Socioeconomic aspects of Coronavirus infection rates across Israeli municipalities

Ayal Kimhi

Abstract
The impact of the coronavirus has varied substantially across Israeli municipalities. This study identifies the impact of several major municipal attributes on the infection rate, while controlling for the effect of other attributes. Two attributes in particular explain the lion’s share of the gaps in infection rates between municipalities. These are the fraction of population living in religious boarding schools and the population density within the municipality. The policy ramifications suggest a middle ground between the policy of overall shutdown that was imposed in Israel, with its enormous economic damage, and a policy of selective isolation on an individual basis founded upon a wide and efficient testing system that is not currently in existence. Specifically, it may be possible to use a selective shutdown policy in certain municipalities with certain attributes in which the risk of being infected and spreading the virus is particularly high.

More than two months after the first coronavirus patient was diagnosed in Israel, the number of infected people has risen above 16,000. Infection rates have been known to vary across different types of municipalities. For example, the infection rate is particularly high in ultra-Orthodox (Haredi) towns and particularly low in Arab-Israeli towns. But infection rates

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1 Professor Ayal Kimhi, Vice-President of the Shoresh Institution for Socioeconomic Research and Head of the Department of Environmental Economics and Management at the Hebrew University. Dan Ben-David provided helpful comments and suggestions. The assistance with obtaining and interpreting the data by Shlomit Avni, Rachel Brenner Shalem and Gidi Peretz from the Ministry of Health and Yael Feinstein, Yifat Shani and Fabiana Schwartz from the Central Bureau of Statistics is gratefully acknowledged.
vary even among Haredi towns and among Arab-Israeli towns, as well as among towns that are neither Haredi nor Arab-Israeli.

What characterizes municipalities with relatively high infection rates? This question is extremely relevant both for protecting against future waves of coronavirus – if and when they occur – and for designing the exit strategy from the economic shutdown. Researchers in other countries have found strong links between a number of socioeconomic attributes and infection rates. Borjas (2020), for example, found relatively high infection rates in New York City neighborhoods with lower average incomes and larger families, as well as in neighborhoods with relatively large minority and immigrant populations. In another paper that compared infection rates across countries, Stojkoski et al. (2020) found that population size is the most important variable for explaining cross-country differences, with lower infection rates in the more populated countries, after controlling for a long list of other attributes. However, they did not find a statistically significant relationship between the infection rates and population density.

This research merges data published by Israel’s Ministry of Health on infection rates in urban municipalities with at least 2,000 residents with data on municipal attributes – including various socioeconomic attributes – published by Israel’s Central Bureau of Statistics. The municipal attributes are from 2018, while the infection rates reflect the situation on May 5, 2020. The analysis was conducted with 196 municipalities for which data from both sources were available.2

A multiple regression analysis identified three municipal attributes with statistically significant (and robust to model specification) effects on the infection rate: the percent of population in the 75+ age group; population density per square kilometer of residential area; and the percent of the population living in religious boarding schools.3 Other attributes that were examined, but were not found to affect the infection rate significantly, include the

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2 The municipality attributes file excludes municipalities that are part of regional councils. For example, the municipality of Kfar Chabad, in which the infection rate is relatively high, is not included in the analysis.

3 Including junior Yeshiva, Yeshiva Gvoha, Yeshivat Hesder and conversion Ulpana, not including secondary-school Yeshiva and girls’ Ulpana. This category also includes the population living in monasteries, but the latter is negligible.
municipality’s socioeconomic ranking, the share of population in the 35-55 age group with an academic degree, the average wage of salaried employees, and the municipality’s peripherality cluster. Exclusion of these variables from the regression did not change the results in a meaningful manner.

The final regression results appear in the appendix. Infection rates were found to be negatively correlated with the percent of population in the 75+ age group, perhaps because people in that age group followed the social isolation orders more strictly. However, this relationship was not particularly large. On the other hand, the other two variables had substantial quantitative effects on municipal infection rates, and their statistical significance was robust to various specifications of the regression model.

Figure 1 provides an indication of the link between infection rates and the fraction of population living in religious boarding schools, while Figure 2 displays the relationship between infection rates and population density. The positive links are clearly evident in both figures. However, it is also evident is that the relationships are stronger at the extreme values of

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4 The Central Bureau of Statistics (2019) ranks Israel’s municipalities by their socioeconomic attributes.

each of the explanatory attributes. In both cases, the group of municipalities with the extreme values of attributes include the Haredi municipalities, but the positive relationships between infection rates and each of the two attributes exist even when the Haredi municipalities are excluded.

The importance of the relationship between infection rates and the two dominant municipality attributes is highlighted in Figure 3, which shows the relative contribution of each attribute to the gap in infection rates per population of 100,000, between the towns with the highest infection rates and the towns with the lowest infection rates. Each group of municipalities includes a population of roughly 1.5 million.

