Descriptive Spatial Analysis of the Distribution of Green Open Spaces (RTH) and Fast Food Stalls on the Prevalence of Hypertension Cases in Surabaya City in 2024

Gifta Azzahra Aulindra Subekti

Public Health, Airlangga University, Indonesia
Coresponden author:
E-mail: gifta.azzahra.aulin-2022@fkm.unair.ac.id

Abstract
The massive urbanization transformation in Surabaya City has triggered the commercial expansion of fast food outlets, creating an obesogenic environment, while simultaneously threatening the existence of public Green Open Spaces (GOS) which are essential for cardiovascular health, including hypertension. This study aims to descriptively analyze the spatial correlation between the distribution of GOS and the accessibility of fast food outlets on the prevalence of hypertension cases in Surabaya City in 2024. This study uses a descriptive spatial analysis method at the sub-district analysis unit in Surabaya City. Secondary data on GOS area, Health Profile, and fast food outlet coordinates from OpenStreetMap were analyzed using overlay techniques and chloropath mapping through QGIS 3.34.3 software. The results of the analysis show significant spatial disparities. Sukolilo and Rungkut Districts have high exposure to fast food outlets, but their hypertension cases are controlled because they are balanced by the largest GOS area. In contrast, high hypertension hotspot areas (12–26%) were identified in Semampir, Pabean Cantian, and Karang Pilang Districts, which have very critical GOS availability (0–5,542 m²). There is an imbalance in the distribution of Green Open Space (RTH) and fast food restaurant clusters that indirectly correlates with the disparity in the prevalence of hypertension cases between sub-districts in Surabaya City in 2024.

Keywords: *Hypertension, Fast Food Shops, Surabaya City, Green Open Space (RTH).*

1. INTRODUCTION

Based on population, Surabaya is the largest city in Indonesia after Jakarta. The population of Surabaya in 2024 was 3.02 million people with a population growth rate of 0.29% (Badan Pusat Statistik Kota Surabaya, 2025). Based on data from the Statistics Indonesia (BPS) of Surabaya City, as of June 2024, 2,904,751 people lived in Surabaya. This number is the accumulation of local residents and migrants who live in Surabaya. From this figure, Surabaya is the city with the highest population density in East Java. Undeniably, migrants choose Surabaya as a destination city to live because of the wide opportunities available in terms of education, employment, and easy access to other needs. As the second largest metropolitan city in Indonesia, Surabaya has experienced a massive urbanization transformation and directly changed the lifestyle of its residents. The fast-paced dynamics of the city demand high productivity from its residents. This condition is also in line with the preference for food consumption towards more practical (Odebeatu et al., 2024). This is what then drives the massive growth of the fast food culinary sector that can answer food needs amidst the high mobility of society.

Meeting the needs of the community is directly proportional to the proliferation of fast food outlets in various corners of the city of Surabaya. From 2020 to 2024, the number of fast food outlets in the city of Surabaya reached more than 250 outlets. Each year, the city of Surabaya added 15 to 25 outlets. This phenomenon does not always lead to a positive impact on the community. There is a risk of health problems that may arise in the community. This is reinforced by the fact that an epidemiological transition has occurred, where there has been a shift in the number of cases of infectious diseases to non-communicable diseases. Non-communicable diseases are mostly caused by unhealthy lifestyles, one of which is the choice of foods that are less nutritious, such as fast food (Hamzah et al., 2021). Fast food is literally food that is prepared, served, and can be eaten in the shortest possible time. Fast food is often also called junk food because of the low nutritional value in one serving (Andriani et al., 2024). This food is synonymous with

high nutritional content of sodium, fat, sugar, etc. If consumed continuously and frequently, there is a risk of non-communicable diseases such as obesity, hypertension, coronary heart disease, and even stroke.

