



## Analysis of Trends and Distribution of Hypertension and Diabetes Mellitus Patients in Tomohon City 2023-2024

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### ARTICLE INFO

**Keywords:** Non-Communicable Diseases, Hypertension, Diabetes Mellitus, Epidemiological Trends, Health Surveillance

*Received* : 5 November

*Revised* : 23 December

*Accepted* : 23 January

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### ABSTRACT

Non-communicable diseases (NCDs) are a global and national health challenge. Comprehensive surveillance is needed to map the burden of diseases and current trends to support effective policies, including in Tomohon City. This study aims to analyze the distribution and trends of NCD cases, especially hypertension and diabetes mellitus, in Tomohon City in the 2023-2024 period based on age group. This quantitative descriptive study used secondary data from the Tomohang City Health Office. Data analysis included calculation of proportions, trends in case increases between years, and stratification by age group. Hypertension (83.21%) and diabetes mellitus (13.88%) dominated 97.09% of the total 20,029 NCD cases. There was a very significant spike in cases in one year, with hypertension increasing by 84.2% and diabetes mellitus by 83.26%. Age analysis revealed the highest spike in the elderly group (>60 years) above 125% for both diseases. Worryingly, the adolescent group (15-17 years) showed a 109% increase in hypertension, indicating a shift in the onset of NCDs to a younger age. Meanwhile, cases of other NCDs such as cancer are reported to be very low, allegedly due to limited screening coverage. Tomohon City is facing an epidemic of NCDs dominated by hypertension and diabetes, with a drastic spike affecting all age groups, including adolescents. In-depth evaluations and different prevention strategies are needed at each stage of life, as well as expanded early detection to control surges in cases and prevent complications

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## **INTRODUCTION**

The shift in disease patterns globally from infectious to non-communicable diseases has been a major challenge for health systems in the 21st century. Hypertension and Diabetes Mellitus (DM) are two non-communicable diseases (NCDs) that contribute significantly to the number of illnesses and deaths worldwide. In Indonesia, based on the 2018 Basic Health Research, the prevalence of hypertension reached 34.1% in the population over 18 years old, while the prevalence of DM was 8.5%. This figure is expected to continue to increase along with lifestyle changes, urbanization, and population aging. These two diseases not only impact a decline in the individual's quality of life, but also burden the health system and the national economy due to the cost of treatment and loss of productivity. This situation not only burdens the health system but also threatens people's productivity and quality of life. Tomohon City, as one of the urban areas in North Sulawesi, is suspected of facing a significant burden on NCDs, which requires in-depth analysis to formulate effective policies.

Tomohon City, as one of the urban areas in North Sulawesi Province, is inseparable from this challenge. Preliminary data from the Tomohon City Health Office shows an increase in the number of hypertension and DM cases recorded in recent years. In 2023, there were 9,047 cases of hypertension and 1,517 cases of DM. Worryingly, this figure will jump dramatically in 2024 to 16,665 cases of hypertension and 2,780 cases of DM. The increase of more than 80% in a one-year period indicates a serious public health problem and requires urgent review. This spike in cases may reflect an increase in actual incidence of the disease, an increase in the coverage and quality of detection by health facilities, or a combination of both.

Several previous studies have identified risk factors for NCDs in various regions of Indonesia, such as diets high in salt and sugar, and sedentary lifestyles (Sari et al., 2021). However, the latest data quantifying the surge in cases and their distribution by age group at the city level is still limited. Most studies are cross-sectional portraits at a single point in time, so they are unable to capture the dynamics and speed of case increases. This gap is the basis of this research, with the aim of mapping the evolution of the NCD epidemic in Tomohon City in a more dynamic manner.

The urgency of this study is reinforced by the dramatic preliminary findings. Data from the Tomohon City Health Office (2024) reveals that there has been a very significant spike in hypertension and diabetes mellitus cases in just one year (2023-2024). Hypertension jumped 84.2% (from 9,047 to 16,665 cases), while diabetes mellitus increased by 83.26% (from 1,517 to 2,780 cases). These two diseases dominated 97.09% of the total 20,029 NCD cases, confirming the dual burden of metabolic and cardiovascular diseases as a major public health threat. This surge indicates a systemic failure in the NCD prevention and control strategy that has been implemented.

