

# COVID-19 Outbreak in İstanbul

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## Abstract

**OBJECTIVE:** The COVID-19 pandemic has demonstrated that the social determinants of health play a fundamental role in the course of the pandemic. This article aims to reveal the class dynamics of the COVID-19 epidemic in İstanbul, Turkey.**MATERIAL AND METHODS:** Spatial analysis and geographic information system data provided by İstanbul Metropolitan Municipality for March and April 2020 were used. Public transport mobility and turnstile data were analyzed. The data obtained were collated into thematic maps.**RESULTS:** Between March 16 and 24, 2020, the use of public transportation declined with the tightening of movement restrictions. However, despite the restrictions, an increase in transportation density was observed between 6 and 9 AM and between 5 and 7 PM. Although the overall mobility toward outside the city has fallen due to travel restrictions, it has been observed that exit mobility continued between Gebze and Kocaeli, both industrial centers where blue-collar jobs dominate. Most of the mobility in the city is observed in Avcılar, Bahçelievler, Esenyurt, and Küçükçekmece, which are mostly blue-collar residential districts. On the Asian side, activity was observed in Kurtköy, Pendik, Samandıra, Ümraniye, and Tuzla, areas where blue-collar workers predominantly reside. From March 25 to April 7, 2020, it was determined that the most intense activity areas of the blue-collar workers were Avcılar, Bahçelievler, Bağcılar, Çekmeköy, Esenyurt, Küçükçekmece, Ümraniye, and D-100 highway line.**CONCLUSION:** The density in the use of public transportation rose during the hours corresponding to the working hours of the workers who had to continue working despite the pandemic. In addition, the physical movement of blue-collar workers continued despite the travel restrictions imposed along the city borders where they worked and resided. Our data point to the importance of social protection measures for workers in general, and blue-collar workers in particular, for the management of the pandemic.**KEYWORDS:** City, health, outbreak, SARS-CoV-2, spread**Received:** April 18, 2021**Accepted:** August 31, 2021

## INTRODUCTION

İstanbul has a population of nearly 15 million people. Straddling 2 continents, Europe and Asia, the city has a 647-km coastline, 39 districts, and 9 isles. With a history dating back 8500 years, İstanbul served as the capital of the Roman, Byzantine, and Ottoman Empires. The city is spread over a 5712-km<sup>2</sup> area, with 2 airports, 1796 historical landmarks, 712 hotels, 57 universities, and 36 libraries. İstanbul is the business and finance capital of Turkey.<sup>1</sup> The most crowded districts of İstanbul are Esenyurt, Küçükçekmece, and Bağcılar, respectively. Adalar, Şile, and Çatalca are the districts with the lowest population.<sup>1</sup> Esenyurt had the fastest-growing population between 2017 and 2018. İstanbul, the capital of trade, business, investment, finance, and tourism, accounts for 20.3% of the workforce, 50.6% of exports, and 54.6% of imports of Turkey.<sup>1</sup>

Since the confirmation of the first COVID-19 case on March 11, 2020, the Republic of Turkey Ministry of Health releases data daily to the public, which include only very limited information such as the positive COVID-polymerase chain reaction (COVID-PCR) cases and deaths along with the total number of tests conducted.<sup>2</sup> According to the World Health Organization data, Turkey ranks sixth among European countries, with 6 018 485 total confirmed cases and 52 703 total deaths.<sup>3</sup> However, information regarding patients who have tested negative for COVID-PCR but have been diagnosed with COVID-19 clinically and radiologically, who were first treated as outpatients, or patients who have died has not been disclosed to the public to date. In addition, basic epidemiological information, such as age, gender, occupation, ethnicity, and place of residence of COVID-PCR-positive patients, and about those who have died has not been shared with the public.

The spread of the pandemic in Turkey as well as the groups most affected are not known due to the limited information disclosed by the Republic of Turkey Ministry of Health. Similarly, no information is shared about which regions and cities are most affected by the COVID-19 outbreak. Health Minister Fahrettin Koca stated on April 24 and 29 that "İstanbul is Turkey's Wuhan"<sup>4</sup> and "Close to 60% of our confirmed cases are in İstanbul."<sup>5</sup>

This article aims, using İstanbul Metropolitan Municipality data, to uncover the dynamics of the pandemic in İstanbul, the city most affected by the pandemic in Turkey, in an environment where the segments of the population affected are unknown. Understanding the pandemic dynamics of cities will shed light on the precautions that countries should take in

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terms of public health as well as reveal the policy preferences of these countries.

