this measure, non-Bedouin Arab, Druze, and mixed Jewish/Arab yishuvim have been the worst affected. In that respect, Covid is a reminder that preexisting chronic conditions, many of which are preventable at the population level, must be confronted more aggressively in those sectors.

Poverty, population density, and percent elderly: Multivariate effects

We now turn our attention to the second question: the extent to which differences in testing, infections, and hospitalizations across sectors are affected by adjusting for poverty, population density, and the percent of the yishuv's population aged at least 65. To accurately estimate these effects, we also include other town characteristics in the models: income inequality, whether the town is formally a development town, and population size.[12]

12 Models include a measure of income inequality for two reasons. The first is to more accurately identify the impact of eshkol, on which low scores index a town's low SES. One of the main components of the eshkol is income, and average income is positively associated with income inequality, confirmed here by the 0.74 correlation between these two measures across the 205 yishuvim in the sample. A secondary reason is that in developed countries, higher inequality is associated with less desirable health outcomes in general, though the specific mechanisms underlying this relationship are a matter of some debate (Pickett & Wilkinson, 2015).
An identifier of development towns is included in order to distinguish different types of yishuvim with the same relatively low eshkol — the average eshkol of development yishuvim is 4.7; the average for other yishuvim in the Jewish sector is 6.8. It may be, for example, that people in a "development town" have more accessible health services than their counterparts in yishuvim with equally impoverished populations that lack that label.
Finally, adding a discrete measure of population size to a model that already includes "Population Density" (intended to capture the increased likelihood of transmission in densely populated residential areas) taps into how interactional culture varies across yishuvim of different sizes. This is a foundational observation in sociology that is related, first and foremost, to how we interact with strangers. In simple terms, city life is largely oriented around rules navigating interaction with countless strangers. We are used to passing them without mutual acknowledgment. In smaller settings, especially those with more stable residential patterns across generations, interactional patterns are usually quite different, closer to the way that Ferdinand Tönnies (1887/1999) characterized a *gemeinschaft* society. Because Covid-19 is an infectious disease, this difference may independently affect the probability of transmission. In other words, the disadvantages of a more densely populated urban area in terms of Covid transmission may be somewhat offset by the greater cultural acceptance of avoiding interaction with strangers. We informally test this by including both population density and population size in the same model.

Analytic approach

We estimate a series of weighted OLS regressions for each of our three dependent variables: cases per capita; tests per capita; hospitalizations per capita.[13]

In each case, we apply weights within each of the seven sectors based on the proportion of the sector's population that resides in that particular town. An example from the Haredi sector is provided in Table 1. Although there are nine yishuvim in the Haredi sector — that is, yishuvim where at least 90% of the population is Haredi — 47.2% of the total population across those nine yishuvim lives in Bnei Brak, only 1.0% in Emanuel, and the remainder between these two extremes.[14] The regression weights are the share of the sector's population that lives in a given town.

Table 1. Haredi yishuvim, by total population and associated regression weight

Town	Population	Weight
Beitar Illit	61,648	0.145
Bnei Brak	200,806	0.472
El'ad	47,548	0.112
Emanuel	4,201	0.010
Kfar Habad	6,874	0.016
Kiryat Ye'arim	6,269	0.015
Kochav Yaakov	8,937	0.021
Modi'in Illit	76,971	0.181
Rekhasim	12,392	0.029
Total	**425,646**	**1.00**

13 The distribution of each of these is close to normal. As a robustness check, final models were replicated using a logged dependent variable. There were no substantive differences in results so we do not present them here.

14 To test for multicollinearity between the different variables, especially the eshkol, Gini coefficient, density per km^2 and population size, variance inflation factors (VIF) were estimated for all variables in baseline models that did not include sectoral differences. Mean VIF scores were 1.6, with the highest on any individual variable being 2.4. This is far lower than even the most conservative threshold for worrying about multicollinearity. In models with dummy identifiers for sector, the VIF score on "population size" climbed to 11.2 (correlated with Haredi/non-Haredi yishuvim). Final models, therefore, do not include population size.

Source: Alex Weinreb, Taub Center | Data: Government portal, COVID-19 Dataset

Finally, since the principal goal of these analyses is to estimate variation by sector in our three dependent variables while statistically accounting for the effects of each town's population density, socioeconomic characteristics, and percent elderly, we intentionally ignore a wider — but especially tricky — question about causal relations between sector and these town-specific measures.[15]

Results

Full regression results are provided in Appendix Tables 2–4. Each of these tables summarizes the relationship between the yishuv-specific characteristics and one of the three dependent variables across sector (Model 1), across the other explanatory variables (Model 2), and with combined sector identifiers and other explanatory variables (Model 3).