Several non-communicable diseases, such as obesity, hypertension, coronary heart disease, and stroke, can arise from the accumulation of unhealthy fats in the body and lead to complications. One of the most common non-communicable diseases in the community is hypertension. Hypertension is a multifactorial disease (Aditya & Mustofa, 2023). This disease can be caused by consuming foods high in sodium, which can be caused by consuming fast food. In addition, hypertension can also be caused by a person's low level of daily physical activity (Hasanudin et al., 2018). Given the highly dynamic and work-oriented population, they often forget about physical activity. A busy daily schedule is an excuse for not engaging in physical activity. Sports activities are not a priority that must be done regularly. This reason should have a linear solution, namely optimizing the effectiveness of public facilities that can meet the community's daily physical activity needs, such as the provision of green open spaces (RTH) for exercise.

In a dense urban ecosystem, Green Open Space (GOS) is no longer merely an aesthetic element in urban areas that fills city streets, but a structural component that has a salutogenic effect on public health. Based on Law No. 26 of 2007 concerning Spatial Planning, every city is required to provide a minimum of 30% of RH from the total area with a proportion of 20% public GOS and 10% private GOS. The existence of this urban vegetation functions as a restorative environment that has been epidemiologically proven to be able to mitigate the burden of cardiorespiratory disease and non-communicable diseases through two main pathways, namely providing safe physical activity suggestions to control blood sugar pressure, and reducing urban environmental stress by reducing sympathetic nerve activity and cortisol hormone in the human body (Girsang, 2026). However, meeting the target area and health function of GOS faces major challenges in metropolitan cities like Surabaya. Therefore, this study aims to descriptively analyze the spatial correlation between the distribution of Green Open Space (GOS) and the accessibility of fast food outlets to the prevalence of hypertension cases in Surabaya City in 2024.

II. METHOD

This study uses a descriptive spatial analysis method to map the distribution of Green Open Space (GOS), fast food outlets, and the prevalence of hypertension in Surabaya City in 2024. The unit of analysis of this study is the sub-district area in Surabaya City. The research data were obtained from secondary data in the form of GOS area through the open-access data portal of the Surabaya City Environmental Agency, data on the prevalence of hypertension cases in 2024 from the Surabaya City Health Profile, and spatial data on the location points of fast food outlets extracted from the OpenStreetMap (OSM) database by utilizing the QuickOSM plugin in QGIS 3.34.3 software through appropriate key-value tagging filtration.

III. RESULTS AND DISCUSSIONS

The human environment is surrounded by a combination of various types of green open spaces (GOS), including private areas such as yards or residential gardens and public facilities such as city parks. The spatial existence of these elements is closely related to reducing mortality rates due to cardiovascular disease (Odebeatu et al., 2024). Surabaya, as a metropolitan city, has an interaction between commercial expansion and shrinking green open spaces, which is suspected of forming a risk for cardiovascular disease, including hypertension. Geographic visualization is needed to identify regional disparities and determine priority intervention zones. This study analyzed data using an overlay technique between variables with visualization of the distribution of GOS area using graduated symbology (Chloropeth Map) from light to dark to represent the GOS area from small to large, while the location points of fast food outlets and hypertension prevalence data used graduated symbols (dot density) with varying sizes to identify spatial clusters.

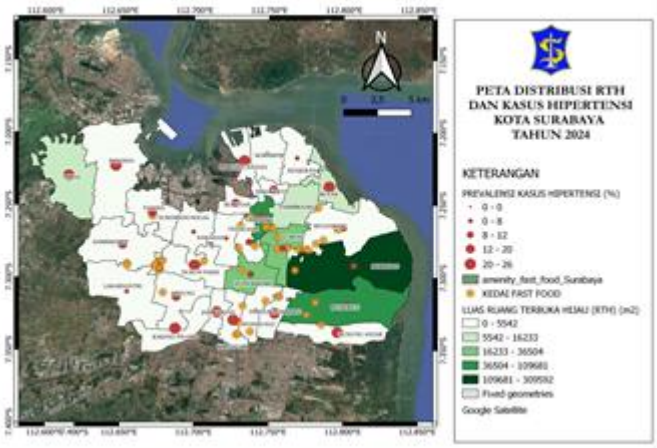

Fig1. Distribution Map of Green Open Space, Fast Food Stalls, and Hypertension Cases in Surabaya City in 2024