## MATERIAL AND METHODS

This research is a descriptive study. The International Cartographic Association defines geographic (spatial) information system (GIS) as a system for capturing, storing, updating, checking, and displaying data and enabling users to understand and analyze the relationship between the data and its location.<sup>6</sup> Therefore, GIS became a tool for presenting information to end-users and decision support systems for decision-makers in many complex social, economic, and environmental analyses. Epidemiology deals with the examination of health-related facts and their determinants, and GIS can be used due to spatial information it provides.<sup>7,8</sup> Spatial analysis and GIS play an important role in the COVID-19 pandemic,<sup>9,10</sup> as in many epidemiological studies of other epidemic of diseases.<sup>11,12</sup>

With this approach, this study has been prepared with the data provided by Istanbul Metropolitan Municipality available at <https://portalcbbs.ibb.gov.tr>. In this context, the study area was geocoded according to geohash precision level 6. Such a cell has a dimension of 1.2 × 0.6 kms. All spatial analyses were evaluated according to the data geo-referenced into these grids. For pinpointing the movements of blue-collar workers, data were obtained from the locations of the telephone signals received from mobile stations in specific areas (industrial sites, factories, etc.) during work hours (9 AM to 5 PM). While determining the residential area, working area, and for mobility analysis, the locations (produced from the applications that collect location information) that received over 1 hour of signal on the same day within the previous week were examined. The most long-term signals were considered as residential or working area depending on the time of the day of signals. For mobility in public transports, transportation card usage and turnstile data were analyzed temporally and spatially based on different types of public transportation. The data were presented with thematic maps.

In this research, data disclosed to the public by the Istanbul Metropolitan Municipality were used. No special data were collected within the scope of the research. The research did not involve any contact with persons or social groups. Therefore, ethics committee approval is not required.

## RESULTS

A total of 1 157 082 people aged over 65 live in Istanbul, which accounts for 7.7% of the population. On the other

hand, there are 439 019 households where all residents are over 65 years old. Of this population, 178 564 are over the age of 65 and live alone.

The following districts of Istanbul are the areas with a high population of people aged 65 and more: Kadıköy, Üsküdar, Maltepe, Fatih, and Küçükçekmece. Districts with a high population of people over the age of 65 living alone are Kadıköy, Üsküdar, Fatih, Maltepe, and Küçükçekmece. The districts of Adalar, Sultanbeyli, Arnavutköy, Şile, Çekmeköy, and Sancaktepe have the lowest population of people over 65.

The COVID-19 pandemic has led to a decline in public transport use across Istanbul. Use of public transport was 45% less on March 16, 2020, than on March 9, 2020. This decline covers all modes of transport and increases steadily. A similar decline in use can be seen in the usage of bus, subway, and railway systems between March 9 and 24, 2020. When examining the public transport usage times, it can be seen that the need for transport city-wide has increased between the hours of 6-9 AM and 5-7 PM.

After the commencement of the quarantine and the ban on entry and exit to and from the city due to COVID-19, a significant decline in transportation in and out of the city was observed. However, despite this restriction, activity in the Gebze district was higher compared to other districts.

When physical activity data were compared alongside places of residence of social groups, it was found that activity was higher in areas where blue-collar workers live and work than other regions (Figure 1).

Due to this overlap, the daily commute data of blue-collar workers from March 25 to April 7, 2020, were analyzed and high activity was observed in Avcılar, Bahçelievler, Bağcılar, Çekmeköy, Esenyurt, Küçükçekmece, Ümraniye, and the D-100 highway area (Figure 2).

An "Istanbul COVID-19 Density Map" was created by analyzing the maps of confirmed COVID-19 cases in Istanbul provided by the Republic of Turkey Ministry of Health on April 7, 2020, along with the blue-collar worker residence, work, and daily commute data using the georeference method. Considering the "COVID-19 Density Map," an "Istanbul Infection Risk Map" (Figure 3) was created by analyzing Istanbul-wide activity and the socio-economic level in connection with income of neighborhoods.

Finally, data from the lockdown that became available as of April 10, 2020, in Turkey showed that it gave rise, contrary to expectations, to a significantly high level of pre-lockdown physical activity, due to the public not being informed of the lockdown. When the hourly activity of Istanbulites was examined for April 10, 2020, an hour after the lockdown was announced at 9 PM, a 62% increase in activity was detected compared to the same day and time of the previous week, and a 98% increase in activity was observed compared to the same time of the previous day. In the analyses made, this activity was directed toward banks and shopping centers. As soon as the lockdown was announced, a 100% increase in citizens heading to ATMs to withdraw cash was observed

### MAIN POINTS

- The main factor of the COVID-19 outbreak in Istanbul cannot be explained by the high density of the population over the age of 65 years.
- The way to prevent the spread of the pandemic is to give all employees paid leave and provide cash support to informal workers.
- The untimely announcement of lockdowns contributes to increased activity in communities with people who do not have the means to store food.