Most models have high levels of explanatory power, but especially those looking at confirmed cases per capita. Model 1 — with nothing more than identifiers of the dominant sector in the yishuv — explain 71%, 82%, and 36% of the variance in per capita tests, cases, and hospitalizations, respectively (adjusted R^2). Model 2 — which substitute the other explanatory variables for sector identifiers — explains 73%, 89%, and 64% of the variance. Combining these two sets of variables in Model 3 raises the models explanatory power

15 The main issue is an endogeneity issue that affects the analysis of Haredi vs. non-Haredi differences. For example, if Haredi men disproportionately choose not to work, and Haredi couples choose to have more children and to reside in Haredi communities, then one can plausibly argue that Haredim choose to reside in communities that score high on population density and low on socioeconomic characteristics, and that they also choose to perpetuate those average characteristics through their individual-level choices. In that sense, the community-supported behavioral choices of individual Haredi families are a direct cause of an area's poverty and high population density. In turn, that means that controlling for those area characteristics in the simple way that we are doing here actually underestimates the total effect of Harediness (חרדיות) on overall infections, tests, and hospitalizations. This is a classic example of a feedback loop in which culturally-driven behavioral choices in a high-conformity setting drive community-level differences. Contemporary statistics has difficulty with these types of problems.

even further: to 78%, 90% and 76%. A final Model 4 in Appendix 3 adds testing per capita to the analysis of confirmed cases, and the adjusted R^2 rises to 94%.[16]

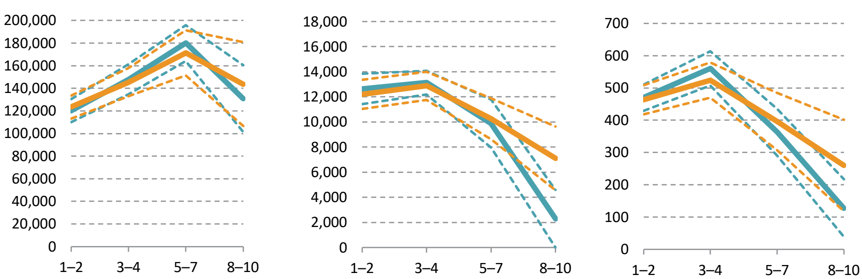
The combination of linear and polynomial terms — squared and sometimes cubed — that make these high levels of explanatory power possible also make them difficult to interpret. We therefore convert these models into a series of graphs in Figure 5 showing the predicted levels of per capita testing, infections, and hospitalizations at given values of the variable of interest. The first row of Figure 5 looks at variation by the yishuv's SES. The second row focuses on variation by population density. And the bottom row looks at variation by the percent of the yishuv's population that is elderly.

Figure 5. Predicted Covid-19 testing, infections, and hospitalizations per 100,000, by yishuv SES, population density, and percent aged 65+

Orange lines are adjusted for sector and other covariates; blue lines are unadjusted

Tests per 100,000 **Infections per 100,000** **Hospitalizations per 100,000**

Yishuv's socioeconomic cluster



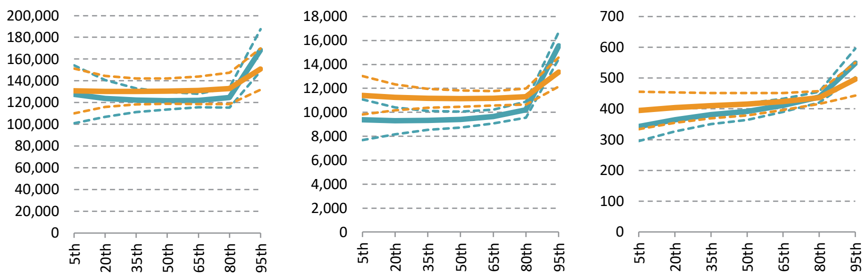
16 The causal relationship between per capita Covid testing and Covid prevalence data is bi-directional. That is, although testing does not cause infection, by increasing the proportion of infected individuals that are identified as having a confirmed case, more extensive testing can cause an increase in observed numbers of infected, and therefore raise official infection levels. On the other hand, areas which are known — or suspected — to have high infection rates have been the target of more intensive testing efforts. We do not attempt to unpack this bi-directionality in this analysis.