The chlorophyll map-based spatial visualization in Figure 1 shows the unequal distribution of green open space area between sub-districts in Surabaya City. East Surabaya, particularly Sukolilo Sub-district (109,681-309,592 m²) and Rungkut Sub-district (36,504-109,681 m²), dominates with the highest green open space area indicated by the darkest green chlorophyll. Conversely, some areas of central, northern, and southern Surabaya City are in the lowest classification (0-5,542 m²), as seen in Tegalsari, Bubutan, Simokerto, Sawahan, and Wonokromo Sub-districts which are dominated by white to very light green.

The distribution of fast food outlets, symbolized by an orange star, indicates a very dense spatial clustering pattern in the central, eastern, and southern corridors of Surabaya City. The highest concentration of outlets was identified in the central economic, business, and educational areas, including the districts of Genteng, Tegalsari, Gubeng, Wonokromo, Sukolilo, and Wiyung. Outlying areas, such as Benowo and Pakal, as well as Semampir and Kenjeran, were observed to have minimal and almost no large-scale commercial fast food outlets.

The prevalence of hypertension cases in 2024, depicted by red circles, shows variations in size representing the severity of cases, ranging from 0% to 26%. Based on the visualization in Figure 1, several sub-districts show significant red circle sizes, namely in the 12-20% and 20-26% categories. These high-prevalence areas are spread across several zones, including Karang Pilang District in the south, Semampir and Pabean Cantian Districts in the north, and Bulak District on the east coast.

Based on the overlay technique on the three variables shown in Figure 1, a spatial pattern trend was found. Areas with a high density of fast food outlets, such as Gubeng and Genteng Districts, do not automatically have the highest hypertension prevalence clusters, but are in the moderate category. In East Surabaya, in Sukolilo and Rungkut Districts, despite being exposed to a significant number of fast food outlets, the presence of extensive green open space is thought to provide a balanced environmental influence on community physical activity. Meanwhile, areas with a high hypertension prevalence, such as Semampir, Pabean Cantian, and Karang Pilang, are spatially proven to be in zones with very low green open space availability (0-5,542 m²).

Discussion

Urban lifestyle changes leading to obesogenic behaviors, such as high consumption of high-calorie foods and minimal physical activity, supported by permissive environmental conditions, are the main factors driving the surge in obesity rates among young people (Elgaard Jensen et al., 2019). Global projections estimate that by 2030, 60% of the world's population will be concentrated in urban areas, and this figure is predicted to jump to 80% by 2050 (Rahmayanti et al., 2026). This massive and progressive urbanization trend has triggered an urgency for academics to explore more deeply the salutogenic effects of urban environments (Rydin et al., 2012). Figure 1. Distribution Map of Green Open Space, Fast Food Restaurants, and Hypertension Cases in Surabaya City in 2024 shows that the distribution of fast food restaurants is concentrated in the central and eastern corridors of Surabaya City. This is in line with the concept of an

obesogenic environment, namely that modern urban spatial planning tends to facilitate an environment that encourages unhealthy eating patterns and minimal physical activity. The role of the city government must be involved in controlling the negative impacts of the environment that trigger disease. The equitable provision of Green Open Space (RTH) is one concrete manifestation of the salutogenic effect, creating living spaces that protect against the risk of cardiovascular disease for urban communities.

