



Analysis of The Temporal Trend of Diabetes Mellitus Mortality In Indonesia In 2000–2021: A Study Based on WHO Global Health Observatory Data

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ABSTRACT

Introduction: Diabetes Mellitus Type 2 is one of the leading non-communicable diseases contributing significantly to global mortality, including in Indonesia. This study aimed to analyze the temporal trend of diabetes mellitus mortality in Indonesia based on data from the World Health Organization Global Health Observatory during the period 2000-2021.

Methods: This quantitative study employed a retrospective ecological design using secondary data obtained from the World Health Organization Global Health Observatory. The analysis was based on the Age Standardized Mortality Rate (ASMR) per 100,000 population and conducted using descriptive time-series analysis, descriptive statistics, and trend visualization.

Results: The results showed that the ASMR increased from 15.62 per 100,000 population in 2000 to 23.40 in 2019 before declining to 22.80 in 2020 and 21.04 in 2021. Overall, the findings indicate an increasing temporal trend in diabetes mellitus mortality during the 2000–2021 observation period.

Conclusion: In conclusion, the mortality trend of diabetes mellitus in Indonesia still demonstrates an overall increasing pattern over time. Therefore, strengthening Medical-Surgical Nursing interventions focusing on promotive and preventive strategies, patient education, and self-management support is essential to reduce complications and mortality risk.

Keywords: *diabetes mellitus; medical-surgical nursing; mortality; temporal trend; WHO Global Health Observatory*

INTRODUCTION

Diabetes Mellitus (DM) is one of the non-communicable diseases that is a major challenge in the global health system due to its increasing trend of prevalence, morbidity, and mortality (Sakul and Andriani, 2025; Nofi Susanti et al., 2024). This disease is characterized by impaired glucose metabolism due to insulin resistance and/or impaired insulin secretion that causes chronic hyperglycemia, thus potentially causing progressive complications (Nofi Susanti et al., 2024). Type 2 Diabetes Mellitus, which is classified in the International Classification of Diseases (ICD-10) code E11, is the most dominant form and accounts for more than 90% of diabetes cases (Sakul and Andriani, 2025; Sapra and Bhandari, 2021). This condition makes it one of the main contributors to the burden of chronic diseases that require continuous management and

multidisciplinary approaches in health services (Nikpour et al., 2022).

The increased mortality due to Diabetes Mellitus reflects not only the high prevalence, but also the complexity in controlling the chronic complications that accompany it (Tomic, Shaw and Magliano, 2022). Long-term hyperglycemia can lead to microvascular and macrovascular damage, such as coronary heart disease, stroke, chronic kidney failure, diabetic neuropathy, retinopathy, and diabetic ulcers, which ultimately increases the risk of death (Purwandari, Wirjatmadi and Mahmudiono, 2022; Zakir et al., 2023). Thus, Diabetes Mellitus can no longer be viewed as an individual clinical problem, but has developed into a public health issue that has a wide impact on quality of life, economic productivity, and health system financing (Febriany, 2023).



In Indonesia, the epidemiological transition marked by an increase in the proportion of non-communicable diseases places Diabetes Mellitus as one of the important causes of morbidity and mortality (Wahidin et al., 2024). Changes in people's lifestyles due to urbanization, increased consumption of high-calorie and sugary foods, low physical activity, and increased prevalence of obesity are the main factors contributing to the increased burden of this disease (Nofi Susanti et al., 2024; Murtiningsih, Pandelaki and Sedli, 2021; Norsipa, Manto and Fazraningtyas, 2025). In addition, delayed diagnosis, low adherence to therapy, and suboptimal control of chronic complications also aggravate the challenge of reducing the mortality rate due to Diabetes Mellitus in Indonesia (Fortuna dkk., 2023; Soewondo, Ferrario dan Tahapary, 2013)

Understanding the changes in Diabetes Mellitus mortality over time is important in the evaluation of public health policies (Rao et al., 2025; Ahmed et al., 2025). Temporal trend analysis allows the identification of patterns of increase, decrease, and stabilization of mortality rates so that it can describe the dynamics of disease burden in the long term. This information is needed to assess the effectiveness of non-communicable disease control programs, strengthen health care systems, and support evidence-based policy formulation that is adaptive to epidemiological changes (Naibaho et al., 2025). The World Health Organization (WHO) Global Health Observatory data provides a standardized and continuous source of information, enabling longitudinal mortality analysis with a high degree of comparability (World Health Organization, 2024).