Figure 5 (continued). Predicted Covid-19 testing, infections, and hospitalizations per 100,000, by yishuv SES, population density, and percent aged 65+

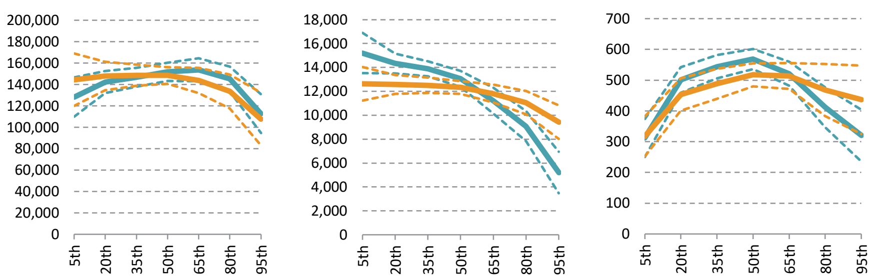
Orange lines are adjusted for sector and other covariates; blue lines are unadjusted

Testing per 100,000 **Infections per 100,000** **Hospitalizations per 100,000**

Population density



Percent aged 65+



Note: In each graph, the blue lines are based on Model 2 in Appendix Tables 2–4. They present the predicted level in the absence of controls for sector. The orange lines are based on the final model, that is, after adding controls for sector. The solid line is the predicted value, and the dotted lines mark the range of 95% confidence intervals around that estimate.

Source: Alex Weinreb, Taub Center | Data: Government portal, COVID-19 Dataset; CBS

A. SES, population density, and percent elderly

The average SES of a yishuv, indexed here by the eshkol, is significantly associated with per capita levels of testing, infections, and hospitalizations. Yishuvim with the lowest SES have the lowest levels of testing, and alongside those scoring 3 and 4, they also have the highest levels of confirmed infections. The latter also experienced the highest per capita levels of hospitalization.

Adding controls to the model, including sector, does not change the effects of SES on testing, infections, or hospitalization, other than at the highest levels. We can still see a downward gradient of infections and hospitalization between SES of 5–7 and 8–10, and though it is more gradual in the model with controls, including sector, it remains statistically significant (Models 3 and 4 in Appendix Table 3 and Model 3 in Appendix Table 4).

The effects of population density on all three dependent variables are much more modest. Up to the 80^{th} percentile of population density, there is no effect on either testing, infections, or hospitalizations. . In the baseline models, this increase is statistically significant. In the final models, this increase is not statistically significant — evidence of the strong covariation between population density and sector.

Levels of per capita testing, infections and hospitalizations do covary with the percent of the population that is aged at least 65. In both adjusted and unadjusted models, we see substantially lower levels of infection and hospitalization in yishuvim with a high percent elderly (especially unadjusted models). This points to successful efforts to reduce infection levels in these yishuvim. Adding controls explains some of these differences, but the overall negative effects remain statistically significant. In addition, we see lower testing and much lower rates of hospitalization in yishuvim with a relatively small percent of elderly. This also makes sense, to the extent that a small percent of elderly means a high percent of young people, who even if infected are more likely be asymptomatic carriers who require neither testing nor hospitalization.

A few other factors in these models are also worth noting. Inequality within a yishuv was associated with lower levels of testing but not infections or hospitalization. The size of a yishuv's population was negatively associated with levels of testing, but positively associated with both the levels of infection and hospitalization. This is inconsistent with the idea that the higher cultural acceptance of avoiding interaction in cities — described in footnote 12 — allows for more effective social distancing. Finally, even after controlling for SES and inequality, the level of infection was significantly higher in development towns.

B. Sectoral differences

Sectoral differences in per capita levels of testing, infections, and hospitalizations are summarized in Table 2 in terms of relative risk (RR). This is one of the standard measures used in epidemiological research — including Muhsen et al. (Muhsen et al., 2021). An RR compares the probability of a given event occurring across two or more groups. Here we use Jewish non-Haredi yishuvim as the reference category. The columns labeled "unadjusted" present the baseline RR across groups without adjusting for any other explanatory variables. The data point to mean differences between groups, but unlike the box plot distributions in Figure 1, these are weighted for yishuv population size. The columns labeled "adjusted" are based on full models presented in Appendix Tables 2–4. They are the predicted marginal effects of those models, in which the value of all yishuv characteristics is set to the national mean. A secondary adjusted column is also presented for models of infections per capita. It includes a control for testing levels.

