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# Distribution of Hypertension Cases Based on Primary Health Care 2017–2021 in Malang, Indonesia: Spatial Analysis

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## Abstract

**Background:** Malang Regency is one of the cities in East Java, Indonesia that has a high trend of hypertension cases. The study aimed to describe the distribution of hypertension cases at the primary health care level in Malang Regency, Indonesia using spatial analysis.

**Methods:** This was a descriptive analysis study using secondary data obtained from the Health Profile of Malang Regency from 2017 to 2021. The total sampling method was used. Data on hypertension cases from 16 primary health cares was collected. Quantum geographic information system (QGIS) was used to visualize the distribution of cases. Data was presented in the tables and a map with different coloring based on the high-low categories of hypertension cases in a region.

**Results:** There was a tendency for an increase in hypertension cases every year in 3 of the 16 primary health cares. Primary health cares with an increased prevalence of cases during 2017–2021 were Arjowinangun (7.65% to 24.24%), Mojolangu (17.20% to 31.57%), and Kendalsari (8.84% to 27.29%). However, cases decreased from 2017 to 2018, and experienced a very high increase from 2018 to 2019.

**Conclusion:** The distribution of hypertension cases in Malang Regency from 2017 to 2021 tends to fluctuate from year to year. An education program for the community about a healthy lifestyle and the importance of conducting regular health checks is needed to decrease hypertension cases.

**Keywords:** Hypertension, non-communicable disease, spatial analysis, quantum geographic information system

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## Introduction

Hypertension is a condition when blood pressure increases beyond normal limits, which is ≥ 140 mmHg at systolic pressure and ≥90 mmHg at diastolic pressure.[1] American College of Cardiology American Heart Association Task Force on Clinical Practice Guidelines has different cut-off, which is >130 mmHg and >80 mmHg.[2] Hypertension is known as silent killer disease,[3] as this high blood pressure can lead to a sudden death.[4] Initially, this disease does not show specific symptoms that later become severe.

Indonesia is one of the countries in Southeast Asia that contributes to the high cases of hypertension.[5] The 2018 Basic Health Research (*Riset kesehatan dasar*, Riskesdas) reported an increase in the prevalence of hypertension cases from previous years, which was 34.1%.[6] Interestingly, in the 2007 Riskesdas report on had similar cases with 2018 (31.7%), which decreased in Riskesdas 2013 (25.8%). Thus, there is a trend to increase again to more than 60 million cases with a high mortality rate, which is estimated at 427,210 cases. Moreover, 41% of hypertension cases have no routine blood pressure checks at health facilities.

One of the provinces in Indonesia that has high cases of hypertension is East Java, as part of the 15 provinces with the highest prevalence of hypertension, in 6$^{th}$ position with a prevalence of 36.3%. Furthermore, Malang