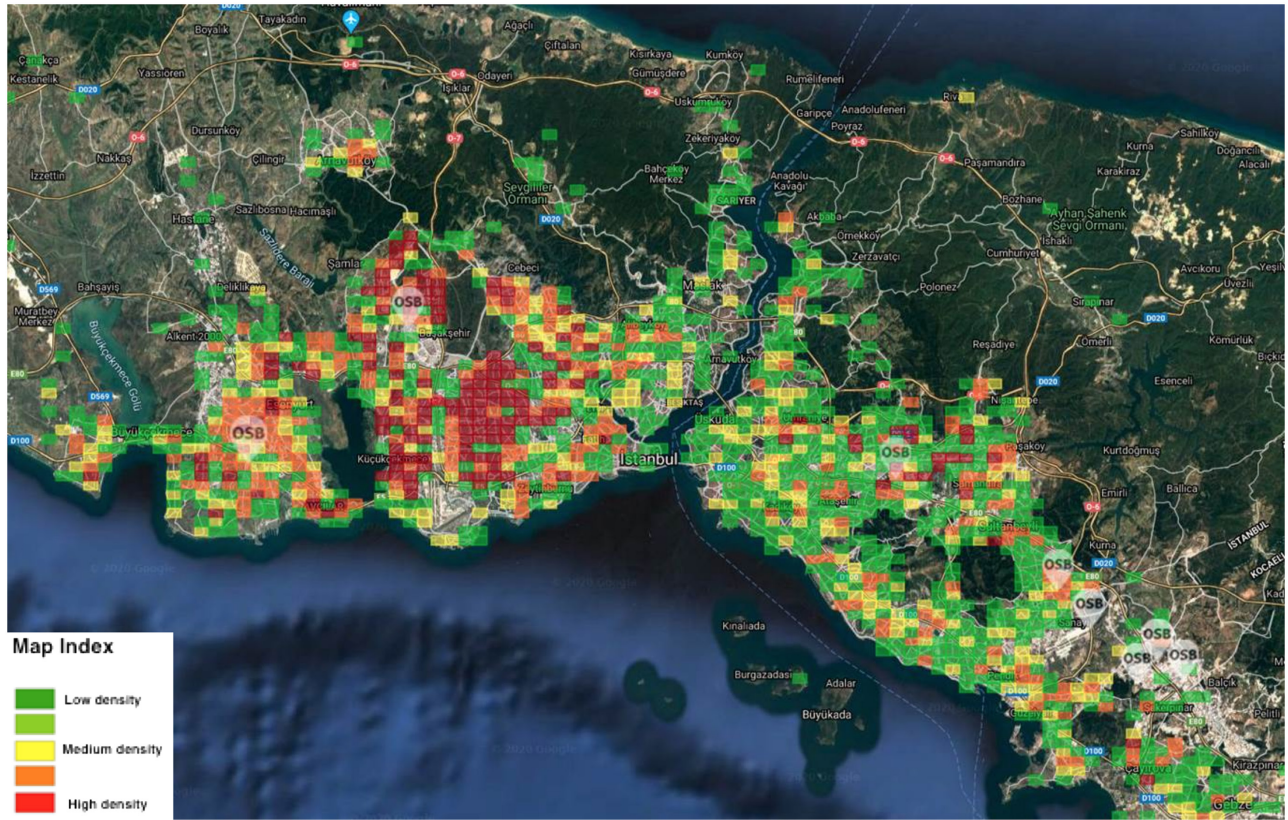


Figure 1. Blue-collar worker residence and work (organised industrial zone) places.

compared to the previous week. Similarly, the increase in the rate of activity for retail outlets such as markets, gas stations, and bakeries was around 100%. It has been determined

that this activity was concentrated in Alibeyköy, Avcılar, Bahçelievler, Esenyurt, Pendik, Sultançiftliği, and Ümraniye (Figure 4).

