CORRELATION OF POPULATION DENSITY AND HEALTH TO URBAN QUALITY OF LIFE IN SUMATRA ISLAND

Abstract

This research aims to analyze the relationship between population density and health in the quality of life of 22 cities in Sumatra. The data used in this study are secondary and primary. This research is a qualitative descriptive analysis, to analyze the correlation between population density and health on the quality of life within a year (Cross Section) in 2020. The analytical model used in this research is the Klassen Typology model or the scatter plot. The results of this study indicate that several cities fall into different categories in each quadrant with descriptions: quadrant (1) region included in the classification of population density and high health, high quality of life; (2) regions in the second quadrant with low-level population density and health but high-level quality of life; (3) regions with a low level of population density and health and low level in the quality of life classifications; (4) regions that have high population density and health but low in the quality of life. It is recommended that the government set a policy to pay more attention to cities that are included in the quadrant IV category so that the high quality of life in quadrant I can be balanced with a low population density.

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1. Introduction

The population that lives in a geographical area seeks to settle or live temporarily, and those who stay temporarily do so due to assignment or work-related displacement. Meanwhile, the population of a country usually increases every year; it rarely decreases, except when a catastrophic disaster occurs, such as a tsunami in Aceh Province or an exodus caused by a great event. A population's size is very influential on the quality of its people. Thus, the quality of life is important to consider in development. As a result, the government must improve the quality of life to continue producing quality humans in the development process.

High population density can have an impact on the quality of life of residents in both rural and urban regions. Poverty, housing, and employment issues can all be exacerbated by high population density. Emerging issues can harm society's quality of life.

In the Indonesian experience, population density has a role in the transmission of COVID-19, referring to the fact that urban areas with high population density lead the disease to spread more quickly through a more complex distribution chain than suburban and rural areas. The primary cause of COVID-19 transmission in urban areas is high population densities (Hardianto, 2020). According to Christiani et al. (2014), people cannot achieve a high quality of life if they live in densely populated places. High population density generates a population explosion, which has a significant impact on the quality of life and environmental balance in a given area.

The population of a nation can either be useful or burdensome. It has potential if the population is balanced with other resources and enjoys a high quality of life. If a country is unable to support its population, however, it becomes a burden. A large population with good quality can contribute to a nation’s development; on the other hand, a huge population with low quality might burden and impede development (Carolina, 2018).

Cities are associated with a huge population or high population density, industrial centers, economic centers, and rapidly rising manufacturing industries. This increases the attractiveness of cities. Urban and rural communities can try their luck financially to improve their well-being and quality of life.
Table 1. Total and Population Density of 15 Selected Cities on Sumatra Island in 2019-2020

<table>
<thead>
<tr>
<th>Cities</th>
<th>Total Population</th>
<th>Population Densities</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>2019</td>
<td>2020</td>
</tr>
<tr>
<td>Medan</td>
<td>2,279,894</td>
<td>2,435,252</td>
</tr>
<tr>
<td>Palembang</td>
<td>1,662,893</td>
<td>1,668,848</td>
</tr>
<tr>
<td>Bandar Lampung</td>
<td>1,051,500</td>
<td>1,166,066</td>
</tr>
<tr>
<td>Batam</td>
<td>1,376,009</td>
<td>1,196,396</td>
</tr>
<tr>
<td>Pekanbaru</td>
<td>1,122,000</td>
<td>983,356</td>
</tr>
<tr>
<td>Padang</td>
<td>950,871</td>
<td>909,040</td>
</tr>
<tr>
<td>Jambi</td>
<td>604,736</td>
<td>606,200</td>
</tr>
<tr>
<td>Bengkulu</td>
<td>385,000</td>
<td>371,788</td>
</tr>
<tr>
<td>Dumai</td>
<td>308,812</td>
<td>316,782</td>
</tr>
<tr>
<td>Binjai</td>
<td>276,597</td>
<td>291,842</td>
</tr>
<tr>
<td>Banda Aceh</td>
<td>268,148</td>
<td>252,899</td>
</tr>
<tr>
<td>Lubuklinggau</td>
<td>232,229</td>
<td>234,166</td>
</tr>
<tr>
<td>Tanjungbalai</td>
<td>175,223</td>
<td>176,027</td>
</tr>
<tr>
<td>Tebing Tinggi</td>
<td>164,402</td>
<td>172,838</td>
</tr>
</tbody>
</table>