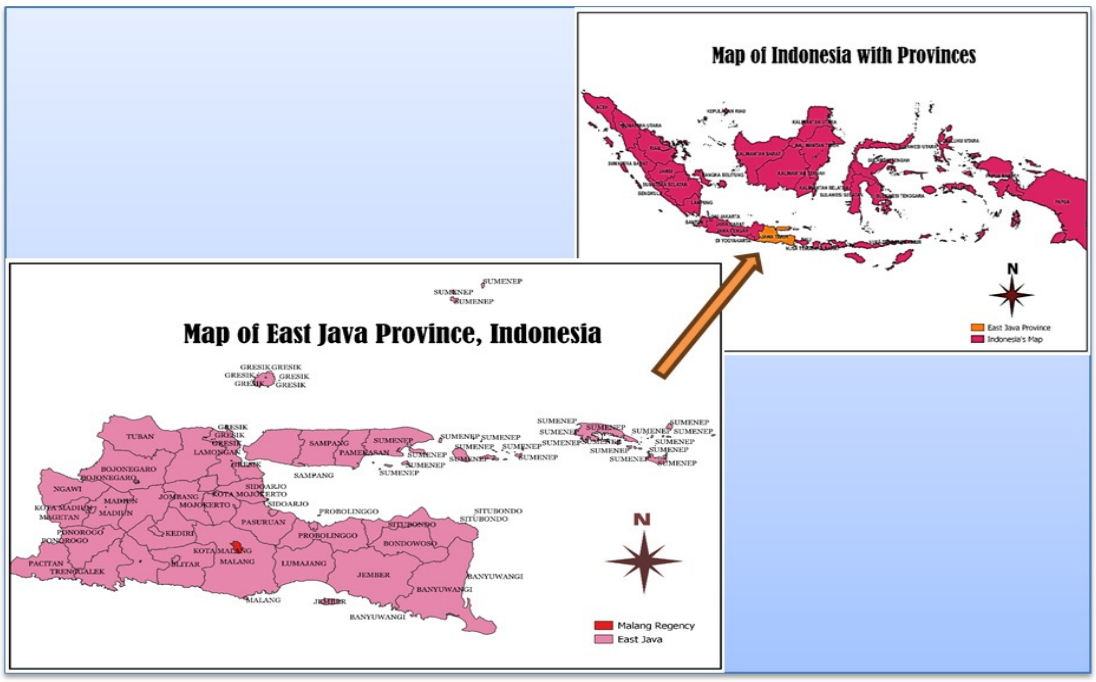


**Figure 1 Map of Malang Regency, East Java Province, Indonesia**

Regency is one of cities in East Java with high cases of hypertension. Cases of hypertension in Malang Regency have never been absent from the 3 most common diseases in Malang Regency from 2017 to 2021.[7-10] Thus, this study aimed to describe the distribution of hypertension cases in Malang Regency in 2017 to 2021 using spatial analysis.

## Methods

This was a descriptive epidemiological study with a time series study design. The data source used was secondary data obtained from the Health Profile of Malang Regency and the Central Statistical Agency of Malang Regency from 2017 to 2021. This study has received approval from the Research Ethics Commission of the Faculty of Public Health, Universitas Airlangga, number 59/EA/KEPK/2023.

There were 3 variables in this study including hypertension patients as the subject variable, all primary health cares in Malang Regency as the place variable (Figure 1), and year 2017 to 2021 as the time variable. In total, there were 16 primary health cares in Malang Regency, Indonesia. The population of the study included all cases of hypertension in Malang Regency from 2017 until 2021. The total sampling method was used.

Furthermore, the data was analyzed into quantum geographic information system (QGIS) software and presented in the form of tables and a map with different coloring based on the high or low category of hypertension cases in a region. Light gray indicates low cases of hypertension. Pink was an indicator that the health center has moderate cases of hypertension. Whereas maroon described the health center area that had very high cases of hypertension.

## Results

The number of hypertension cases in Malang Regency in 2017-2021 was 861,414 cases in 2017, 866,118 cases in 2018, 870,682 cases in 2019, 843,810 cases in 2020, and 844,933 cases in 2021. From 2017 to 2021, the smallest number of cases was in 2020.

The number of hypertension cases in Malang Regency in 2017–2021 by sub-districts and gender was depicted in Table 1. The sub-district with the highest number of hypertension cases was Kedungkandang with 303,948 cases, followed by Lowokwaru with 241,632 cases, and Sukun district with 238,141 cases. Hypertension cases in Malang Regency based on sub-districts were consistently dominated by female. In 2020, two of the five sub-districts, namely Klojen (from 102,018 to

**Table 1 Hypertension Cases in Malang Regency Based on Sub-district in 2017-2021[9]**

| Sub-District | Year | Gender | | Total |
|---|---|---|---|---|
| | | Male | Female | |
| Kedungkandang | 2017 | 94,663 | 95,611 | 190,274 |
| | 2018 | 95,662 | 96,654 | 192,316 |
| | 2019 | 96,684 | 97,657 | 194,341 |
| | 2020 | 104,156 | 103,272 | 207,428 |
| | 2021 | 104,480 | 103,595 | 208,075 |
| Sukun | 2017 | 95,852 | 97,099 | 192,951 |
| | 2018 | 96,516 | 97,805 | 194,321 |
| | 2019 | 97,194 | 98,465 | 195,659 |
| | 2020 | 98,090 | 98,210 | 196,300 |
| | 2021 | 98,171 | 98,316 | 196,487 |
| Klojen | 2017 | 49,102 | 54,027 | 103,129 |
| | 2018 | 48,833 | 53,751 | 102,584 |
| | 2019 | 48,571 | 53,447 | 102,018 |
| | 2020 | 45,928 | 48,184 | 94,112 |
| | 2021 | 45,880 | 48,192 | 94,072 |
| Blimbing | 2017 | 88,861 | 90,507 | 179,368 |
| | 2018 | 89,209 | 90,895 | 180,104 |
| | 2019 | 89,570 | 91,235 | 180,805 |
| | 2020 | 90,664 | 91,667 | 182,331 |
| | 2021 | 90,730 | 91,774 | 182,504 |
| Lowokwaru | 2017 | 96,333 | 99,359 | 195,692 |
| | 2018 | 96,858 | 99,935 | 196,793 |
| | 2019 | 97,397 | 100,462 | 197,859 |
| | 2020 | 81,063 | 82,576 | 163,639 |
| | 2021 | 81,122 | 82,673 | 163,795 |