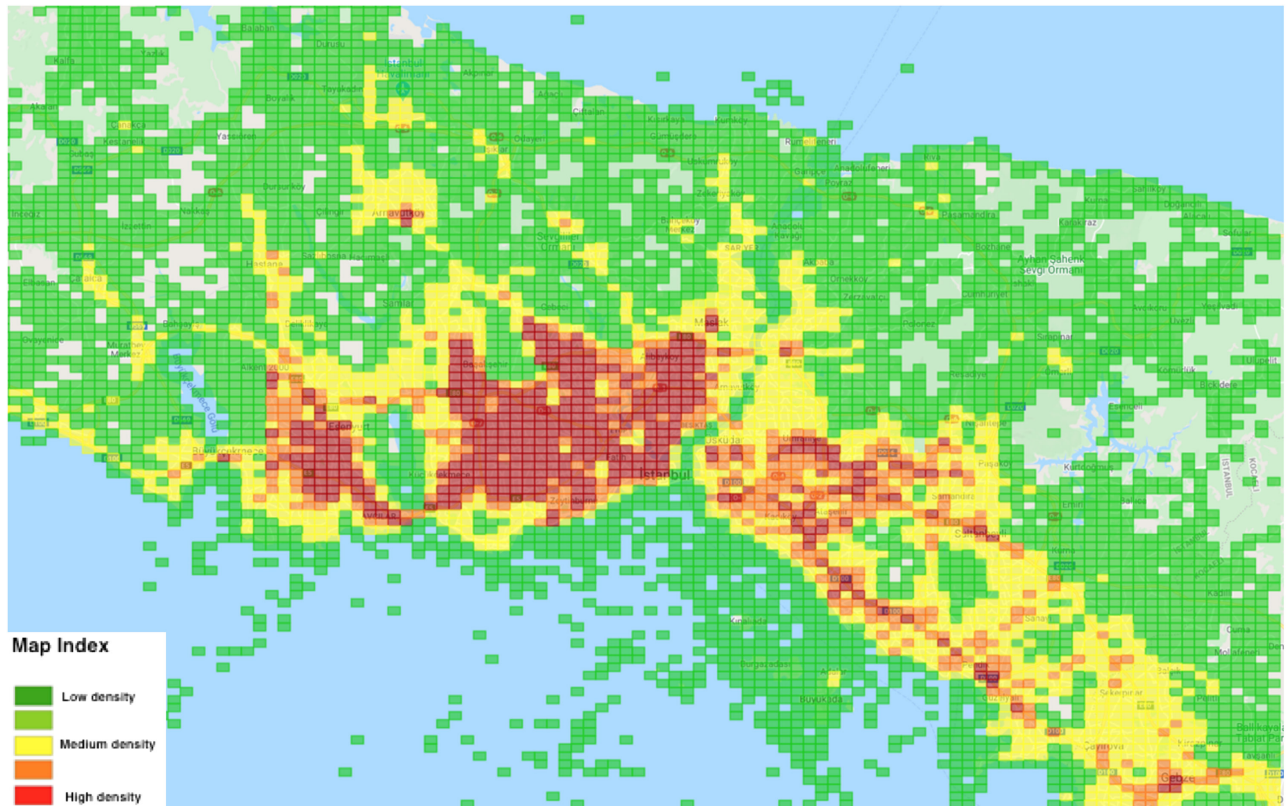


Figure 2. Blue collar worker commute activity.