Resources: Central Bureau of Statistics Indonesia, 2019-2020

Table 1 shows that Medan City has the highest population of the 15 selected cities on Sumatra Island, with a total population of 2,435,252 people. Meanwhile, Tebing Tinggi City has the smallest population of 172,838 people. The data also shows that Medan City has a population density of 9186 people per km². This depicts the city's dense population. Dumai City, on the other hand, has a comparatively low population density of 179 people per km² across an area of 1,772 km².

Rapid urban population growth increases the demand for numerous urban infrastructures and utilities. Health facilities as a service to the population's basic needs for health are an important thing that must be provided as public facilities to support urban development. High population density may have a negative impact on health in a variety of ways, including environmental cleanliness and air pollution (Irfan, 2018).

Health is an important factor in human life associated with the impact of their quality of life. Life expectancy (LE) is one of the qualities of life elements. Life expectancy is a quality of life indicator used to analyze the health of the population. The proportion of health professionals in a country determines life expectancy. This is due to the fact that health workers are part of the health system and play a significant role in promoting public health through various activities and health services. The ratio of health professionals to the population measures the availability of health workers to accomplish specific health development goals.
Table 2. The Ratio of Health personnel to the Total Population (per 100,000 people), 2020

<table>
<thead>
<tr>
<th>Districts/Cities</th>
<th>Number of Health personnel</th>
<th>General Practitioners</th>
<th>Dentists</th>
<th>Medical Specialists</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Medan</td>
<td>1,101</td>
<td>211</td>
<td>925</td>
<td></td>
</tr>
<tr>
<td>Ratio</td>
<td>1: 45</td>
<td>1: 8</td>
<td>1: 38</td>
<td></td>
</tr>
<tr>
<td>Palembang</td>
<td>545</td>
<td>100</td>
<td>469</td>
<td></td>
</tr>
<tr>
<td>Ratio</td>
<td>1: 32</td>
<td>1: 6</td>
<td>1: 28</td>
<td></td>
</tr>
<tr>
<td>Bandar Lampung</td>
<td>495</td>
<td>73</td>
<td>293</td>
<td></td>
</tr>
<tr>
<td>Ratio</td>
<td>1: 43</td>
<td>1: 6</td>
<td>1: 25</td>
<td></td>
</tr>
<tr>
<td>Batam</td>
<td>347</td>
<td>69</td>
<td>223</td>
<td></td>
</tr>
<tr>
<td>Ratio</td>
<td>1: 29</td>
<td>1: 5</td>
<td>1: 18</td>
<td></td>
</tr>
<tr>
<td>Pekanbaru</td>
<td>625</td>
<td>149</td>
<td>463</td>
<td></td>
</tr>
<tr>
<td>Ratio</td>
<td>1: 63</td>
<td>1: 15</td>
<td>1: 47</td>
<td></td>
</tr>
<tr>
<td>Padang</td>
<td>498</td>
<td>122</td>
<td>414</td>
<td></td>
</tr>
<tr>
<td>Ratio</td>
<td>1: 55</td>
<td>1: 13</td>
<td>1: 45</td>
<td></td>
</tr>
<tr>
<td>Jambi</td>
<td>382</td>
<td>70</td>
<td>229</td>
<td></td>
</tr>
<tr>
<td>Ratio</td>
<td>1: 63</td>
<td>1: 11</td>
<td>1: 37</td>
<td></td>
</tr>
<tr>
<td>Bengkulu</td>
<td>206</td>
<td>55</td>
<td>109</td>
<td></td>
</tr>
<tr>
<td>Ratio</td>
<td>1: 55</td>
<td>1: 14</td>
<td>1: 29</td>
<td></td>
</tr>
<tr>
<td>Dumai</td>
<td>123</td>
<td>27</td>
<td>34</td>
<td></td>
</tr>
<tr>
<td>Ratio</td>
<td>1: 39</td>
<td>1: 8</td>
<td>1: 10</td>
<td></td>
</tr>
<tr>
<td>Pematang Siantar</td>
<td>104</td>
<td>24</td>
<td>54</td>
<td></td>
</tr>
<tr>
<td>Ratio</td>
<td>1: 38</td>
<td>1: 8</td>
<td>1: 20</td>
<td></td>
</tr>
<tr>
<td>Binjai</td>
<td>160</td>
<td>48</td>
<td>76</td>
<td></td>
</tr>
<tr>
<td>Ratio</td>
<td>1: 54</td>
<td>1: 16</td>
<td>1: 26</td>
<td></td>
</tr>
<tr>
<td>Banda Aceh</td>
<td>262</td>
<td>40</td>
<td>215</td>
<td></td>
</tr>
<tr>
<td>Ratio</td>
<td>1: 96</td>
<td>1: 14</td>
<td>1: 79</td>
<td></td>
</tr>
<tr>
<td>Lubuk Linggau</td>
<td>67</td>
<td>15</td>
<td>35</td>
<td></td>
</tr>
<tr>
<td>Ratio</td>
<td>1: 28</td>
<td>1: 6</td>
<td>1: 14</td>
<td></td>
</tr>
<tr>
<td>Tanjung Balai</td>
<td>50</td>
<td>6</td>
<td>16</td>
<td></td>
</tr>
<tr>
<td>Ratio</td>
<td>1: 28</td>
<td>1: 3</td>
<td>1: 9</td>
<td></td>
</tr>
<tr>
<td>Tebing Tinggi</td>
<td>75</td>
<td>11</td>
<td>36</td>
<td></td>
</tr>
<tr>
<td>Ratio</td>
<td>1: 43</td>
<td>1: 6</td>
<td>1: 20</td>
<td></td>
</tr>
</tbody>
</table>