Table 2. Relative risk* of undergoing a Covid test, having a confirmed Covid infection, or being hospitalized with Covid, by sector, relative to non-Haredi Jewish yishuvim

	Testing		Infections			Hospitalizations	
Sector	Unadjusted	Adjusted[1]	Unadjusted	Adjusted[1]	Adjusted[2]	Unadjusted	Adjusted[1]
Jewish non-Haredi	*Reference category*		*Reference category*			*Reference category*	
Haredi	0.747	0.854	2.529	2.030	2.394	1.863	1.325
Arab	0.662	0.739	1.203	0.944	1.206	1.916	1.236
Bedouin	0.375	0.506	0.702	0.660	1.107	1.114	0.920
Druze	0.703	0.754	1.326	1.018	1.280	1.733	1.225
Haredi/Non-Haredi	0.672	0.817	1.336	1.238	1.478	1.943	1.270
Jewish/Arab	0.849	0.935	0.998	0.898	0.945	1.571	1.112

[1] Estimates from Model 3 in Appendix Tables 2–4;
[2] Estimates from Model 4 in Appendix Table 3.
* Relative risk (RR) = $P(E|N_{group\ 1})/P(E|N_{group\ 2})$, where P is the probability, E is a given event (in this case, having a test, becoming infected or hospitalized), and N is the size of the group. Group 2 is the reference group — typically the "unexposed" group in epidemiological terms — and here associated with non-Haredi Jewish yishuvim.
Source: Alex Weinreb, Taub Center | Data: Government portal, COVID-19 Dataset; CBS

The models point to some exceptional patterns in terms of testing, infections, and hospitalizations, but equally to the fact that these patterns are not limited to the Haredi sector.

We begin with sectoral differences in rates of testing. Cumulative covid testing rates were highest in non-Haredi Jewish yishuvim. Within the non-Jewish sector, Bedouin yishuvim in particular had much lower testing rates. Even after adding controls for SES and all the other variables in the full regression model, the RR for Bedouin yishuvim remains 0.50. Arab and Druze yishuvim, too, had much lower testing rates even after adjusting for these differences (RR 0.74 and 0.75, respectively).

Models of infection levels are where clear signs of Haredi exceptionalism emerge. Unadjusted estimates point to significantly higher relative risk in Haredi (RR 2.5), though infection levels are also substantially higher in mixed Haredi/non-Haredi, Druze, and Arab yishuvim (RRs of 1.3, 1.3, and 1.2, respectively). Adjusting for most yishuv-specific characteristics reduces these differences in most cases, though in final models which also control for testing levels, the RR of infection remains 2.4 times higher in Haredi yishuvim than in non-Haredi Jewish yishuvim, and 1.4 times higher in mixed Haredi/non-Haredi yishuvim.

The Bedouin sector points to a different storyline. This is the only sector with a lower risk of infection than non-Haredi Jewish yishuvim in unadjusted models (RR 0.7), and the only sector in which, after adding controls for yishuv-characteristics, there is an increase in this sectoral difference. Here, too, once a control is added for testing per capita, the estimated relative risk rises to 1.1, statistically identical to non-Haredi Jewish sector. In other words, the models suggest that if testing rates in Bedouin communities had been at the national mean, confirmed infection rates would have been statistically identical to those in non-Haredi Jewish sector.

Sectoral differences in hospitalization rates point to a third pattern. The unadjusted RRs are all in the 1.7–1.9 range in Haredi, Arab, Druze, and mixed Haredi/non-Haredi yishuvim — they all experienced between 619–694 people hospitalized per 100,000 residents, relative to 357 in non-Haredi Jewish yishuvim. Yet the RRs in all four of these sectors fall to the 1.2–1.3 range after adjustments for yishuv characteristics. These differences are no longer significantly different from hospitalization rates in the reference group, showing that most of the differences in hospitalization levels between sectors are associated with observed characteristics. Further tests show that the most important of these is the percent of the population aged at least 65.

Summary

This paper set out to estimate the magnitude of differences between sectors in terms of cumulative rates of Covid infection, testing, and hospitalizations; to look at the association between these three measures of Covid and yishuv-specific characteristics like levels of SES, population density, and percent elderly; to see how much these sectoral differences remain once we adjust for these yishuv-specific characteristics; and to see the reverse, that is, how much the effects of yishuv-specific characteristics like SES, population density, and percent elderly remain once we control for sectoral differences.

Findings illuminate all these issues. Analyses have confirmed that net of controls for population sector, poorer yishuvim in Israel experienced lower rates of testing. Analyses also showed that the wealthiest yishuvim, and those with larger populations of elderly, experienced the lowest rates of infection, and that higher rates of infection and hospitalization were also experienced in the most densely populated areas.