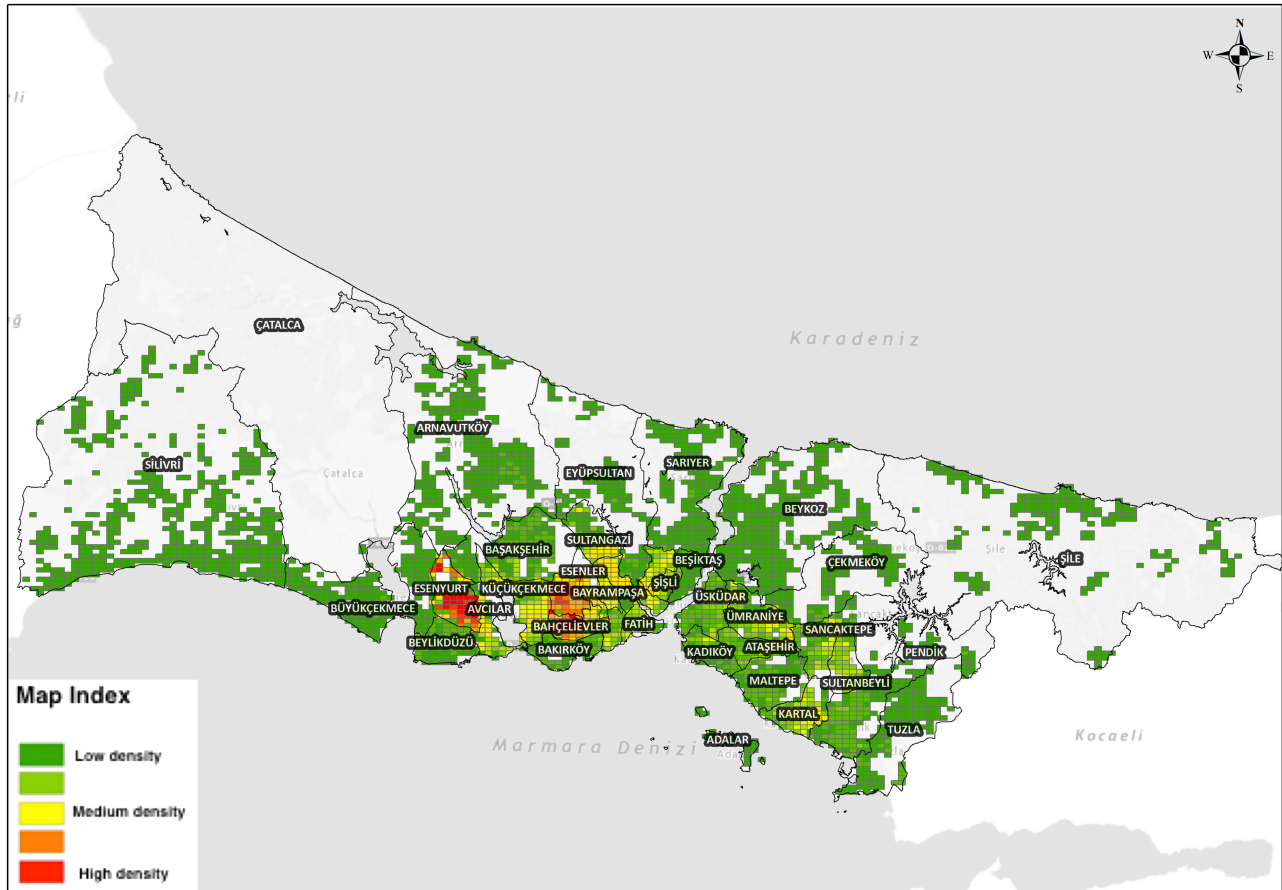


Figure 3. İstanbul infection risk map.

DISCUSSION

This article indicates that, contrary to expectations, the main risk group of the COVID-19 outbreak in İstanbul is not older people but people who have to continue working

despite the pandemic. Also, unplanned and unorganized lockdowns contribute to the spread of the pandemic by increasing activity instead of reducing it by restricting social activity.