## LITERATURE RIVIEW

This study not only describes the prevalence, but conducts an in-depth analysis of temporal trends and age stratification. The most critical finding was the identification of two alarming phenomena. *First, the* burden of disease increases exponentially with age, with a surge of more than 125% in the elderly group (>60 years). *Second, and more concerning,* is the early warning of young age groups, characterized by a 109% increase in hypertension in adolescents (15-17 years) and hundreds of cases in young adults (18-29 years). These findings suggest that the onset of NCDs has shifted dramatically to younger ages, an aspect that has not been empirically well explored in the local context. In addition, the low cases of cancer and sensory disturbances detected (only 0.07% of the total cases) are strongly suspected to reflect limited access to screening services, rather than the low incidence of them.

Therefore, this research has high significance for the world of public health. This comprehensive analysis that blends the dimensions of time, disease type, and age group provides strong empirical evidence for the Tomohon City Government and relevant stakeholders to conduct an in-depth evaluation and redesign NCD prevention interventions. The resulting recommendations are expected to be more targeted, with different strategies for each stage of life, to control the surge in cases and prevent long-term complications that could burden the health system more severely in the future. The purpose of this study is to analyze the temporal trend of hypertension and Diabetes Mellitus cases in Tomohon City for the 2020-2025 period.

## METHODOLOGY

This research method uses a quantitative descriptive approach with a cross-sectional time-trend study design to analyze the trend and spatio-temporal distribution of Non-Communicable Diseases (NCDs) in Tomohon City for the 2023-2024 period. Secondary data was obtained from the Tomohang City Health Office which included all registered NCD cases, with variables including disease type, number of cases, and demographic distribution based on age group (15-17, 18-29, 30-39, 40-49, 50-59, and >60 years). Data analysis was carried out descriptively through three stages: (1) proportional analysis to identify dominant diseases by calculating the percentage contribution of each NCD to the total burden of disease; (2) analysis of time trends by comparing absolute counts and calculating the percentage of change in cases between years to identify epidemiological spikes; and (3) analysis of age stratification to map the distribution and dynamics of case increase in specific age groups, especially for hypertension and diabetes mellitus. The entire analysis is presented in tabular and graphical form to facilitate the interpretation of NCD distribution patterns, with a focus on the identification of the highest risk population and the age shift in onset, without involving inferential statistical tests considering the research objectives of comprehensive epidemiological mapping for health policy planning needs.

RESULT

Types of NCDs in Tomohon City

Data from the Tomohon City Health Office shows that there are around 22 types of NCDs found in Tomohon City in 2024 with a total of 20,029 cases. The number of cases and proportions for each type of NCD can be seen in Table 1. The results of this study show that the highest number of NCD cases in the city of Tomohon in 2024 is hypertension as many as 16,665 cases (83.21%) and diabetes mellitus as many as 2,780 cases (13.88%). These two diseases together account for about 97.09% of all recorded NCD cases, confirming that metabolic and cardiovascular diseases are the main health challenges in Tomohon City.

Table 1. Number of Cases and Proportion of Ncds

| Types of NCD                                          | Number of Cases | Proportion (%) |
|-------------------------------------------------------|-----------------|----------------|
| Hypertension                                          | 16,665          | 83.21          |
| Diabetes Mellitus                                     | 2,780           | 13.88          |
| Heart Disorders (general)                             | 308             | 1.54           |
| Stroke Disorders                                      | 82              | 0.41           |
| Other Hearts                                          | 111             | 0.55           |
| Obesity                                               | 61              | 0.30           |
| Coronary Heart                                        | 89              | 0.44           |
| Heart Failure                                         | 106             | 0.53           |
| Cataract Vision Disorders                             | 12              | 0.06           |
| General COPD                                          | 15              | 0.07           |
| Hearing Loss (general)                                | 9               | 0.04           |
| Hearing Loss (Chronic Suppurative Otitis Media/ CSOM) | 8               | 0.04           |
| Chronic Obstructive Pulmonary Disease (COPD)          | 8               | 0.04           |
| Myopia                                                | 4               | 0.02           |
| Breast Cancer                                         | 7               | 0.03           |
| Congenital Heart                                      | 2               | 0.01           |
| Cervical Cancer                                       | 1               | 0.00           |
| Colorectal Cancer                                     | 1               | 0.00           |
| <b>Total</b>                                          | <b>20,029</b>   | <b>100</b>     |