Alongside these differences, analyses have also confirmed that there are some very substantial sectoral differences in Israel. Most notably, even after adjusting for differences in SES, population density, and other yishuv-specific characteristics, the risk of infection in Haredi yishuvim was 2.4 times higher than in non-Haredi Jewish yishuvim. If anything, this is an underestimate of Haredi versus non-Haredi differences at the individual level, since, as shown in Figure 3, some non-Haredi Jewish yishuvim also have significant Haredi populations, and these were widely reported to have very high infection rates (gimel and zayin neighborhoods in Ashdod). Indeed, using individual-level data, the BOI estimates the relative risk of infection for an individual Haredi — we extrapolate these from odds ratios reported in Figure 5 (BOI, 2021, p.256) — at 3.9 times as high as the level for a non-Haredi Jew in their adjusted models.[17]

17 The estimated RR for Haredi yishuvim in Muhsen et al. (2021) is 2.1, though our 2.4 falls within the upper area of their confidence interval (1.66–2.67).

Likewise, after adjusting for differences in a range of yishuv-specific characteristics, rates of testing in Haredi yishuvim were statistically identical in Haredi yishuvim as in their non-Haredi counterparts, but rates of hospitalization were much higher, in spite of having a much lower percentage of elderly in the population — much more likely to be symptomatic and most likely to be hospitalized.

Together, these findings show that elevated infection levels in the Haredi sector are only partly the result of yishuv-specific "structural" factors like poverty, population density and age structure. Without accounting for variation in levels of testing, these factors account for 33% of Haredi areas' higher infection levels — in models that explain 94% of the variance. The remaining 66% appears to stem from factors not in these models. We assume that those are predominantly behavioral issues. In contrast, the same yishuv-specific structural factors explain more than 90% of the excess levels of infection in the Arab and Druze sectors relative to non-Haredi Jewish yishuvim.

Sectoral differences in rates of hospitalization — in particular, the much higher rates of hospitalization in the Arab and Druze sectors than in the non-Haredi Jewish sector, relative to the differences in testing and infection levels in these two sectors — are consistent with reported differences in the prevalence of heart disease and diabetes, though we have no yishuv-specific measures of these conditions to test this empirically. This means that the community-level measures used here — including the eshkol and percent aged at least 65 — are likely picking up on those factors (since heart disease and diabetes rise with age and, in developed countries like Israel, are negatively associated with SES).

Bedouin communities, too, have a distinct pattern. Belying popular perceptions, the Bedouin sector is the only sector to have lower rates of infection than the non-Haredi Jewish sector (though, as shown in Table 2, adjusting for the percent tested completely explains this away). Rates of hospitalizations in Bedouin yishuvim also exceed their non-Haredi Jewish counterparts, an additional sign of systematic under-testing of Bedouin. This is not surprising given that it is, for the most part, the most under-served sector in the country.

We think these results, especially those focused on cases and testing per capita, are robust. They are based on data from 205 yishuvim that include 88% of Israel's population, including all major and minor yishuvim in the country. Even if there are somewhat different patterns in the remaining 12% of the population, they would have to be extraordinarily different to modify the overall findings identified here. Finally, the results presented here are consistent with the prior analyses by the BOI (2021) and Muhsen et al. (2021), even as they add some more detail.

If there is a single missing element in this research it is the lack of data on mortality. We look forward to the government releasing data unencumbered by the "less-than-15" rule, which will allow us to replicate these analyses on sectoral variation in Covid mortality.

Even with this reservation, however, our findings are important. They point to systematic under-testing of Covid in Bedouin yishuvim, to the heightened sensitivity of Druze and Arab yishuvim to more severe cases of Covid — hence their elevated rates of hospitalization — and, perhaps most notably, to unparalleled infection levels in Haredi communities. Cumulatively, the relative risk of infection in Haredi yishuvim, unadjusted for poverty, population density, and a range of yishuv characteristics, was 2.5 times as high as in non-Haredi Jewish yishuvim. Even after adjusting for yishuv characteristics, it remained 2.4 times as high. Levels of infection were also higher in Druze and Arab yishuvim, though nothing approaching Haredi levels.

These sectoral differences need to be taken into account as we plan for future epidemics. Note that this is not an "if" scenario. There will be a next epidemic. New infectious diseases have been emerging with increasing frequency (there are more points of contact between people and pathogens), moving with increasing speed (the world is more connected), and mutating in increasing numbers (population growth means that they have more hosts). We have little control over these processes. But what we can control — if we will it — are two things.

First, we can improve access to healthcare in under-served areas by devoting resources to clinics and personnel — perhaps especially trusted locals — who, once on the ground, can leverage latent unmet demand or, absent that demand, can employ "social marketing" to create it. There are models of this type of intervention the world over. Versions of it are already being used in Israel to promote healthier dietary and behavioral choices in the Arab sector, whose higher prevalence of heart disease and diabetes led directly to the higher rates of hospitalization documented in Figure 4 and Table 2.