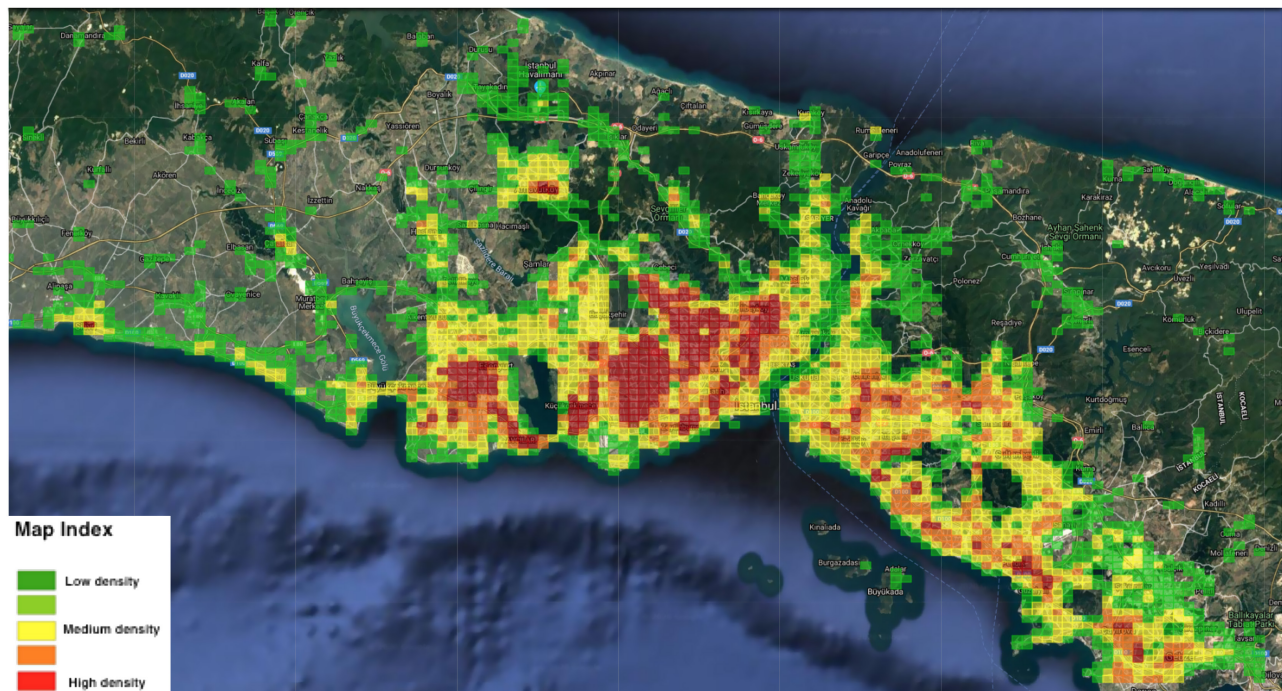


Figure 4. Mobility zones.

Although all age groups are at risk of contracting COVID-19, older people are more likely to contract the virus and die.<sup>13</sup> The median age of confirmed COVID-19 cases is 51, and 66% of people aged 70 and over experience comorbidity and are, therefore, at higher risk of contracting COVID-19. Besides the common diseases frequently observed in the elderly population, physiological changes due to aging and reduced immune function also increase the risk of COVID-19. Data from Italy, Spain, Sweden, Switzerland, and the Netherlands indicate that people over the age of 65 who smoke, have hypertension, diabetes, cardiovascular disease, chronic respiratory disease, immune deficiency condition, cancer, and obesity are in the high-risk group for COVID-19.<sup>14</sup> Although it is thought that differential levels of Angiotensin converting enzyme 2 (ACE2), which are identified as the SARS-CoV-2 receptor, in the cardiac and pulmonary tissues of younger versus older adults make the latter more susceptible to COVID-19, it should be recognized that the elderly are not a uniform group and the pandemic management should not be reduced to ageism.<sup>15</sup> The virus is spreading more in districts such as Avcılar, Bağcılar, Bahçelievler, Esenyurt, and Ümraniye, where the population over the age of 65 is not as dense as in districts such as Kadıköy, Üsküdar, Maltepe, and Fatih. This suggests that non-age factors also play an important role in the dynamic of the COVID-19 outbreak in İstanbul. In a single statement made by the Republic of Turkey Ministry of Health on age groups and frequency of COVID-19, it is stated that the infection rate among the population over the age of 65 is lower compared to other age groups. It is certain that this is due to the lockdown of those above 65 without exception, commenced 10 days after the first COVID-19 case was confirmed in Turkey. Like almost any infectious disease, the COVID-19 outbreak is also affected by human activity. Thus, COVID-19 was also defined as a disease subject to quarantine measures just like cholera, diphtheria, tuberculosis, plague, yellow fever, viral hemorrhagic fever, and influenza.<sup>16</sup> Hand hygiene, the use of face masks, avoiding crowded settings, social distancing between people in such environments, and city- or country-wide quarantine measures will prevent the spread of the virus. History and literature show that the quarantine measure is the most effective method in reducing the number of patients and deaths. According to the Cochrane analysis, the quarantine measure has reduced the number of incident cases from 81% to 44% and deaths, from 61% to 31% for the COVID-19 pandemic.<sup>17</sup>

In Turkey, the Ministry of Health has called for maintaining hand hygiene, the use of face masks, social distancing in crowded settings, and implemented stay-at-home measures for people below the age of 20 and above the age of 60. As our research uncovered, the use of all public transport, especially bus, subway, and railway systems between March 9 and 24, 2020, in İstanbul being almost cut in half indicates that these calls for activity restriction have been successful. However, the fact that the use of public transport has risen and peaked between 6 and 9 AM and between 5 and 7 PM. in İstanbul shows that these calls do not cover all population groups in the city.