Hypertension dominates the burden of NCDs in Tomohon City with a very significant proportion. This shows that hypertension is a very serious public health problem. Hypertension is often a "silent killer" and is a major risk factor for heart disease, stroke, and kidney failure. Diabetes ranks second with a considerable proportion. The high rate of diabetes is closely correlated with hypertension, as these two diseases often accompany each other (comorbidities) and have similar lifestyle risk factors, such as unhealthy diet, obesity, and lack of physical activity.

The data in Table 1 shows a low number of diagnosed cancer cases. When compared to cardiovascular disease, the number of cancer cases detected is very low (only 9 cases out of 4 types of cancer). This can be caused by two things: (a) the lower incidence rate of cancer, or (b) there is still limited coverage and access to cancer early detection services (*screening*) in the community. These findings could be the basis for improving cancer screening programs, particularly for breast and cervical cancers.

Cases of complex heart disorders that although the proportion is small compared to hypertension, data show a diverse burden of heart disease, ranging from heart failure, coronary heart disease, to congenital disorders. Heart Failure (106 cases) and Coronary Heart (89 cases) are the most common types of specific heart disorders after the general "Heart Disorders" category.

The number of reported data on sensory disorders and COPD such as hearing loss, vision (cataracts and myopia), and COPD was very small. This may reflect a greater focus of detection activities on metabolic and cardiovascular diseases, or a lack of public awareness to check for these health problems. Furthermore, the 2 highest types of NCDs are explained, namely hypertension and diabetes mellitus.

#### **Trends in Hypertension and Diabetes Mellitus Cases (2023 vs. 2024)**

The data shows a significant increase in the number of cases recorded for both diseases from 2023 to 2024. This can be seen in Figure 1.

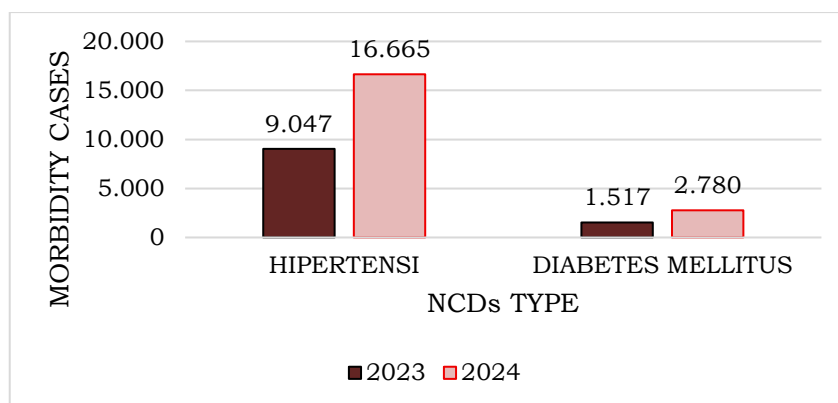


Figure 1. Number of People with Hypertension and Diabetes Mellitus in 2023-2024

Figure 1 shows that in general there has been an increase in cases from 2023 to 2024. Hypertension patients have increased from 9,047 in 2023 to 16,665 in 2024. Hypertension cases in Tomohon City have increased by 84.2% from 2023 to 2024. This is a very significant and worrying surge phenomenon in just one year. An increase of this magnitude requires an in-depth review, which can be caused by several factors such as aggressive increases in screening and detection activities, changes in data recording or reporting methodologies and the occurrence of very massive new patients due to lifestyle, diet, or stress factors.