Second, we can take a more consistent approach towards enforcing rules designed to limit the spread of viruses. For most of the epidemic there was only selective enforcement of these rules. For example, mass funerals for leading rabbis were not prevented — examples include the funerals of

Rav Mordechai Yissachar Ber Laifer on October 5, 2020, Rav Meshulam David Soloveitchik and Rav Yitzhak Shiner on January 31, 2021, and Rav Haim Meir HaLevi Wazner on February 6, 2021 — and there were also repeated reports in the press of mass gatherings for weddings and “tishes.” At the same time, far fewer Covid fines were issued (per capita) in Haredi areas or yishuvim than in their non-Haredi Jewish equivalents, and far more were issued in Arab areas (Abraham & Sherki, 2021; Broitman, 2020; Neuman, 2021).

These selective enforcement efforts facilitated the spread of Covid infection. If we are to effectively minimize the impact of the next epidemic, or manage a resurgent Covid variant that is even more resistant to existing vaccines than “Delta” (Iacobucci 2021), national decision makers need to adopt a different tack. In particular, they need to re-establish state authority in areas where it has deteriorated. In the long-term, this may even be one of the most important things to take away from Covid-19’s trajectory through Israeli society these past 18 months.

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Appendix

Appendix Table 1. Yishuvim in each sector

Jewish (n=108)

Afula
Alfe Menashe
Arad
Ariel
Ashdod
Ashkelon
Atlit
Azur
Bat Hefer
Bat Yam
Beer Sheva
Beer Yaakov
Beit Arieh
Beit Dagan
Beit El
Beit Shean
Binyamina-Givat Ada
Bnei Ayish
Carmiel
Ceasaria
Cochav Yair
Dimona
Efrat
Eilat
Eliakim
Elkana
Even Yehuda
Gan Yavne
Ganei Tikva
Gedera
Geva Benyamin
Givat Shmuel
Givat Ze'ev
Givatayim
Hadera
Har Adar
Harish
Hazor HaGlilit
Herzliyah
Hod Hasharon
Holon
Jish-Gush Halav
Kadima Zoren
Karnei Shomron
Katzrin
Kdumim
Kfar Saba
Kfar Tavor
Kfar Vradim
Kfar Yona
Kiryat Arba
Kiryat Ata
Kiryat Bialik
Kiryat Ekron
Kiryat Gat
Kiryat Malachi
Kiryat Motzkin
Kiryat Ono
Kiryat Shmona
Kiryat Tivon
Kiryat Yam
Lehavim
Ma'aleh Adumim
Mazkeret Batya
Meitar
Mevasseret Zion
Migdal Haemek
Mizpe Ramon
Modi'in-Maccabim-Re'ut
Nahariyah
Nazareth Illit
Nes Ziona
Nesher
Netanya
Netivot
Ofakim
Omer
Or Akiva
Or Yehuda
Oranit
Pardesia
Paredes Hanna-Karkur
Petach Tikvah
Ra'anana
Ramat Gan
Ramat Hasharon
Ramat Yishai
Rehovot
Rishon Le'Zion
Rosh Ha'ayin
Rosh Pina
Savyon
Sderot
Sha'arei Tikva
Shlomi
Shoham
Tel Aviv-Yafo
Tel Monde
Tiberias
Tirat Carmel
Tzur Hadassah
Tzur Yitzhak
Yavne
Yavne'el
Yehud
Yeruham
Yokne'am Illit
Zichron Yaakov

Arab (n=53)

Abu Gosh
Abu Snan
Achsal
Ar'ara
Arraba
Aylboon
Baqa al-Gharbiyye
Basma
Bi'ina
Bu'eine Nujeidat
Deir al-Asad
Deir Hanna
Dvurya
Ein Mahil
Fassuta
Fureidis
Ghajar
Gisr A'Zarka
I'billin
Jadeidi-Makr
Jaljulia
Jatt
Ka'abiyye-Tabbash-Hajajre
Kabul
Kafr Bara
Kafr Kanna
Kafr Manda
Kafr Qara
Kafr Yasif
Kaukab Abu al-Hija
Kfar Qasim
Ma'ale Iron
Majd al-Krum
Mashhad
Mazra'a
Me'ilya
Nahf
Nazareth
Qalansawe
Rameh
Reineh
Sakhnin
Sha'ab
Shefa-'Amr (Shfar'am)
Shibli-Umm al-Ghanam
Tamra
Tayibe
Tira
Tur'an
Umm al-Fahm
Yafa an-Naseriyye
Zemer

Druze (n=16)

