Patterns of Non-Communicable Diseases in Semarang City: Descriptive Analysis Based on Public Health Data

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Abstract: Non-communicable diseases (NCDs) remain a major health issue both globally and nationally. According to the WHO, NCDs cause 41 million deaths each year, accounting for 74% of all global deaths.The high prevalence of NCDs can lead to decreased productivity and disruptions in daily activities.. Therefore, effective and sustainable prevention and control efforts are necessary to address these issues and support the achievement of health development goals in Indonesia. To conduct a comprehensive descriptive analysis of non-communicable diseases (NCDs) cases in the city of Semarang, identifying and highlighting key trends and patterns that emerge from the data. This study employs a descriptive analysis approach. Data source: The data used is Non Communicable Disease case data taken from the 39 Public Health Centers Electronic Health Record's (SIMPUS) of Semarang for the period 2020-August 2024. The data was collected, cleaned, and normalized before analysis. The result were visualized to identify trends and pattern and were integrated in dashboard intelligent visualization system. The total number of NCD cases in the study period was 155,720, the analysis revealed that the highest number of non-communicable disease cases in Semarang City occurred in July 2024 (16,940 cases), with the lowest in May 2020 (7,688 cases). Hypertension and non-insulin-dependent diabetes mellitus were the most common conditions. Geographically, Tembalang sub-district had the most NCDs cases (15,362), with Sendangmulyo village leading within sub-districts (2,772 cases). Women accounted for the majority of cases, totaling 95,985 (61,7%). Most non-communicable disease patients suffered from hypertension and non-insulin- dependent diabetes mellitus. The interventions are recommended, particularly in high-incidence areas like Tembalang and Sendangmulyo, focusing on hypertension and diabetes mellitus non-insulin. The findings can influence urban health policy, healthcare resource allocation, and community health programs, while also guiding future studies on climate change, healthy behaviour, and urbanization's impact on health outcomes.

Keywords: Non-communicable diseases (NCDs), Descriptive Analysis.

INTRODUCTION

Non-communicable diseases (NCDs) have emerged as a major global health concern, accounting for around 41 million deaths each year, which represents approximately 74% of all deaths worldwide (WHO, 2023). NCDs such as cardiovascular diseases, cancer, chronic respiratory diseases, and diabetes are the leading causes of premature mortality, particularly in low- and middle-income countries (Arifin et al., 2022).

In Indonesia, the transition from communicable diseases to NCDs has become increasingly evident, driven by factors like urbanization and lifestyle changes (KemenKes RI, 2020). Semarang, as a major city in Indonesia, is similarly burdened with high rates of NCDs, with hypertension and diabetes being the most prevalent conditions.

Research indicates that risk factors, such as central obesity and hypertension, are more common in men, whereas central obesity is more frequently found in women (Poniasih et al., 2024). Additional risk factors, including smoking, lack of physical activity, and inadequate fruit and vegetable consumption, also contribute significantly to the rising incidence of NCDs (Arifin et al., 2022). As a result, interventions aimed at mitigating these risk factors are crucial, particularly for reducing the NCD burden among vulnerable populations.

Moreover, team-based approaches within health service systems, such as the Posbindu NCD program, have shown promising outcomes. Following a six-month period, there was a 26.1% increase in hypertensive patients receiving treatment post-implementation, alongside notable improvements in public health workers' knowledge through intensive training (Taher et al., 2022). These initiatives underscore the importance of sustainable strategies for addressing NCDs across different levels of healthcare.

The COVID-19 pandemic has provided important lessons for NCD management policies in Indonesia and Malaysia, revealing both positive and negative impacts. During emergency situations, both countries need to consider enacting specific regulations to safeguard public health during pandemics or epidemics (Budiarsih et al., 2022). Early screening, timely treatment, and regular monitoring of NCDs have become increasingly vital in detecting diseases before complications arise, thereby facilitating more effective prevention and management efforts (Purnamasari, 2018).