Furthermore, people with Diabetes Mellitus (DM) showed an increase from 1,517 cases in 2023 to 2,780 cases in 2024. DM cases in Tomohon City have increased by 83.26% from 2023 to 2024. This data shows a very large and almost

as high spike as the increase in hypertension cases (84.2%), which confirms the alarming trend for metabolism-related Non-Communicable Diseases (NCDs) in the city of Tomohon. The drastic increase in these two diseases (Hypertension and DM) within one year indicates an urgent need for an evaluation and review of existing NCD prevention and control programs, increased health promotion on healthy eating, physical activity, and weight control and further investigations to understand the driving factors behind this surge in cases, Is it due to more massive detection factors or really due to an increase in risk factors in the community.

Table 2. Comparison of the Number of Cases of Hypertension and DM by Age Group

| Age Group<br>(years) | Hypertension |               | Diabetes Mellitus |              |
|----------------------|--------------|---------------|-------------------|--------------|
|                      | 2023         | 2024          | 2023              | 2024         |
| 15-17                | 11           | 23            | 2                 | 1            |
| 18-29                | 453          | 483           | 28                | 40           |
| 30-39                | 671          | 875           | 70                | 105          |
| 40-49                | 1,541        | 2,706         | 214               | 372          |
| 50-59                | 2,981        | 4,822         | 574               | 842          |
| 60 >                 | 3,390        | 7,756         | 629               | 1,420        |
| <b>Total</b>         | <b>9,047</b> | <b>16,665</b> | <b>1,517</b>      | <b>2,780</b> |

Table 2 shows the number of cases of hypertension and DM by age group as follows:

#### Analysis by Age Group

The results of the analysis based on age group are:

1. Terrible Trends in the Elderly
  - a. The >60-year-old age group experienced the highest spike for both diseases.
  - b. Hypertension increased by 128.8% and Diabetes increased by 125.8%.
  - c. This indicates a very large and increasing burden of disease in the elderly population.
2. Early Warning from Young People
  1. Adolescents (15-17 years): The 109% increase in hypertension (the 2nd highest) is very worrying, indicating that an unhealthy lifestyle has started early.
  2. Young Adults (18-29 years): The existence of 483 cases of hypertension and a 42.9% increase in diabetes at the supposed optimal age is an alarm for public health.
3. Critical Points in Midlife
  - a. The 40-49 year group is the point where the increase becomes very drastic (>75% for both diseases).
  - b. This group is the "prime time" where many metabolic diseases begin to be diagnosed.
4. Close Relationship of Hypertension and Diabetes
  - a. The upward trend of these two diseases runs almost parallel, especially at the age of 30 years and above.

- b. This reinforces the fact that these two diseases often appear at the same time (comorbidities) due to the same lifestyle risk factors.

### **Main Patterns and Trends**

1. Age-Based Escalation: There is a very clear pattern where the older the age group, the greater the absolute increase in cases. The age group of >60 years was the most affected, followed by the 50-59 age group. This corresponds to the pathophysiology of NCDs which are progressive and accumulative.
2. Explosion of Cases in the Elderly: The increase of more than 100% in the elderly group for these two diseases is astonishing. This can be caused by:
  - a. Cumulative Effects: Decades of risk factors eventually manifest as disease.
  - b. Decreased Organ Function: A natural decline in kidney and blood vessel function due to aging.
  - c. Increased Screening Coverage: The possibility of a more aggressive screening program targeting the elderly group.
3. Early Warning from Young People: Although the numbers are small, the increase in hypertension and DM in the 18-29 and 30-39 age groups is a critical early warning. This signifies that the "age of onset" for NCDs is getting younger, which will lead to a greater burden of disability and health costs over time.
4. Close Correlation of Hypertension and Diabetes: These two diseases show a parallel upward trend, especially in the age group of 40 years and above. This reinforces the concept that these two diseases often appear at the same time (comorbidities) because they have the same lifestyle risk factors (diet, obesity, lack of movement).

## **DISCUSSION**

### **Increasing Case Trends and Epidemiological Implications**

The results of the study revealed a significant increase in cases of hypertension and DM between 2023 and 2024. Hypertension increased by 84.1% (from 9,047 to 16,665 cases), while DM increased by 83.3% (from 1,517 to 2,780 cases). This increase far exceeds natural population growth, indicating the existence of environmental and behavioral risk factors that need to be examined more deeply.