The manifestation of this salutogenic effect faces significant challenges in metropolitan cities where rapid urbanization often goes hand in hand with high commercial expansion. Instead of creating a health-promoting environment, the conversion of green areas into business districts in central and southern Surabaya has actually increased exposure to behavioral risk factors through the proliferation of fast food outlets. This spatial imbalance creates a contradictory situation. On the one hand, urban areas offer economic efficiency through affordable fast food outlets, but on the other hand, urban spatial planning becomes permissive to the development of non-communicable diseases, including hypertension. This phenomenon of spatial imbalance in several sub-districts is clear evidence of the city's failure to maintain its salutogenic function, which directly threatens the sustainability of public health in the future. Therefore, the high prevalence of hypertension cases in several areas, such as in Semampir and Pabean Cantian Districts, can no longer be seen purely as an individual failure to maintain a healthy lifestyle, but rather as a direct result of the manifestation of spatial inequality (Herdiawan, 2021). When a dense residential area is allowed to grow without leaving any green space, the city has systematically revoked its citizens' salutogenic rights to a beautiful environment. On the other hand,The successful control efforts in East Surabaya, specifically in Sukolilo and Rungkut, provide concrete evidence that environmental intervention through a massive green ecosystem can act as a protective barrier in reducing the negative impacts of an obesogenic environment. Ultimately, the integration of spatial analysis in this study goes beyond mapping disease distribution, but also serves as an advocacy tool that urges policymakers to reform the city's urban landscape to achieve equitable, region-based health equity.

IV. CONCLUSION

Based on the results of descriptive spatial analysis, it was concluded that there was an imbalance in the distribution of Green Open Space (RTH) and fast food restaurant clusters which were indirectly correlated to the disparity in the prevalence of hypertension cases between sub-districts in Surabaya City in 2024. The impact of this study confirmed that public health interventions in Surabaya City can no longer be generalized so it is recommended to implement area-based interventions.

REFERENCES

[1]. Aditya, NR, & Mustofa, S. (2023). Hypertension: An Overview. stroke, 5(9), 10.

[2]. Andriani, N., Nurdin, A., Fitria, U., & Dinen, KA (2024). Fast food consumption behavior in adolescents and its impact on health. ***Public Health Journal***, 1(2).

[3]. Surabaya City Central Statistics Agency. (2025). Surabaya City in Figures 2025. Surabaya: Surabaya City Statistics Agency

[4]. Elgaard Jensen, T., Kleberg Hansen, A.K., Ulijaszek, S., Munk, A.K., Madsen, A.K., Hillersdal, L., & Jespersen, A.P. (2019). Identifying notions of environment in obesity research using a mixed-methods approach. Obesity Reviews, 20(4), 621-630.

[5]. Girsang, DG (2026). The Impact of Daily Physical Activity on Physiological and Psychological Health: A Literature Review. ***Harapan Community Education Journal***, 5(03).

[6]. Hamzah, BD, Akbar, H., Rafsanjani, TM, Sinaga, AH, Hidayani, WR, Panma, Y., & Bela, SR (2021). Epidemiological Theory of Non-Communicable Diseases. ***Muhammad Zaini Publishing Foundation***

[7]. Hasanudin, H., Ardiyani, VM, & Perwiraningtyas, P. (2018). The relationship between physical activity and blood pressure in people with hypertension in the Tlogosuryo area, Tlogomas Village, Lowokwaru District, Malang City. Nursing News: Scientific Journal of Nursing, 3(1).

[8]. Herdiawan, J. (2021). Social Inequality Due to Internal Capital Contradictions in Geographic Space According to David Harvey's View

[9]. Odebeatu, C.C., Darssan, D., Roscoe, C., Ahmed, M., Reid, S., & Osborne, N.J. (2024). Greenspace and risk of obesity-related cancer in the UK Biobank cohort: An analysis of private residential gardens and other green-space types. ***Science of the Total Environment***, 943, 173833.

[10]. Rahmayanti, FD, Gunawan, A., Fauzi, AM, & Santosa, E. (2026). GREEN CITY (Risk-Based Urban Agriculture Strategy and Agroecology). Pustaka Aksara

[11]. Rydin, Y., Bleahu, A., Davies, M., Dávila, J.D., Friel, S., De Grandis, G., Wilson, J. (2012). Shaping cities for health: complexity and the planning of urban environments in the 21st century. ***The lancet***, 379(9831), 2079-2108.

[12]. World Health Organisation. Why Urban Health Matters Geneva; World Health Organization: Geneva, Switzerland, 2010.