94,112 cases) and Lowokwaru (from 197,859 to 163,639 cases), experienced a decrease in the number of cases (Table 1).

The prevalence of hypertension cases in Malang Regency was grouped based on the number of primary health care in each working area. It was known that in 5 sub-districts in Malang Regency there were 16 primary health cares, of which 3 primary health cares experienced an increase in hypertension cases from 2017 to 2021. These primary health cares were Arjowinangun with a prevalence 7.65 (2017), 9.51 (2018), 23.42 (2019), 23.81 (2020), 24.24 (2021), Mojolangu with a prevalence 17.20 (2017), 21.01 (2018), 30.67 (2109), 31.01 (2020), 31.57 (2021), and Kendalsari with a prevalence 8.84 (2017), 7.98 (2018), 26.63 (2019), 26.81 (2020), and 27.29 (2021). Kendalsari primary health care not only experienced an increase (2019, 2020, 2021) but also a decrease (2018) (Table 2).

The map of the distribution of hypertension from 2017 to 2021 was shown in Figure 2. In 2017, cases of hypertension in Malang Regency reached 59,283 cases. This number was categorized as high and was colored maroon because it was between 4,341 and 7,029 cases of hypertension. Primary health cares that were included in the high hypertension case area were Gribig, Mulyorejo, Janti, Bareng, Kendalkerep, and Dinoyo (Figure 2).

In 2018, although there were still several primary health cares that had high cases of hypertension, indicated by the maroon color, hypertension cases in Malang regency tended to decrease from the previous year and the lowest number of hypertension cases was 365 cases. The highest number of hypertension cases was only 5,423 cases that occurred at the Kendalkerep Primary Health Care. The distribution of hypertension cases in 2019 experienced a very high increase, reached 221,539 cases. This can be seen from several area that were previously light gray to pink. The highest cases of hypertension were found in the Dinoyo Primary Health Care with 21,825

**Table 2 Prevalence of Hypertension Cases based on Primary Health Care in Malang Regency, 2017-2021**

| Primary Health Care | Prevalence (%) | | | | |
|---|---|---|---|---|---|
| | 2017 | 2018 | 2019 | 2020 | 2021 |
| Kedungkandang | 10.88 | 6.89 | 23.73 | 23.99 | 24.43 |
| Gribig | 17.98 | 8.39 | 24.20 | 24.49 | 24.93 |
| Arjowinangun | 7.65 | 9.51 | 23.42 | 23.81 | 24.24 |
| Janti | 12.67 | 8.03 | 25.76 | 26.00 | 26.47 |
| Ciptomulyo | 11.04 | 8.40 | 30.80 | 31.10 | 31.66 |
| Mulyorejo | 20.79 | 5.82 | 20.67 | 22.17 | 22.57 |
| Arjuno | 6.24 | 17.47 | 29.53 | 29.44 | 29.98 |
| Bareng | 42.74 | 15.98 | 27.02 | 26.93 | 27.42 |
| Rampal Celaket | 11.71 | 2.12 | 25.68 | 25.63 | 26.06 |
| Cisadea | 12.32 | 5.40 | 25.91 | 25.99 | 26.46 |
| Kendalkerep | 15.08 | 9.18 | 26.01 | 26.12 | 26.60 |
| Polowijen | 18.83 | 7.19 | 24.21 | 24.38 | 24.82 |
| Pandanwangi | 18.16 | 10.53 | 24.39 | 24.68 | 25.12 |
| Dinoyo | 19.79 | 13.53 | 34.31 | 34.53 | 35.15 |
| Mojolangu | 17.20 | 21.01 | 30.67 | 31.01 | 31.57 |
| Kendalsari | 8.84 | 7.98 | 26.63 | 26.81 | 27.29 |

cases.