To better support data-driven health policy planning, there is a need for more detailed descriptive analyses of NCD distribution in Semarang. Collaboration between multiple stakeholders is essential for effective NCD prevention and control, with ongoing monitoring and evaluation necessary to ensure the success of health interventions. Geographical studies of NCD prevalence are critical for identifying vulnerable areas, and insights into the spatial distribution of cases, age groups, and socioeconomic factors can guide more targeted health strategies. Electronic medical record systems like SIMPUS, utilized in community health centers, further streamline the collection and analysis of NCD data in Semarang.

This research aims to perform a descriptive analysis of NCD case data in Semarang, focusing on identifying trends and distribution patterns between 2020 and 2024. The findings from this study are expected

to contribute to future NCD prevention and control efforts, as well as inform the development of health policy in the city.

METHOD

This study employs a descriptive analysis method, utilizing data from electronic medical records (SIMPUS) covering the period from January 2020 to June 2024. Prior to the analysis and visualization stages, several preparatory steps were taken to ensure data quality and accuracy, including data collection, processing, visualization, and analysis.

The dataset includes variables such as gender, age, geographic location, type of non-communicable disease, and the date of diagnosis by healthcare professionals. The non-communicable diseases analyzed in this study encompass bronchial asthma, colorectal cancer, breast cancer, lung cancer, cervical cancer, decompensated heart failure, non-insulin dependent diabetes mellitus, insulin dependent diabetes mellitus, chronic kidney disease, hypertension, acute myocardial infarction, leukemia, obesity, osteoporosis, COPD, retinoblastoma, stroke, and thalassemia.

The selected variables were considered to be relevant and crucial for achieving the research objectives. These variables were subjected to a data cleaning process, which involved identifying missing values, removing duplicates, and addressing inconsistencies in the data. Afterward, the data was normalized to standardize formats, recoded, and aggregated to avoid excessive granularity (Mohammed Mahmoud, 2024). The processed data was further organized by age group, diagnosis, gender, geographic location, and case timeline.

The subsequent step involved creating visualizations based on the processed data, including graphs of case trends grouped by gender, age, and time. Detailed maps were generated to visualize the distribution of non-communicable diseases at the district and sub-district levels, revealing spatial distribution patterns. These visualizations provide a deeper understanding of the vulnerability to non-communicable diseases in Semarang City. To enhance accessibility and usability, the visualizations were integrated into the Ckrawala Buana dashboard, a website developed by the Semarang City Health Office. Ckrawala Buana is an innovative platform designed to present clear and accessible information on non-communicable diseases in Semarang City, supporting better-informed decision-making for disease management and control.

Finally, an interactive analysis of the visualized data was conducted to extract meaningful insights. The integration of data analysis, visualization, and online dissemination represents a significant advancement

in public health innovation in Semarang. By combining these elements, this research contributes to enhancing decision-making quality in the health sector (Suhito et al., 2024).

RESULTS

The findings of this study offer an insight into the distribution patterns of non-communicable diseases, analyzed through monthly trends, disease types, geographic regions, age groups, and gender, presented in graphical and map formats. This research emphasizes the prevalence of non-communicable disease cases, factoring in patient visits and the incidence rates of these conditions.

