Neighborhood Level Socio-Economic Differences in Explaining the Geo-Spatial Distribution of Excess All-Cause Mortality During COVID-19 Pandemic in Istanbul

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Background

Under pandemic circumstances, excess all-cause mortality (EACM) was suggested as a more reliable indicator of the mortality impact. Turkey is one of the countries with the highest cumulative COVID-19 cases, but COVID-19 deaths lag the expected numbers. In this study, we aimed to examine the geospatial distribution of EACM during the COVID-19 pandemic and its association with demographic and socioeconomic variables at the neighborhood level in Istanbul, Turkey.

Methods

This ecological study used the death numbers at the neighborhood level provided by the Istanbul Metropolitan Municipality along with socioeconomic and transportation vulnerability index scores of each neighborhood. EACM rate was calculated by extracting the number of deaths in 2020 from the mean of 2018 and 2019 divided by the population number of the neighborhood (per 1,000). We used geographical information systems to map EACM and conducted a linear regression to analyze the association of EACM with socio-demographic variables in R Studio.

Findings

The all-cause mortality rate in 2018 and 2019 were 3.48 and 3.58 per 1,000 respectively, while it was 4.38 per 1,000 in 2020 constituting an EACM of 0.85 per 1,000 in Istanbul's 39 districts and 964 neighborhoods. Linear regression analysis indicated that higher EACM was associated with higher population density, higher percentage of 50 years and older age groups, and higher socioeconomic vulnerability index score at the neighborhood level.

Conclusion

This study highlights the heterogeneity of EACMR across the neighborhoods of Istanbul, Turkey, indicating that the COVID-19 pandemic's impact on mortality is significantly higher in crowded, older, and socio-economically vulnerable neighborhoods.

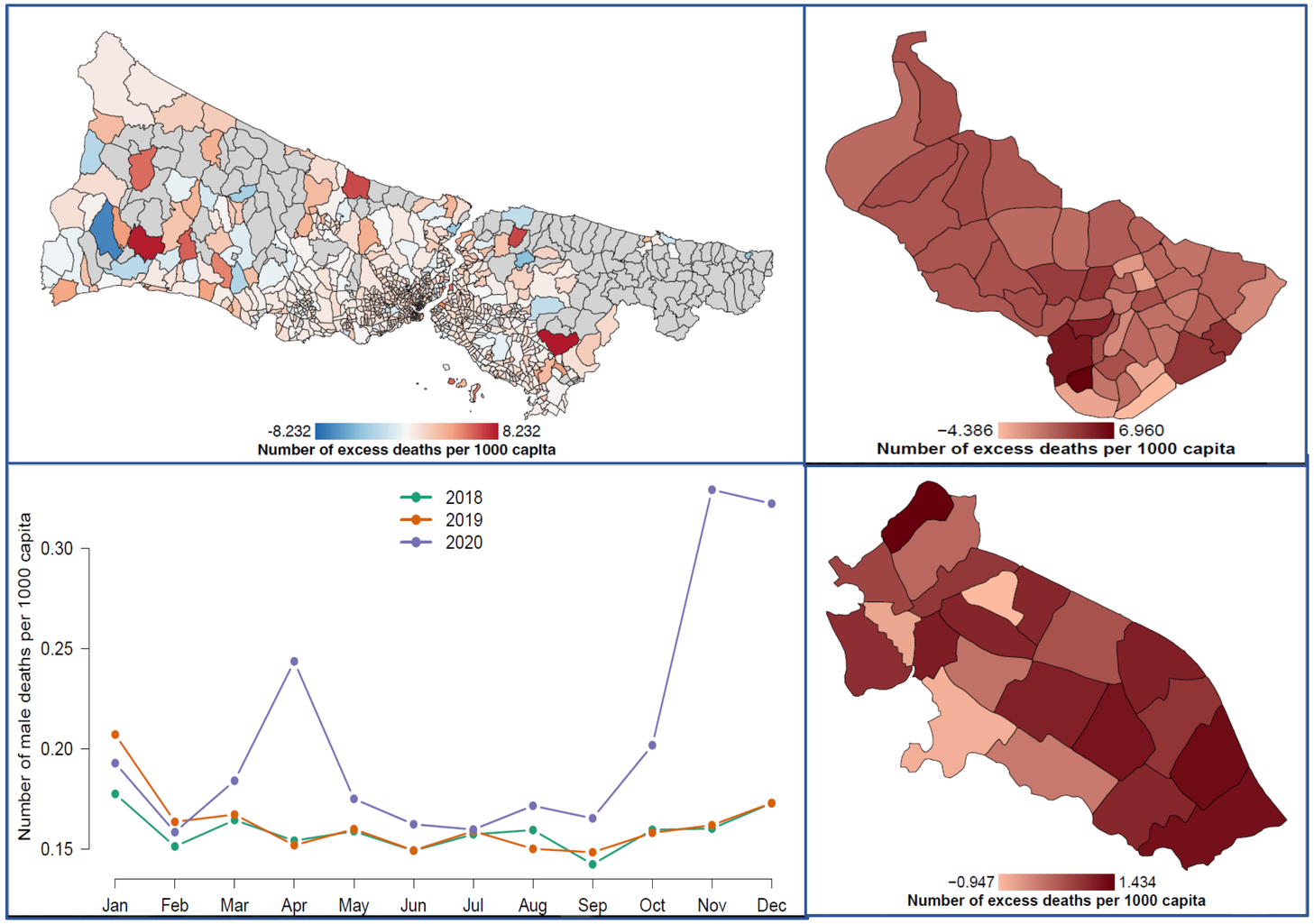

Figure 1: Heat map of spatial distribution of all-cause excess mortality rate in neighborhoods of Istanbul (A), Beyoğlu (B), Kadıköy (D); and temporal distribution of death numbers per 1000 person for the years 2018-2019-2020 (C).

Table 1. Lineer regression of neighborhood level indicators and EACM	Total excess mortality		Female excess mortality		Male excess mortality	
Neighborhood level indicators	**Coefficient**	**P value**	**Coefficient**	**P value**	**Coefficient**	**P value**
Population Density	3.69×10^{-06}	0.102	2.56×10^{-07}	0.861	3.43×10^{-06}	**0.037**
Percentage of people under 50 years	-3.26	**<0.001**	-1.07	**0.008**	-2.18	**<0.001**
Socioeconomic Vulnerability Index	2.14×10^{-02}	**<0.001**	5.65×10^{-03}	0.053	1.58×10^{-02}	**<0.001**