*Resource: Health PPSDM Agency, 2020 (processed)*

Table 2 shows that the ratio of health professionals per 100,000 population remains low, indicating that more health workers must be added and distributed. Tanjung Balai City and Lubuk Linggau City have the fewest doctors, while Medan City has the most. Tanjung Balai has the lowest ratio, while Medan has the highest. When it comes to integrated health service requirements, one doctor can ideally serve a maximum of 100,000 residents, thus more doctors are still required. The World Health Organization (WHO) recommends a medical worker-to-population ratio of 1:2,500. It indicates that 1 doctor will care for 2,500 people. One of the goals outlined in the Regulation of the Minister of Law and Human Rights of the Republic of Indonesia Number 34 of 2016 concerning Criteria for Districts/Cities concerned with Human Rights, particularly the fulfillment of the right to health, is this ideal state as described by the WHO. However, the distribution of health workers encounters issues such as challenges with education and training, placement, retention, and performance in practically all nations, regardless of their
level of social and economic development. Because they have a direct impact on the caliber of healthcare services delivered, health workers with the right mix of quantity and quality are crucial to achieving the best health metrics.

2. Theoretical Review

2.1 Quality of Life

According to the World Health Organization (Kwan, 2000), a person's perspective of the context and cultural values that are present in life about objectives, expectations, standards, and other factors that affect perception constitutes their quality of life. The concept of quality of life tends to have a varied meaning for each individual because it has various contributing aspects, such as financial, security, and health factors. It is frequently characterized as a component of well-being and pleasure in life. Because of this, the term "quality of life" is frequently used in the healthcare industry (Fayers & Machin, 2007).