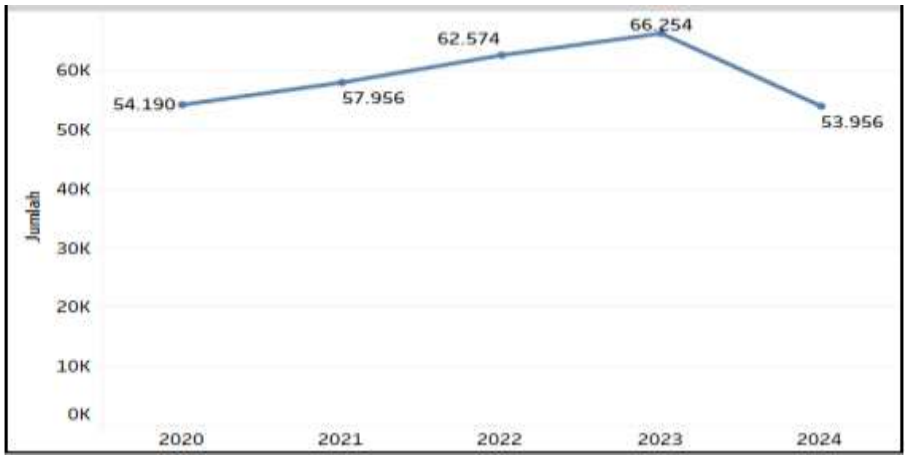


Figure 1. Trends of Patient with NCDs Cases from 2020 to August 2024

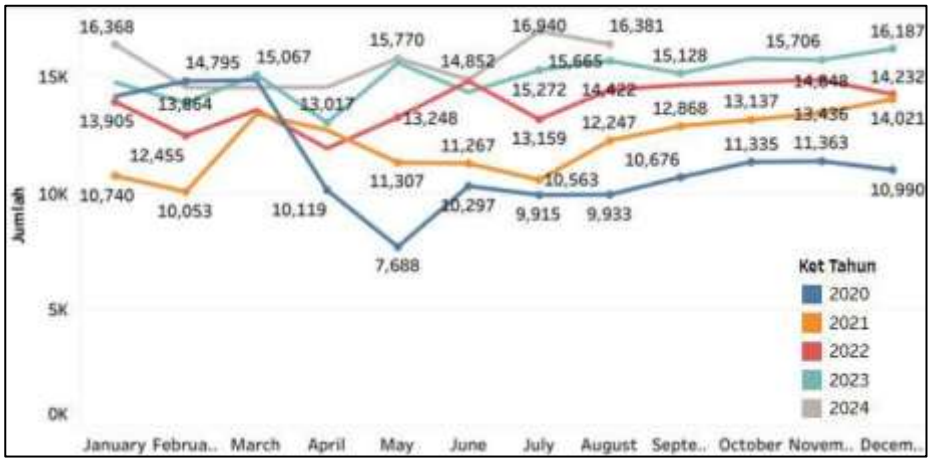
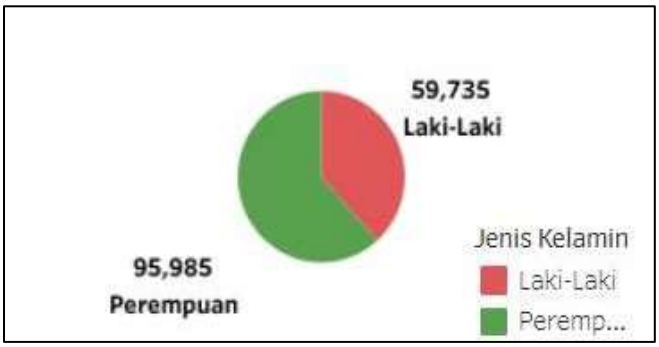


Figure 2. Monthly Trends of Patient with NCDs Cases from 2020 to August 2024

The chart illustrates the trend of non-communicable disease cases in Semarang City, revealing a fluctuating pattern during specific months each year. Various factors may contribute to the random variations

in case numbers, which require further investigation. From July to December, the number of non-communicable disease cases consistently increases each year without a significant decrease. The peak of non-communicable disease cases occurred in January 2024, with 16,368 cases, while the lowest count was recorded in May 2020, with 7,688 cases.



. **Figure 3.** Number of Non-Communicable Disease Patients by Gender

The diagram illustrates that non-communicable disease cases in Semarang City are predominantly found in females, accounting for 61.7% of the total cases (95,985 cases), compared to 38.3% in males, with 59,735 cases. This descriptive analysis underscores the importance of focusing more attention on female patients and exploring the underlying causes of this gender disparity. However, when examining the percentages by disease type, not all categories are dominated by women, as shown in Table 1.

Table 1. Percentage per type of Non-Communicable Disease Patients by Gender.