Beit Jann
Buq'ata
Daliyat al-Karmel
Ein Qiniyye
Hurfeish
Isfiya
Julis
Kfar Kama
Kisra-Sumei
Maghar
Majdal Shams
Mas'ada
Peki'in
Sajur
Yanuh-Jat
Yarka

Bedouin (n=11)

Ar'arat an-Naqab
Basmat Tab'un
Bir al-Maksur
Hura
Kuseife
Laqiya
Rahat
Shaqib al-Salam (Segev Shalom)
Tel as-Sabi (Tel Sheva)
Tuba-Zangariyye
Zarzir

Haredi (n=9)

Beitar Illit
Bnei Brak
El'ad
Emanuel
Kfar Habad
Kiryat Ye'arim
Kochav Yaakov
Modi'in Illit
Rekhasim

Appendix Table 1 (continued). Yishuvim in each sector

Mixed Jewish/Arab (n=5)
Acco
Haifa
Lod
Ma'alot Tarshiha
Ramle

Mixed Haredi/non-Haredi (n=3)
Beit Shemesh
Jerusalem
Safed

Source: Alex Weinreb, Taub Center | Data: Government portal, COVID-19 Dataset

Appendix Table 2. Cumulative Covid tests per 100,000 residents: Weighted OLS regression estimates with robust standard errors

	(1)	(2)	(3)
Sector			
Jewish non-Haredi		*Reference category*	
Arab	-105,179***		-71,288***
	(7,376)		(18,016)
Bedouin	-194,514***		-135,832***
	(10,172)		(29,928)
Druze	-92,510***		-67,072***
	(11,666)		(17,309)
Haredi	-78,872***		-39,316
	(14,359)		(43,480)
Haredi/non-Haredi	-102,068***		-49,656**
	(4,483)		(20,949)
Jewish/Arab	-46,930***		-16,953*
	(9,923)		(9,064)
Socioeconomic index			
Eshkol 0–2		*Reference category*	
Eshkol 3–4		36,006**	31,326**
		(14,884)	(15,714)
Eshkol 5–6		102,392***	74,251***
		(19,830)	(19,485)
Eshkol 7+		101,028***	82,243***
		(25,788)	(26,907)
Population density			
Linear term		4.114	3.519
		(9.037)	(8.918)
Quadratic		0.000706	-1.50e-05
		(0.000944)	(0.00105)
Cubed		-2.81e-08	-1.95e-09
		(2.45e-08)	(2.74e-08)

Appendix Table 2 (continued). Cumulative Covid tests per 100,000 residents: Weighted OLS regression estimates with robust standard errors

	(1)	(2)	(3)
Percent aged 65+			
Linear term		15,511***	6,541
		(3,847)	(4,644)
Quadratic		-637.7***	-365.0**
		(139.9)	(158.5)
Gini coefficient			
Linear term		-1.278e+06	-3.336e+06***
		(1.515e+06)	(1.072e+06)
Quadratic		2.279e+06	4.398e+06***
		(1.908e+06)	(1.387e+06)
Population (number)			
Linear term		-0.218**	-0.174**
		(0.110)	(0.0880)
Quadratic		1.60e-07	1.51e-07*
		(1.06e-07)	(8.23e-08)
Development town		41,898***	12,420
		(10,216)	(10,336)
Constant	311,135***	250,844	858,270***
	(4,423)	(295,315)	(214,949)
Observations	205	205	205
Adjusted R^2	0.711	0.732	0.784

Note: Robust standard errors in parentheses.
* p < 0.1; ** p < 0.05; *** p < 0.01.
Source: Alex Weinreb, Taub Center | Data: Government portal, COVID-19 Dataset

Appendix Table 3. Cumulative confirmed Covid infections per 100,000 residents: Weighted OLS regression estimates with robust standard errors