In Turkey, the “Stay at Home” movement implemented to reduce the impact of the pandemic is an example of

self-quarantine, contrary to the compulsory quarantine imposed on people aged 20 and under, and 60 and over. In this form of quarantine, people are asked not to go out unless necessary, not to go to work if not necessary, or to work from home. However, this is not possible for blue-collar workers working in organized industrial zones, factories, and so on and people who earn money from daily informal and temporary jobs. For these people to be able to self-quarantine, the population over the age of 18 including informal workers need to be given paid leave or support. Turkey and many other countries implemented various kinds of support for the working population. For example, cash transfer programs, as the primary instrument for support, have been widely implemented in 186 countries around the world, and such programs were followed by utility/financial obligation waiver/postponement in 181 countries and in-kind voucher schemes implemented in 125 countries.<sup>18</sup> In addition, countries took additional measures through the social insurance programs of which the largest form of support being the social security contribution waiver/subsidy implemented in 110 countries and the second and third largest form of support being the unemployment benefits and paid sick leave.<sup>18</sup> Some countries resorted to support through active labor market programs and labor regulations which include wage subsidies and shorter work time, although these measures are more limited in comparison to social assistance and social insurance measures.<sup>18</sup> The nature of the above-mentioned support programs for the working population reflects the expansion of pre-pandemic dominance of flexibility and self-reliance in the labor market. Expansion of such policies further accelerates the insecurity for the working population. Thus, the “Stay at Home” self-quarantine measure is directed toward the self-employed and people who have sufficient savings to be able to not work during this period or people who are able to work from home. Blue-collar workers working in industrial zones and white-collar workers who are unable to work from home are compelled to use public transport systems for daily commute to and from the place of work. On the other hand, while human mobility fell in İstanbul, commuting to and from Gebze, which is situated at the outskirts of the city, continued. The data showed that this activity is mainly around the Gebze Organized Industrial Zone, which is an industrial space largely populated by blue-collar workers.

The spread of the virus was found to be intense in areas where blue-collar workers resided such as Avcılar, Bağcılar, Bahçelievler, Esenyurt, and Küçükçekmece as well as areas where they commuted every day, back and forth, such as Avcılar, Bahçelievler, Bağcılar, Çekmeköy, Esenyurt, Küçükçekmece, Ümraniye, and the D-100 highway area. Thus, the European side of İstanbul, where blue-collar workers frequently work and reside, is the epicenter of the COVID-19 outbreak in İstanbul. On the Asian side, Kurtköy, Pendik, Samandıra, Ümraniye, and Tuzla are notable risk areas in terms of COVID-19 due to them being residential areas for blue-collar workers (Figure 5).

The daily commute of white- and blue-collar workers to industrial areas, such as Beylikdüzü, Birlik, Dudullu, İkitelli, Anatolian side of İstanbul, İstanbul Leather Organized Industrial Zone, Tuzla and Tuzla Chemicals Organized