Non Communicable Diseases Type	2020		2021		2022		2023		2024	
	Male	Female	Male	Female	Male	Female	Male	Female	Male	Female
bronchial asthma	43,3	56,7	42,48	57,52	41,82	58,18	42,67	57,33	42,85	57,15
collecteral cancer	42,5	57,5	52,38	47,62	38,1	61,9	40,58	59,42	50,67	49,33
breast cancer	1,24	98,76	1,67	98,33	0,98	99,02	0,95	99,05	0,29	99,71
lung cancer	59,65	40,35	62,26	37,74	56,72	43,28	54,93	45,07	50	50
cervical cancer	0,69	99,31	0,79	99,21	0,89	99,11	1,31	98,69	0,74	99,26
decompensation cordis	53,66	46,34	47,69	52,31	44,44	55,56	46,2	53,8	47,06	52,94
Non-insulin dependent diabetes mellitus	34,89	65,11	35,46	64,54	34,77	65,23	35,11	64,89	33,49	66,51
insulin dependent diabetes mellitus	34,97	65,03	34,3	65,7	32,41	67,59	34,75	65,25	34,2	65,8
chronic kidney disease	50	50	59,46	40,54	44,44	55,56	62,16	37,84	72,97	27,03
hypertension	34,94	65,06	35,15	64,85	33,12	66,88	32,74	67,26	32,13	67,87
accurate myocardial infarction	49,32	50,68	63,64	36,36	64,29	35,71	65,57	34,43	59,46	40,54
Leukimia	57,89	42,11	35,71	64,29	46,15	53,85	33,33	66,67	38,46	61,54
Obesity	21,47	78,53	24,23	75,77	24,52	75,48	28,68	71,32	28,93	71,07
Osteoporosis	31,82	68,18	73,68	26,32	43,48	56,52	31,58	68,42	30,77	69,23
COPD	60,64	39,36	59,84	40,16	57,79	42,21	59,48	40,52	58,57	41,43
Retinoblastoma	50	50	0	100	33,33	66,67	50	50	66,67	33,33
Stroke	54,25	45,75	52,35	47,65	48,06	51,94	49,75	50,25	53,79	46,21
Thalasemia	50	50	53,85	46,15	43,1	56,9	46,55	53,45	46,43	53,57

Source: Processing data from SIMPUS 2020 - 2024

Based on this data, we also found things that need to be studied further, especially in breast cancer and cervical cancer, whether it was found in male patients or whether there were errors in the patient data input process.

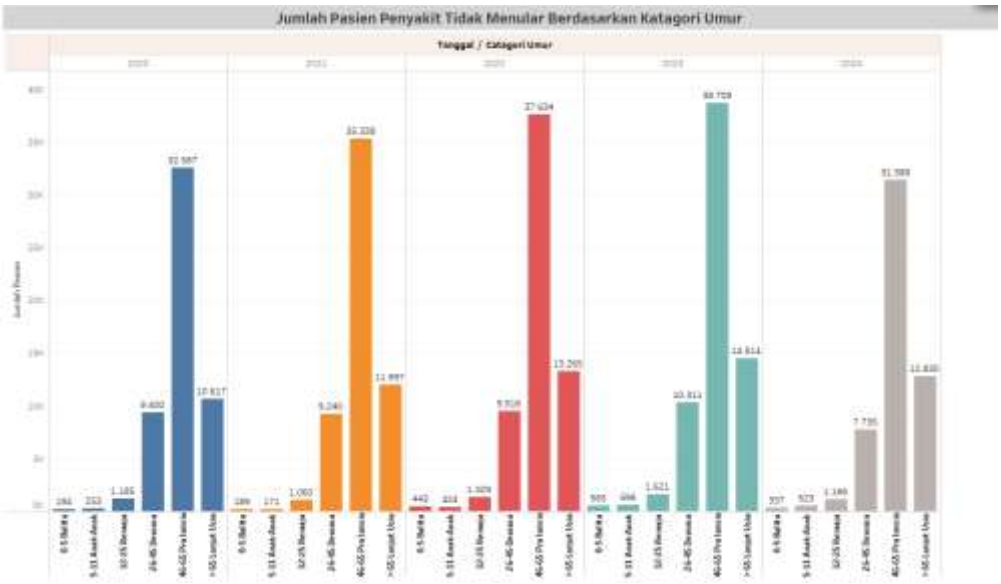


Figure 4. Category of Non-Communicable Disease Cases by age from 2020 to June-2024

Based on the graph above, the prevalence of non-communicable diseases is predominantly seen in the age group of 46 - 65 years, categorized as pre-elderly and then in the age group >65 years or categorized as elderly. However, non-communicable disease cases have been experienced in all age groups.