	(1)	(2)	(3)	(4)
Sector				
Jewish non-Haredi			*Reference category*	
Arab	2,484***		-614.3	2,547
	(610.8)		(1,656)	(1,544)
Bedouin	-3,642***		-4,631*	1,393
	(953.9)		(2,686)	(2,677)
Druze	3,983***		436.5	3,411**
	(830.6)		(1,805)	(1,538)
Haredi	18,678***		14,725***	16,468***
	(1,837)		(4,233)	(2,800)
Haredi/non-Haredi	4,103***		3,540**	5,742***
	(941.0)		(1,739)	(1,561)
Jewish/Arab	-22.81		-1,265	-513.2
	(2,269)		(1,087)	(954.1)
Socioeconomic index				
Eshkol 0–2			*Reference category*	
Eshkol 3–4		-101.7	1,674**	284.3
		(1,156)	(676.2)	(884.4)
Eshkol 5–6		-3,617*	-72.07	-3,365**
		(2,032)	(1,589)	(1,564)
Eshkol 7+		-15,751***	-6,008***	-9,655***
		(2,467)	(2,242)	(2,203)
Population density				
Linear term		-0.326	-0.277	-0.433
		(0.633)	(0.891)	(0.641)
Quadratic		0.000166**	8.41e-05	8.48e-05
		(7.43e-05)	(0.000116)	(7.96e-05)
Cubed		-5.14e-09**	-2.79e-09	-2.70e-09
		(1.99e-09)	(3.09e-09)	(2.11e-09)
Percent aged 65+				
Linear term		-161.7	677.3*	387.3
		(303.6)	(402.5)	(243.0)
Quadratic		-17.62	-35.95**	-19.76**
		(11.27)	(13.91)	(7.792)
Gini coefficient				
Linear term		119,543	-86,337	61,625
		(157,524)	(135,810)	(132,582)
Quadratic		-71,422	121,489	-73,551
		(196,238)	(169,865)	(162,697)

Appendix Table 3 (continued). Cumulative confirmed Covid infections per 100,000 residents: Weighted OLS regression estimates with robust standard errors

	(1)	(2)	(3)	(4)
Population (number)				
Linear term		-0.000279	0.00690	0.0146***
		(0.00716)	(0.00653)	(0.00539)
Quadratic		-5.80e-09	-1.25e-08**	-1.92e-08***
		(6.84e-09)	(6.24e-09)	(5.07e-09)
Development town		1,186	2,272**	1,722*
		(918.0)	(1,023)	(876.2)
Tests per 100,000		0.0531***		0.0443***
		(0.00976)		(0.0104)
Constant	12,216***	-28,895	26,704	-11,357
	(539.2)	(30,649)	(27,749)	(27,659)
Observations	205	205	205	205
Adjusted R^2	0.821	0.885	0.902	0.936

Note: Robust standard errors in parentheses.
* p < 0.1; ** p < 0.05; *** p < 0.01.
Source: Alex Weinreb, Taub Center | Data: Government portal, COVID-19 Dataset

Appendix Table 4. Cumulative confirmed Covid hospitalizations per 100,000 residents: Weighted OLS regression estimates with robust standard errors

	(1)	(2)	(3)
Sector			
Jewish non-Haredi		*Reference category*	
Arab	326.9***		115.1
	(36.61)		(102.6)
Bedouin	40.85		-40.43
	(37.84)		(105.8)
Druze	261.7***		110.0
	(53.64)		(112.8)
Haredi	308.0**		159.1
	(140.3)		(124.1)
Haredi/non-Haredi	336.7***		131.8
	(48.16)		(108.9)
Jewish/Arab	203.8*		54.26
	(105.5)		(53.45)
Socioeconomic index			
Eshkol 0–2		*Reference category*	
Eshkol 3–4		65.70*	47.05
		(37.22)	(34.72)
Eshkol 5–6		-133.6**	-107.3
		(54.61)	(70.45)
Eshkol 7+		-401.7***	-270.6***
		(60.76)	(101.5)
Population density			
Linear term		0.0298***	0.0113
		(0.00780)	(0.00979)
Quadratic		-6.60e-07**	-1.35e-07
		(2.84e-07)	(3.36e-07)
Percent aged 65+			
Linear term		158.1***	126.3***
		(17.74)	(27.26)
Quadratic		-12.09***	-9.200***
		(1.601)	(2.584)
Cubed		0.271***	0.206***
		(0.0411)	(0.0651)
Gini coefficient			
Linear term		-277.6	-3,427
		(3,893)	(3,804)

Appendix Table 4 (continued). Cumulative confirmed Covid hospitalizations per 100,000 residents: Weighted OLS regression estimates with robust standard errors

	(1)	(2)	(3)
Quadratic		-934.3	1,431
		(4,893)	(4,647)
Population (number)			
Linear term		0.000161	0.000413*
		(0.000227)	(0.000243)
Quadratic		-1.60e-10	-3.45e-10
		(2.26e-10)	(2.47e-10)
Development town		-22.23	-11.56
		(51.06)	(65.36)
Constant	356.9***	188.9	1,094
	(32.42)	(753.3)	(785.1)
Observations	205	205	205
Adjusted R^2	0.363	0.735	0.763

Note: Robust standard errors in parentheses.
* p < 0.1; ** p < 0.05; *** p < 0.01.
Source: Alex Weinreb, Taub Center | Data: Government database, COVID-19 Dataset