Although various studies on Diabetes Mellitus in Indonesia have been conducted, the existing research focuses (Nofi Susanti et al., 2024) more on the identification of risk factors and management of Type 2 Diabetes Mellitus, while research from (Purwandari, Wirjatmadi and

Mahmudiono, 2022) focuses on factors that affect the occurrence of chronic complications in Type 2 Diabetes Mellitus patients. Meanwhile, the study (Febriany, 2023) examined the quality of life of people with Diabetes Mellitus through a systematic review approach. These three studies make important contributions in understanding disease characteristics, risk factors, complications, and patient quality of life, but have not yet described the longitudinal changes in mortality of Diabetes Mellitus in the long term. To date, no study that specifically analyzed the temporal trend of Diabetes Mellitus mortality in Indonesia using World Health Organization (WHO) Global Health Observatory data for more than two decades. This condition means the dynamics of changes in Diabetes Mellitus mortality in Indonesia are not comprehensively documented as a basis for evaluating health policies and planning future disease control strategies.

This study is new not only because it uses data from the World Health Organization (WHO) Global Health Observatory, but also because it applies a longitudinal approach to describe changes in Diabetes Mellitus mortality in Indonesia during the period 2000–2021 using the Age Standardized Mortality Rate (ASMR) indicator. This approach allows for the identification of mortality dynamics over 22 years, providing a more comprehensive picture of changes in the burden of mortality due to Diabetes Mellitus compared to previous studies that generally use cross-sectional designs or focus on prevalence, risk factors, and clinical complications. Thus, this study provides a long-term epidemiological perspective that can be used as a basis for evaluating public health policies and planning evidence-based Diabetes Mellitus control strategies.

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changes in Diabetes Mellitus mortality in Indonesia during the period 2000–2021 using the Age Standardized Mortality Rate (ASMR) indicator. This approach allows for the identification of mortality dynamics over a continuous 22-year period, providing a more comprehensive picture of changes in the burden of mortality due to Diabetes Mellitus compared to previous studies that generally use cross-sectional designs or focus on prevalence, risk factors, and clinical complications. Thus, this study provides a long-term epidemiological perspective that can be used as a basis for evaluating public health policies and planning evidence-based Diabetes Mellitus control strategies.

Based on this description, this study aims to analyze the temporal trend of Diabetes Mellitus mortality in Indonesia based on data from the World Health Organization Global Health Observatory for the period 2000–2021. In particular, this study aims to describe mortality patterns during the observation period, analyze the tendency of change over time, describe the dynamics of change through a descriptive statistical approach, and provide a scientific basis for strengthening public health policies in efforts to prevent, control, and reduce mortality due to Diabetes Mellitus in Indonesia. The results of this study are expected to contribute to the development of non-communicable disease epidemiology and become a reference for policymakers and health practitioners in designing more effective and evidence-based interventions.

METHOD

Study Design

This study is a non-experimental quantitative study with a retrospective ecological study design and a descriptive epidemiological approach through temporal trend analysis (descriptive time-series analysis) (Slater and Hasson, 2025). This design is used to describe the pattern of changes in the mortality of Type 2 Diabetes Mellitus in Indonesia based on population data available over a long period of time without intervention on the

study subjects (Varaei et al., 2024). This approach allows the identification of trends in mortality changes longitudinally, so that it can provide an overview of the development of disease burden as a basis for evaluating public health policies and strengthening evidence-based health service practices (Alanazi, Wiechula and Foley, 2024).