Figure 5. Trend of Non-Communicable Disease Cases from 2020 to June-2024

The data utilized in this study identifies several types of non-communicable diseases prevalent in Semarang City, including bronchial asthma, colorectal cancer, breast cancer, lung cancer, cervical cancer, and others. Among these, hypertension accounts for the highest number of cases, ranging between 29,728

and 47,127. The peak incidence of hypertension occurred in 2020, with 47,127 cases, while the lowest was recorded at 29,728 cases in mid-2024. Following hypertension, non-insulin-dependent diabetes mellitus ranks as the second most prevalent condition, with the lowest number of cases in 2020 at 14,737, and the highest in 2023, reaching 21,729 cases.

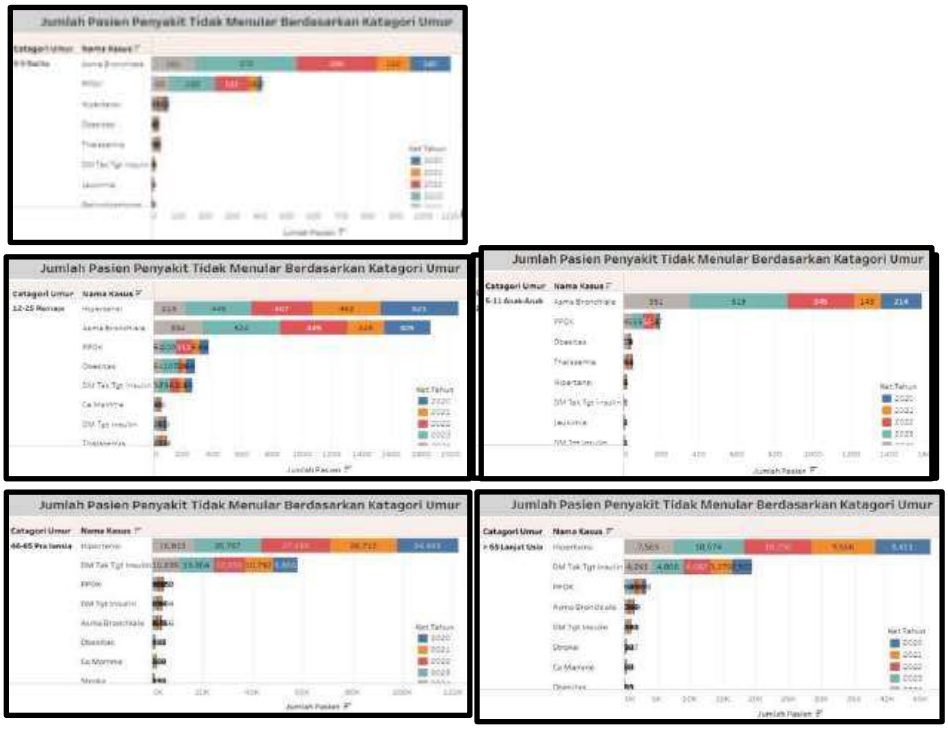


Figure 6. Number of Non-Communicable Disease Cases based on age group

The visualization reveals that Bronchial Asthma is the most prevalent non-communicable disease among children aged 0-5 years, with the number of cases increasing annually, followed by Chronic Obstructive Pulmonary Disease (COPD). Similarly, in the 5-11 age group, Bronchial Asthma remains the most common non-communicable disease, with a steady rise in cases each year, and COPD continuing as the second most prevalent condition.

In the 12-25 age group, the visualization shows that Hypertension is the leading non-communicable disease, with the highest number of cases (521) recorded in 2020. Bronchial Asthma ranks second, with its peak of 524 cases occurring in 2023. For individuals aged 26-45, Hypertension is again the most prevalent disease, with 6,855 cases in 2020, while Non-Insulin Dependent Diabetes Mellitus (NIDDM) follows, reaching its highest number in 2023 with 2,085 cases.