HDI indicators have an impact on quality of life. According to the UNDP, a region's human development index is determined by several factors, including longevity and healthy life in terms of health; school enrollment rates to see the value of performance improvement measures from aspects of education and knowledge; and each community's ability to buy and fulfill several basic daily needs, as measured by average expenditure per capita for aspects of a decent standard of living. Income, housing, environment, social stability, health, education, and work possibilities are all indicators of quality of life (OECD, 1982).

2.2 Population Density

The population density in an area is classified into four categories:

1) Crude Population Density, or the number of people per square kilometer.
2) Physiological population density is defined as the number of people per square kilometer of planted land.
3) Agricultural density is the number of farmers per square kilometer of cultivable land area, also known as agricultural population density.
4) Population economic density is the ratio of the total population to productive land area.

The rapid population growth has had a severe impact on the area's people's welfare, particularly in the socio-economic field.
2.2 Health

Health is a person's overall state of well-being. Physical, mental, and socioeconomic well-being can all contribute to overall health. Health is defined as "a state of well-being of the body, soul, and social that enables everyone to lead a socially and economically productive life" (Law No. 23 of 1992).

Health efforts are activities that are undertaken to maintain and improve one's health. A health professional is someone who is dedicated to the health sector and has acquired the knowledge and skills necessary to carry out work in the health sector through various types of health education. Health facilities are locations where health initiatives are carried out. The ratio of health professionals per population reflects the availability of health workers and service coverage to deliver health services to the population.

3. Research Methodology

This study uses a descriptive-qualitative analysis method to describe and facilitate the interpretation of data provided in graphs and tables. The variables used in this study are population density variables (BPS computed in Souls/km2) and health as assessed by health workers per 100,000 population as measured by ratio, with the quality of life index (QoL) a number that is calculated and quantified with an index unit.

Secondary and primary data were employed in this study. Population density and health data from the 2020 BPS were used as secondary data in this analysis. Meanwhile, the Quality of Life Index is calculated using primary/microdata provided by SUSENAS. Quality of Life Index Calculation (Puskorius, 2015):

\[ I = \sum_{i=1}^{n} a_i b_i \]

where:

- \( a \) and \( b \): Indicator weight coefficient
- \( I \): Indicators of the number of quality of life

This study used a qualitative descriptive analysis method with a scatter plot model in its analysis. The scatter diagram describes the association (correlation) between two variables and demonstrates the closeness of the relationship between one variable and another to determine how far apart the quality of the two data is.

As a boundary to correlation analysis, the average value of each variable is calculated on the two limiting axes that overlap perpendicularly at the point (X, Y), resulting in four quadrants,
namely quadrant I, quadrant II, quadrant III, and quadrant IV. A summary of the four quadrants, namely:

1) Quadrant I describes the best area conditions, or the abscissa (x) and ordinate (y) are both positive (+, +).
2) Quadrant II is nearly to an ideal area condition, or the abscissa (x) is negative and the ordinate (y) is positive (-, +).
3) Quadrant III is a non-ideal area condition, meaning the abscissa (x) and ordinate (y) is negative (-, -).
4) Quadrant IV is a less-than-ideal region, or the abscissa (x) is positive while the ordinate (y) is negative (+, -).

A Cartesian diagram is used as a description of each condition in that area based on the existing data to determine if an area is included in the right quadrant. The Klassen typology serves as the foundation for this analysis, which provides an overview of regional trends and structures. Areas are divided using quadrants utilizing this Klassen typology analysis (Selvia et al., 2015).

4. Result and Discussion

4.1 Result Analysis Using a Cartesian Scatter Plot

Figure 1 depicts an analysis of the relationship between the Quality of Life Index (QoL) and Population Density (PD).