These findings are in line with the Basic Health Research report (2018) which shows an increase in the prevalence of hypertension nationally from 25.8% to 34.1% in the 2013-2018 period. However, the rate of increase in Tomohon City within one year is very high, requiring further investigation of local determinant factors. Some hypotheses that can be proposed include changes in salt and sugar consumption patterns, increased post-pandemic psychosocial stress, or increased coverage of case detection by health facilities.

The distribution of cases by age group shows a pattern consistent with the literature, where the burden of disease is concentrated in the productive age group and the elderly. The age group of >60 years is the largest contributor with 7,756 cases of hypertension and 1,420 cases of DM in 2024. These findings confirm a study by Supriyati et al. (2021) on the burden of degenerative diseases on the elderly population in urban areas of Indonesia.

### **Prevalence and Distribution Analysis by Age Group**

Prevalence calculations based on population data for June 2024 provide a more comprehensive epidemiological picture. The prevalence of hypertension reached 19,947.4 per 100,000 population (about 20%), while DM was 3,328.0 per 100,000 population (about 3.3%). This figure is above the national average according to Basic Health Research 2018 (hypertension of 34.1% at the age of  $\geq 18$  years; DM of 8.5% at the age of  $\geq 15$  years), indicates a heavier burden of disease in Tomohon City.

Analysis by age group shows a prevalence gradient that increases with age, with a significant spike starting from the 40-49 age group. The prevalence of hypertension in the  $>60$  age group reached 49,213.2 per 100,000 (49.2%), meaning that almost one in two elderly people suffer from hypertension. A similar pattern was seen in DM with a prevalence of 9,010.2 per 100,000 (9.0%) in the same group.

These findings are consistent with the concept of *accumulation of risk factors* throughout the life cycle. The increased prevalence in the 40-49 age group indicates a critical period where exposure to cumulative risk factors begins to manifest as a clinical disease (Stringhini et al., 2017). The policy implication that emerges is the importance of preventive intervention in the young age group (15-39 years) before irreversible organ damage occurs.

### **Policy Implications and Strategic Recommendations**

Based on the research findings, several policy implications can be suggested:

1. A review of early detection strategies with a focus on the 30-39 age group as a window of opportunity for primary prevention is needed. Periodic screening in this group can reduce the incidence rate in the next decade.
2. The strengthening of the integrated chronic service model (Program Pengelolaan Penyakit Kronis/ PROLANIS) needs to be optimized, given the high burden of disease in the elderly group. The integration of hypertension-DM services with healthy aging programs can improve efficiency and effectiveness.
3. Performance disparities between health centers require a customized approach based on the assessment of the needs and capacity of each health center. Learning between health centers (cross-learning) can be a strategy to reduce the gap.
4. Fluctuations in quarterly results indicate the need to improve a real-time monitoring and evaluation system, as well as a more even distribution of resources throughout the year

### **CONCLUSION**

The conclusion of this study is that Tomohon City is facing an epidemic situation of non-communicable diseases (NCDs), especially hypertension and diabetes mellitus, which is characterized by a very significant spike in cases (more than 80%) in the past year. The highest upward trend occurred in the elderly group ( $>60$  years), while an alarming increase was also found in the young age group (adolescents and young adults) indicating a shift in NCD onset to an earlier age as well as systemic failures in prevention and early detection efforts. Therefore, it is recommended that the Tomohon City Government

immediately strengthen NCD prevention and control policies with different strategies based on age stages, including through aggressive health promotion campaigns for adolescents and young adults, as well as expanding the scope of screening and integrated management for the middle-aged and elderly groups, accompanied by further research to identify the specific causes of the surge in cases and evaluate the effectiveness of interventions.

## ACKNOWLEDGEMENT

The author expresses his sincere appreciation and gratitude to the Institute for Research and Community Service of Sam Ratulangi University for the support of funding for this research through the Unsrat Basic Research scheme. This financial support is a key factor that allows research to be carried out smoothly and produces findings that can be contributed to the development of science and public health development.

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