In 2020, hypertension cases in Malang Regency still increased but not significantly. Hypertension remained the most prevalent disease among the people of Malang regency.

In 2021, there was the highest number of cases overall, reaching 227,270 cases. Dinoyo Primary Health Care was a primary health care that had the most cases of hypertension, both in terms of the total number of cases from 2017 to 2021 and the number of cases each year. This can be seen from the color on the map which was always maroon (Figure 2 & 3). The number of cases of hypertension at the Dinoyo Primary Health Care from 2017 to 2021 were 7,029; 4,679; 21,825; 21,966; and 22,361 (data not shown). Meanwhile, Rampal Celaket Primary Health Care was a primary health care that with the fewest cases of hypertension from 2017 to 2021, shown in light gray on the map (Figure 2 & 3). Rampal Celaket Primary Health Care only had 457 hypertension cases in 2017 and 365 hypertension cases in 2018. However, in 2019 there was a significant increase, reaching 5,229 cases and in 2020 there was a slight decrease with a total of 5,219 cases then increasing again in 2021 to 5.305 cases.

## Discussion

Malang Regency is one of the cities in Indonesia that has high cases of hypertension. This city, which is located in East Java Province, is also experiencing a shift in disease patterns. In 2017–2019, the first rank for the most common diseases in Malang Regency was acute respiratory infection (ARI), which incidentally is a contagious infectious disease. However, in 2020–2021, based on the Malang Regency health profile report, hypertension became the disease most commonly suffered by its people.[9] Hypertension is a non-communicable disease with a high prevalence.[11] Many non-communicable diseases currently dominate the epidemiological transition, or movement of disease patterns. The cause is none other than an unhealthy lifestyle.[12]

Based on the results of the spatial analysis, it shows that in 2019 there was a significant increase in the number of hypertension cases and has increased steadily over the last year. The high number of hypertension cases are inseparable from the influence of the COVID-19 pandemic. Based on data from the COVID-19 Task Force, it is explained that of the total positive COVID cases, 50.5% of sufferers