Figure 1. The relationship between population density and quality of life for cities in Sumatra in 2020

Resource: The result of research (2021)
Figure 1 shows the results of the distribution of cities divided into four quadrants. The average population density is 5484.01 people/km$^2$, while the average quality of life index is 39.45. The results can be explained as follows:

a. Quadrant I shows areas with a high population density and a high quality of life. This quadrant includes Jambi City, Medan City, Padang City, Bandar Lampung City, Pekanbaru City, Batam City, and Palembang City.

b. Quadrant II denotes an area with a high level of quality of life but a low population density; no city in this quadrant meets these criteria.

c. Quadrant III includes Pematangsiantar City, Lhokseumawe City, Binjai City, Banda Aceh City, Pangkal Pinang City, Dumai City, Metro City, Tanjung Pinang City, Bukittinggi City, Prabumulih City, Lubuk Linggau, Pariaman City, Sungai Full City, and Sabang City, which have a low quality of life and population density.

d. In contrast, Quadrant IV represents locations with a low quality of life but a high population density. None of the cities in this quadrant satisfy the same criteria as those in quadrant II.

Following the findings of this study, cities with a high population density also have a good quality of life. Cities with a low population density also have a low quality of life. This can also demonstrate that the larger a city, the better the people's quality of life. Rumengan (2019), Sadali (2017) dan Lumbantoruan (2013) revealed that the provision of public facilities is significantly dependent on the existence of a population. Since public facilities are generally complete, there is a high population concentration there, and vice versa. A high population density or a large city can be said to correlate with the availability of public facilities and infrastructure, which will thus affect the quality of life. This condition describes how residents may easily access various facilities.

Figure 2 depicts the relationship between quality of life and level of health (HL).

Figure 2 depicts the relationship between health level and quality of life in Sumatra cities in 2020

Source: The result of research (2021)
Figure 2 shows the findings of the city distribution, which is likewise separated into four quadrants. The average health personnel ratio is 5.09 percent, with a quality of life index (QoL) of 39.45. Their relationship can be explained as follows:

a. Quadrant I includes Batam City, Medan City, Palembang City, Bandar Lampung City, Padang City, Pekanbaru City, and Jambi City, which have a high quality of life and above-average health levels.

b. Quadrant II depicts locations with a good quality of life but below-average health, yet there are no cities in this quadrant.

c. Quadrant III includes Bengkulu City, Dumai City, Banda Aceh City, Binjai City, Metro City, Pematangsiantar City, Sungai Full City, Lhokseumawe City, Tanjung Pinang City, Tanjung City Pinang, Bukit Tinggi City, Prabumulih City, Pariaman City, and Sabang City.

d. Quadrant IV depicts areas with low quality of life but above-average health; there are no cities in this quadrant that satisfy these criteria.

This analysis also confirms that a city with a high quality of life also has a high level of health. A city with a low quality of life is also a city with a low level of health, and vice versa. These findings are consistent with the findings of Indrayani and Riniatmodjo (2018) and Nursilmi (2017), who found that quality of life has a positive correlation with health, with a good quality of life having an impact on improving health.

This population growth is a result of development success, particularly in the health sector. The improved health and welfare of the people will have an impact on the quality of human life. Improving the Indonesian quality of life, particularly in Sumatra's urban areas, is one of the development plan's objectives, as shown by the influence of population density and the ratio of health personnel.

5. Conclusion and Policy Implications

Conclusion

Based on the research results, it is possible to conclude that:

1) High and low population densities correlate with the quality of life index. This indicates that the higher the population density or city size, the higher the quality of life, and vice versa.

2) The better the level of service and health, the higher the city's quality of life index.

Policy Implications

Based on the findings of this study, the following recommendations can be made:

1) While higher population density in larger cities provides a higher quality of life, this does not mean that various economic and social policies should be ignored. As a result, numerous economic and social policies, particularly those capable of raising income and decreasing...
poverty, must be maintained.

2) Social factors, such as health, must continue to be a major concern in urban growth. As a result, factors that contribute to a decline in health must be carefully considered.

3) Future researchers are expected to be able to recognize and identify issues in the relationship between the variables in this study and quality of life to increase discussion in future research.

The degree of life quality must be examined again with the amenities and infrastructure that are established so that these cities become cities with quality people and can build a country's economy. As a result, as a country's economy grows, so does its people's standard of life and well-being.

Daftar Pustaka


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