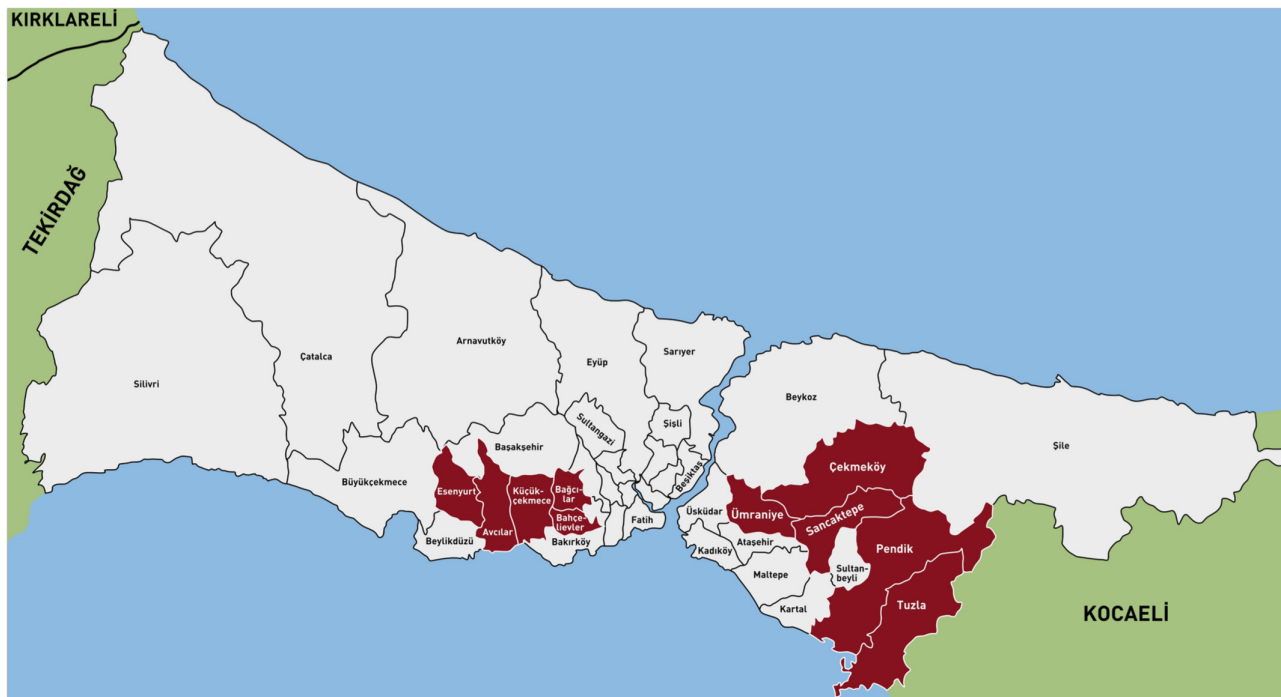


Figure 5. İstanbul district map.

Industrial Zone, and so on, is contributing to the rapid spread of the virus across İstanbul. Avcılar, Bahçelievler, Esenler, and Esenyurt, in correlation with human mobility and relatively low-income level, are the districts where blue-collar workers are heavily exposed to the virus. It is noteworthy that there are no similar studies in other countries and cities, which would support our findings regarding the COVID-19 outbreak. On the other hand, a report published by a labor union with the majority of members being blue-collar workers and partially white-collar workers working in industrial zones in Turkey stated that the prevalence of COVID-19 among union member workers was 3.2 times higher than the general population and that 1 out of every 4 union member workers died due to COVID-19, which support our findings.<sup>19</sup> Similarly, data provided by the Occupational Health and Safety Council, a civilian initiative group that exposes work-related accidents and deaths in Turkey, shows that at least 13 043 workers have been diagnosed with COVID-19, at least 128 workers have lost their lives due to COVID-19, and the mean age of the deceased workers is 50, 78% of whom worked in İstanbul during the first 2 months after the confirmation of the first COVID-19 case in Turkey.<sup>20</sup> A small number of studies conducted around the world on this topic have also revealed that blue-collar workers are a critical risk group in the epidemic. For example, in a cross-sectional study including 9468 people from Ecuador, it was found that COVID-19 mortality is higher among blue-collar workers and the unemployed.<sup>21</sup> Similarly, in a study conducted in France, it was determined that the COVID-19 pandemic worsened the level of self-reported health of blue-collar workers, especially during the lockdown periods.<sup>22</sup>

Lastly, increased human activity has been detected following the announcement of a poorly timed lockdown on April 10, 2020, in the Alibeyköy, Avcılar, Bahçelievler, Esenyurt, Pendik, Sultançiftliği, and Ümraniye districts. It can be seen

that the mobility zones visualized in Figure 4 are highly compatible with the areas of residence of the blue-collar workers visualized in Figure 1. This activity indicates that people living in the aforementioned areas did not have the necessary income and food stored at their homes at the time of the poorly timed 48-hour lockdown and that they buy their food and other necessary items on a daily basis.

The most important limitation of this study is the inability to show the ratio of infection to population at the neighborhood and district levels and the effects of gender and ethnic background due to lack of basic epidemiological public data for age, gender, occupation, ethnic background, and place of residence of COVID-19 patients. However, despite these shortcomings, this study has shown that it is possible to ensure-albeit partly-transparency regarding the course of the pandemic through the analysis of data from local authorities in countries such as Turkey, where the central government is not transparent and accountable.

In summary, this research points to the notion that the main factor of the COVID-19 outbreak in İstanbul cannot be explained by the high density of the population of 65 years or over, that the "Stay at Home" self-quarantine measure does not include blue- and white-collar workers, that the primary victim of the pandemic is the poor, who are forced to work every day including those that work informally, that the way to prevent the pandemic dynamic of cities is to give all employees paid leave and provide cash support including informal workers, and that the untimely and unorganized announcement of lockdowns contribute to increased human mobility in communities with people who do not have the means to store food.

**Ethics Committee Approval:** Ethical approval is not necessary due to the nature of this study.

**Informed Consent:** Informed consent is not necessary due to the nature of this study.

**Peer-review:** Externally peer-reviewed.

**Author Contributions:** Concept – N.A., O.E. ; Design – N.A., O.E.; Resources – N.A., O.E.; Materials – N.A., O.E.; Data Collection and/or Processing – N.A., O.E.; Analysis and/or Interpretation – N.A., O.E.; Literature Review – N.A., O.E.; Writing Manuscript – N.A., O.E.; Critical Review – N.A., O.E.

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