The research will be carried out in 2026 through the process of collecting, verifying, and processing secondary data sourced from the World Health Organization (WHO) Global Health Observatory (GHO). The data analyzed covers the period 2000–2021, so that it is able to describe the dynamics of Type 2 Diabetes Mellitus mortality in Indonesia for more than two decades.

Setting & Participants

The study population includes all mortality data on Type 2 Diabetes Mellitus (ICD-10: E11) in Indonesia available in the WHO Global Health Observatory database during the period 2000–2021. Because the research uses secondary data that is available in full, the sampling technique is total sampling, namely all data that meet the inclusion criteria are used as research samples. Thus, the sample consisted of mortality data for 22 years of observation (2000–2021) (Slater and Hasson, 2025).

Variables & Measuremen

The independent variable in this study is the time or year of observation (2000–2021), while the dependent variable is the mortality of Type 2 Diabetes Mellitus, which is expressed in the form of Age Standardized Mortality Rate (ASMR) per 100,000 population based on WHO Global Health Observatory data. Operational definitions are used to provide clear boundaries for each research variable, facilitating the measurement and interpretation of research results.

This study uses secondary data obtained from the World Health Organization Global Health Observatory (WHO GHO). The main variable analyzed was type 2 diabetes mellitus, which was identified based on the ICD-10 code E11. The

research output was in the form of mortality due to type 2 diabetes mellitus, which was measured using the Age-Standardized Mortality Rate (ASMR) or the number of deaths due to type 2 diabetes mellitus. Temporal trends were analyzed based on changes in mortality rates during the observation period, then interpreted to describe patterns of changes in mortality over time. The observation period spanned from 2000 to 2021, with each year being used as a unit of time in the analysis. The ASMR value is expressed as the number of deaths per 100,000 population, allowing for comparison of mortality rates between periods while taking into account differences in population age structures.

Data Collection

The data source comes from the official secondary data of the World Health Organization (WHO) Global Health Observatory. The main indicator analyzed is the Age Standardized Mortality Rate (ASMR) per 100,000 population according to the indicators available in the WHO Global Health Observatory. The use of ASMR indicators was chosen because it has been standardized based on the age structure of the population, so that it allows for a more valid comparison of mortality between periods in epidemiological analysis (World Health Organization, 2024).

The data extraction process was carried out by selecting the country of Indonesia, the indicator of the cause of death of Type 2 Diabetes Mellitus (ICD-10: E11), and the time range 2000–2021 through the WHO Global Health Observatory portal. Furthermore, the data are verified by checking the completeness of each year of observation, consistency of measurement units, and suitability of indicators before tabulation and analysis. The research instrument is in the form of documentation sheets and data extraction formats that are used to systematically record all mortality data before being processed using Microsoft Excel.

Data Analysis

Data collection was carried out through a documentation method using secondary data from the WHO Global Health Observatory (GHO). The initial stage includes the identification of mortality indicators of Type 2 Diabetes Mellitus (ICD-10: E11) in Indonesia and the determination of the observation period 2000–2021. The data were then downloaded, verified to ensure completeness and consistency, and tabulated using Microsoft Excel. Furthermore, the data were arranged chronologically by year of observation.

Data analysis was carried out using descriptive statistics, including annual distribution, minimum values, maximums, averages, standard deviations, and percentage changes in mortality, and presented in the form of tables, line graphs, and descriptive narratives. The descriptive statistical approach was chosen because the main purpose of this study was not to test causal relationships or predict changes in mortality, but to describe the pattern of changes in mortality of Diabetes Mellitus longitudinally based on national population data available at the WHO Global Health Observatory. Therefore, descriptive analysis is considered adequate to provide an overview of temporal trends as a basis for epidemiological evaluation and public health policy.