The infection rate in municipalities with the lowest infection rates is 31 persons per population of 100,000. In municipalities with the highest infection rates, the infection rate reaches 560 persons per population of 100,000. In towns with the lowest infection rates, the fraction of population living in religious boarding schools is almost nil – about 0.11 of one percent. On the other hand, in towns with the highest infection rates, over 2% of the population live in religious boarding schools. Had the percentage of population in municipalities with the lowest infection rates living in religious boarding schools risen to 2%, their infection rate would have increased by 232 per population of 100,000.

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6 The Haredi municipalities are Bnei Brak, Modi’in Illit, Betar Illit, El’ad, Rechasim, Kiryat Yearim and Immanuel.

7 1.3 million people live in municipalities in which the infection rates are below 60 per population of 100,000, and 1.6 million people live in municipalities in which the infection rates are above 300 per population of 100,000.
The second important municipality attribute (in terms of its contribution to the infection rate gap between both types of municipalities) is the number of persons per square kilometer of residential area. In municipalities with the lowest infection rates, population density is about 9,300 persons per square kilometer. At the other end of the spectrum, in municipalities with the highest infection rates, population density is over two and a half times higher – about 25,000 persons per square kilometer. An increase in population density in the towns with the lowest infection rates to the population density in the towns with the highest infection rates would have increased their infection rates by 205 persons per population of 100,000. Overall, these two attributes explain nearly the entire gap in infection rates between the two groups of municipalities.

What could be the reason for the strong relationship between infection rates and the fraction of population living in religious boarding schools? It could be due to lack of compliance with the social distancing regulations – either due to simple ignorance, to a basic attitude of non-compliance with government authorities, or to irresponsible conduct by the heads of those institutions. It should be noted that no statistical relationship was found between infection rates and the percentage of population living in non-religious boarding schools, in medical institutions, in assisted living accommodations, and in other institutions. As for population density, it is not necessary to explain how it’s related with infection rates.

Many of the municipalities with the highest infection rates are predominantly Haredi – Bnei Brak, El’ad, Kiryat Yearim, Modi’in Illit, Betar Illit, Immanuel and Rechasim – and their population represents about a quarter of the high-infection group of municipalities. The additional municipalities in this group are Deir Al-Asad, Hura, Efrat, Mitzpe Ramon, Yavne’el, Beit Shemesh, Bi’ina, Or Yehuda, Jerusalem, Migdal HaEmek and Tiberias. Some of these have substantial Haredi populations. But without data on the proportion of Haredim in each municipality’s population, it is difficult to estimate the relation between the infection rates and the share of Haredim precisely. However, an analysis of partial and less accurate data suggests that this relationship is much less important than the impact of the percentage of population living in religious boarding schools and population density.
This study’s conclusions are relevant for both the design of an exit strategy from the socioeconomic shutdown and for preparation for additional coronavirus waves – if and when they occur. It appears that Israeli authorities already realize, even if somewhat late, that the policy of overall closure does not provide the correct balance between lowering infection rates and the economic losses resulting from such closure. As long as an alternative policy of a “smart closure” in which the infected population is identified quickly and isolated (Ben David, 2020) is not operational, it is possible to apply selective closures of certain populations on a statistical basis (Shalev-Shwartz and Shashua, 2020). This is not very different from the suggestion of a “breathing closure” by Dekel (2020).

The statistical analysis presented in this policy brief finds that municipalities with religious boarding schools and municipalities with high population density would be candidates for such selective closures, if such a need should arise in the future. Of course, using this conclusion for policy design requires further analysis with more detailed data, including smaller municipalities and neighborhoods within cities. In addition, the results of this research support the conclusion of Maaravi (2020) that selective closure of the older population will cause more damage than benefit, and contradict Karlinsky’s (2020) recommendation to isolate the older population.

It should be noted that the results of this research could be affected by the fact that the infection rate in each municipality depends on the fraction of the population tested for coronavirus infection in that municipality. The fraction of the population tested is not random, and it is statistically related to municipal attributes as well. Since such a relation could bias the regression results, there is a need to find a method of neutralizing the effects on the empirical analysis emanating from the lack of randomness in the share of population being tested.
References


Shalev-Shwartz, Shai, and Amnon Shashua (2020), “Can we Contain Covid-19 without Locking-down the Economy?,” Center for Brains, Minds and Machines (CBMM) Memo No. 104.


Statistical appendix – Multiple regression results

This appendix presents the results of a multiple regression analysis of the relations between the municipality’s infection rate and several socioeconomic attributes of the municipality. These results were used in the simulation presented in Figure 3.

<table>
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<th>Sample average</th>
<th>Regression coefficient</th>
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<td>***-5.47</td>
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<td>Percentage of population living in religious boarding schools</td>
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<td>***9.74</td>
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*** Coefficient significant at the 0.01 level.