The above visualization shows that hypertension is the most common non-communicable disease in the age group of 46-65. Non-insulin-dependent diabetes mellitus (NIDDM) is the second most common disease in this group, with 13.864 cases recorded in 2023. The visualization above shows that hypertension is the most common non-communicable disease in the 65+ age group. Hypertension is also the leading non-communicable disease, with NIDDM as the second most prevalent condition. Both diseases saw their highest increase in cases in 2023.

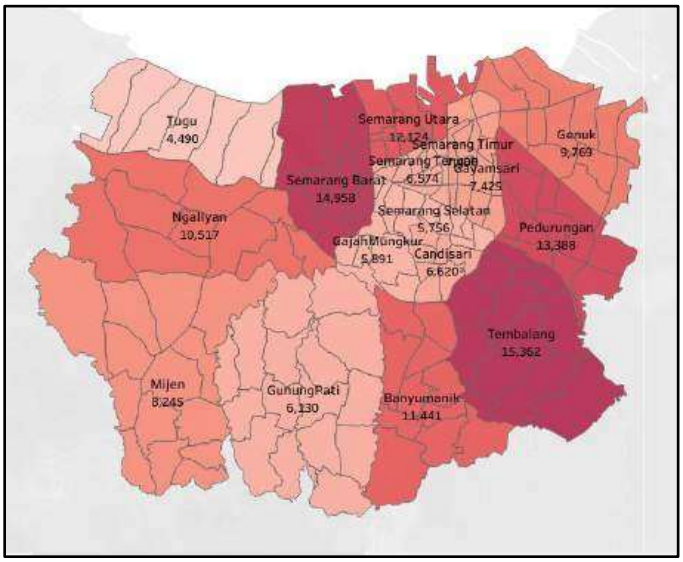


Figure 7. Distribution of Non-Communicable Disease Cases in Semarang City based on sub district

The maps presented illustrate the distribution of non-communicable disease cases across sub-districts within Semarang City. Darker areas on the map represent regions with a higher concentration of cases. Tembalang is identified as the district with the highest number of cases, totaling 15,362, followed by Semarang Barat with 14,958 cases. Tugu is the sub-district with the lowest number of non-communicable disease cases, recording a total of 4,490.

DISCUSSION

The increasing prevalence of non-communicable diseases (NCDs) has emerged as a significant public health issue across various countries, including those in Southeast Asia (de Silva et al., 2023). The definition of NCDs has broadened to encompass a wide array of health issues, such as liver, kidney, and gastrointestinal diseases, alongside endocrine, hematological, neurological, and dermatological conditions, genetic disorders, trauma, mental health issues, and disabilities, including blindness and deafness (Schrag, 2019).

In this study, the morbidity data were sourced from electronic medical records (SIMPUS) at public health centers (Puskesmas) throughout Semarang City, offering a city-wide perspective. However, it is important to acknowledge the limitations regarding the completeness of the data, which should be addressed for future improvements.

Figures 1 and 2 illustrate significant variability in NCD case trends in Semarang City from 2020 to August 2024. These fluctuations are influenced by several factors, including changes in community behavior, access to healthcare services, and environmental conditions affecting health. The consistent rise in cases observed from July to December each year suggests a seasonal pattern, potentially linked to lifestyle habits or an increase in patient visits to healthcare facilities. This aligns with a study by the World Health Organization, which indicates that environmental factors such as pollution and climate play a role in the growing incidence of NCDs, possibly explaining the observed fluctuations (WHO, 2023).

The findings of this study, which show a rise in NCD cases over the past four years, align with predictions of a shift towards non-communicable diseases. Over the last three decades, the global burden of communicable diseases has decreased significantly, while the burden of NCDs has continued to increase (Shu & Jin, 2023). The study revealed that hypertension was the most common condition, followed by non-insulin-dependent diabetes mellitus, bronchial asthma, chronic obstructive pulmonary disease (COPD), and insulin-dependent diabetes. Several other studies emphasize that these chronic diseases warrant special attention due to the increasing number of cases and rising mortality rates (Peng et al., 2024).