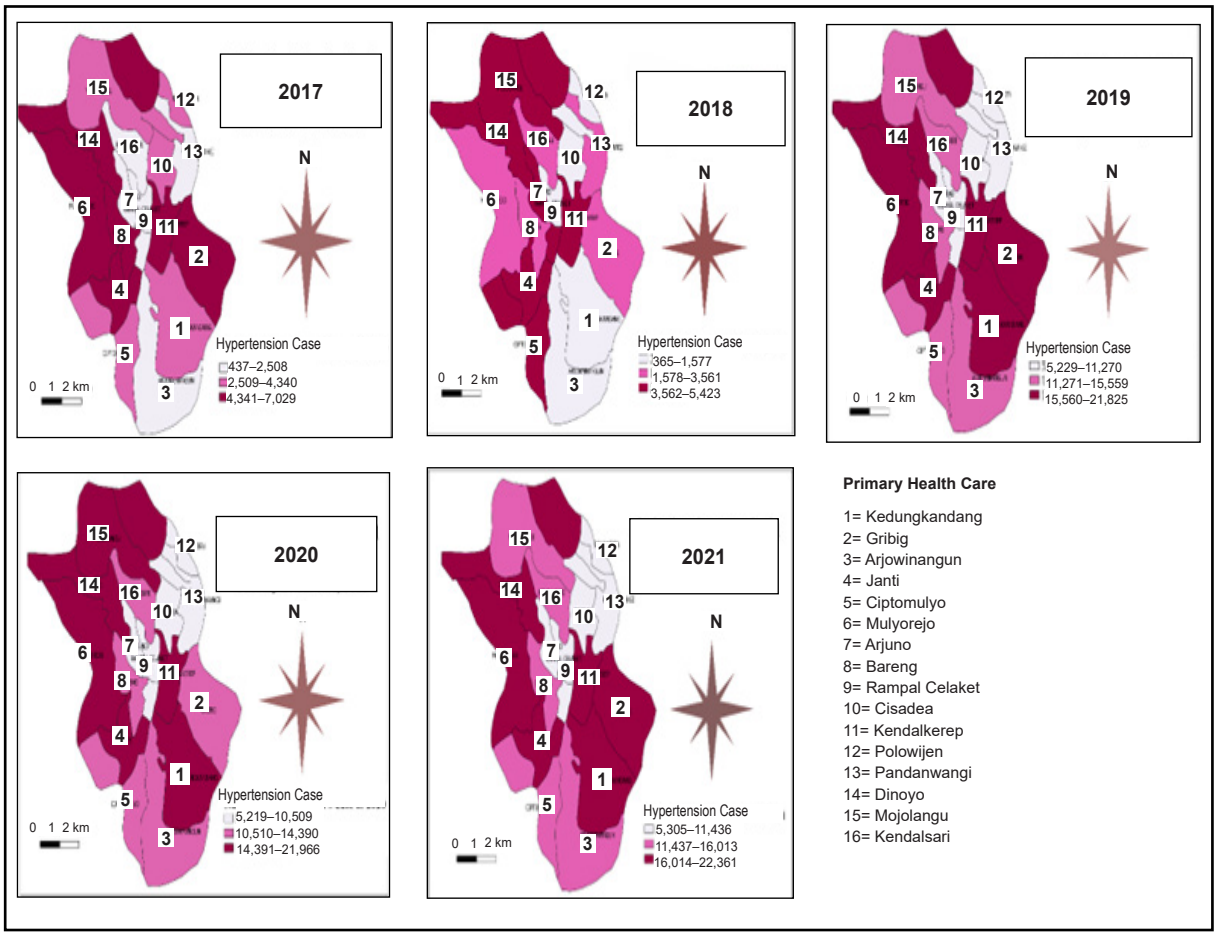


**Figure 2 Spatial Analysis of Hypertension Case in Malang Regency in 2017–2021**

have comorbid hypertension.[13] In addition, during the COVID-19 pandemic, many people who measuredtheir blood pressure caused many cases to be reported, whereas before the pandemic people were reluctant to carry out regular checks. In another study, it was stated that a family history of hypertension also influenced the incidence of hypertension during the pandemic. Family association has a strong relationship with epigenetic issue in this disease.[14] However, this does not mean that everyone who has a history of hypertension will always suffer from hypertension.[15] Stress during a pandemic can cause hypertension. Physiologically, when stress occurs, blood vessels narrow which can cause an increase in blood pressure.[16]

This study found that female outnumber male in cases of hypertension. Females are more at risk of experiencing hypertension due to changes in hormone levels.[17] The hormone estrogen plays a role in increasing high-density lipoprotein and maintaining the elasticity of blood vessels.[18] Another study has also mentioned the same thing. This change in estrogen levels is related to the menopause process in female, which often occurs at the age of over 40 years.[19] For adults, people with hypertension are more female. This study is in contrast to another research which shows that males are 3,617 time more at risk of hypertension than females because males do not have estrogen to prevent arteriosclerosis.[20]

Interestingly, a study in children has shown that boys were more likely to have hypertension.[21] It seems that gender is associated with a high risk of hypertension and age is also a risk factor. Taking hypertension medication regularly will help control blood pressure, especially in children. Pressure-controlled blood pressure rises at a younger age than at an older age. The proportion of blood pressure controlled at the age of 25–34 years (60.00%), 35–44 years (32.56%), 45–54 years (28.35%), and 55–64 years (14.29%) drops with age.[22] Therefore, it is

recommended for those aged 15–59 years to screen their health conditions, one of which is blood pressure measurement, as an early detection effort. Blood pressure measurement is included in the Minimum Service Standards (MSS) in the Productive Age Health Sector as part of an effort to detect hypertension early.

A limitation of this study is the lack information collected on certain characteristic of respondent, such as age. Therefore, completeness of respondent's demographic data would be more beneficial for further analysis.

In conclusion, the distribution of hypertension cases in Malang Regency from 2017 to 2021 tends to fluctuate from year to year. The increase in cases every year is found at the Arjowinangun, Mojolangu, and Kendalsari Primary Health Care.

Intervention strategies for hypertension-related programs need to be carried out by paying attention to primary health centers that experience an increase in hypertension cases. To minimize the number of hypertension cases, it is recommended to have an education program for the community about a healthy lifestyle and the importance of conducting regular health checks, especially to control blood pressure.

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