In the context of public health, key priorities include addressing social determinants of health, reinforcing health systems, particularly primary and secondary care empowering primary care physicians in managing hypertension, utilizing non-physician health workers to enhance adherence to therapies, and evaluating patient control and empowerment (Angell et al., 2015).

Non-communicable diseases (NCDs) are more frequently observed in women than in men, as women are generally more susceptible. Research has shown that biological factors, such as obesity, high blood pressure, diabetes, and cholesterol, tend to occur more frequently among women in the same age group compared to men. In Indonesia, women also exhibit higher prevalence rates for certain behavioral and clinical risk factors than men (Arifin et al., 2022). Additionally, women from lower socioeconomic backgrounds are 1.67 times more likely to develop hypertension compared to their wealthier counterparts (Defianna et al., 2021). As a result, it is crucial for the government to account for the specific vulnerabilities of women when developing and implementing NCD prevention and control programs.

Analysis of data from 2020 to 2023 suggests that predictions can be made for NCDs case trends between July and December 2024. These identified trends also provide a useful reference for managing NCDs cases in the years ahead. Moreover, they offer opportunities for further examination of the factors influencing NCDs case fluctuations in Semarang City.

The high incidence of hypertension and non-insulin-dependent diabetes mellitus should be a central focus for policy development and healthcare interventions. This data can be used to explore underlying factors contributing to the high number of cases, providing a basis for targeted prevention and control strategies addressing these two diseases.

Figure 3 demonstrates that NCD cases are predominantly seen in women, comprising 61.7% of all cases. This gender disparity emphasizes the need for greater attention to women's health, driven by differences in hormonal regulation, lifestyle, and healthcare access. Furthermore, Figure 4 reveals that NCD cases are most prevalent among individuals aged 46-65, suggesting that pre-elderly and elderly populations are particularly vulnerable. However, NCDs affect all age groups, underscoring the need for broad preventive efforts. Gelmini's study indicates that increasing awareness of health and disease prevention across all ages can significantly help reduce the NCD burden (Gelmini et al., 2020).

Figure 5 highlights that hypertension is the most common NCDs, followed by non-insulin-dependent diabetes mellitus. The high prevalence of hypertension points to the need for more focused policies and intervention strategies. Greater emphasis should be placed on controlling risk factors such as obesity and poor dietary habits, as supported by Wattanapisit's research, which stresses the importance of community-based hypertension control programs (Wattanapisit et al., 2022).

Figures 7 and 8 map the distribution of NCDs cases, showing that the districts of Tembalang and West Semarang have the highest case numbers. This calls for deeper investigation into the environmental and social factors affecting public health in these areas. Implementing targeted policies in high-prevalence regions will be crucial for NCDs control, as Purwoko's research suggests that spatial analysis can help develop more effective health interventions (Purwoko et al., 2020).

Based on the descriptive analysis of Semarang's districts, further spatial analysis should be undertaken to explore the relationship between disease vulnerability and geographic factors. This can guide policy development and enable targeted interventions for districts with higher NCD rates.

In conclusion, this study sheds light on the distribution characteristics of NCDs in Semarang City, which are heavily influenced by various demographic and geographic factors. The patterns identified offer a

foundation for health intervention planning and encourage more targeted efforts to enhance overall public health outcomes.

CONCLUSION

Based on the research findings, the majority of non-communicable disease (NCDss) patients in Semarang City suffer from hypertension and non-insulin-dependent diabetes mellitus. These findings highlight the need for targeted interventions, particularly in areas with high incidence rates, such as Tembalang and Sendangmulyo, with a special emphasis on managing hypertension and non-insulin-dependent diabetes mellitus. Furthermore, the results of this study can significantly influence urban health policies, healthcare resource allocation, and public health programs. These findings can also serve as a guide for future studies on climate change, healthy behaviors, and the impact of urbanization on health outcomes. Collaborative efforts between the government, healthcare providers, and the community are crucial in addressing the burden of non-communicable diseases and improving overall public health.

Conflict of Interest

The author declare that they have no conflict of interest.

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