Temporal trend analysis was performed to identify patterns of change based on the time sequence of observation, which was categorized as an upward trend, a downward trend, or a stabilization (stable trend). The percentage change in mortality was calculated using the formula:

$$\text{Percentage of Change (\%)} = \frac{X_t - X_0}{X_0} \times 100\%$$

Description:

(X₀) = mortality value (ASMR) in the first year of observation (2000)

(X_t) = mortality value (ASMR) at the end of the year of observation (2021)

Furthermore, descriptive statistical analysis was carried out to obtain the size of data concentration and dispersion. The average value of mortality is calculated using the formula:

$$\bar{X} = \frac{\sum_{i=1}^n X_i}{n}$$

with:

($\bar{X}$) = rate-rate;

($\sum X$) = sum of the total mortality value;

(n) = number of years of observation.

Meanwhile, the standard deviation is calculated using the formula:

$$SD = \sqrt{\frac{\sum_{i=1}^n (X_i - \bar{X})^2}{n - 1}}$$

with:

(SD) = simpangan baku (standard deviation);

(X_i) = mortality value in observation (i);

($\bar{X}$) = mean value of mortality;

(n) = number of years of observation.

The formula for calculating the mean and standard deviation is not presented because it is a

basic statistical procedure that is automatically available in data processing software and is used according to the rules of descriptive statistical analysis.

RESULTS

Mortality Distribution of Type 2 Diabetes Mellitus in Indonesia (2000–2021)

This subchapter presents an overview of the mortality distribution of Type 2 Diabetes Mellitus (ICD-10: E11) in Indonesia based on data from the World Health Organization (WHO) Global Health Observatory during the period 2000–2021. The indicator used is *the Age Standardized Mortality Rate* (ASMR) per 100,000 population, which has been adjusted to the age structure of the population, thus allowing for a more valid comparison between years of observation in the context of the epidemiology of non-communicable diseases.

Table 1. Mortality Distribution of Type 2 Diabetes Mellitus in Indonesia (2000–2021)

Year	ASMR	Year	ASMR
2000	15.62	2011	19.49
2001	15.96	2012	19.88
2002	16.31	2013	20.34
2003	16.61	2014	20.83
2004	Not in the top 10	2015	21.28
2005	17.23	2016	21.79
2006	17.54	2017	22.32
2007	17.98	2018	22.84
2008	18.35	2019	23.40
2009	18.73	2020	22.80
2010	19.14	2021	21.04

Description: In 2004, Diabetes Mellitus was not included in the top ten causes of death due to changes in the structure of global causes of death due to natural disasters (tsunamis).

Based on Table 1, the Age Standardized Mortality Rate (ASMR) value of Type 2 Diabetes Mellitus in Indonesia shows a tendency to increase during the observation period. The ASMR value increased from 15.62 per 100,000 population in 2000 to 23.40 per 100,000 population in 2019, which was the highest value during the observation period. In 2020, the ASMR value decreased to 22.80 per 100,000 population and again decreased to 21.04 per

100,000 population in 2021. Overall, the data showed a pattern of increasing mortality until 2019, followed by a decline in the last two years of the observation period.

Descriptive Statistics of Mortality of Type 2 Diabetes Mellitus

The descriptive statistical analysis in this subchapter is used to describe the main characteristics of Diabetes Mellitus Type 2 (ICD-10: E11) mortality data in Indonesia during the

period 2000–2021. All analyses are based on the Age Standardized Mortality Rate (ASMR) per 100,000 population indicator obtained from the World Health Organization Global Health

Observatory, so that it can represent the burden of mortality in a more standardized manner over time.

Table 2. Descriptive Mortality Statistics of Type 2 Diabetes Mellitus (2000–2021)

Parameter	Value
Number of observations	22
Minimum score	15.62
Maximum value	23.40
Average score	19.50
Default deviation	2.43

The results of descriptive statistical analysis showed that the average ASMR of Type 2 Diabetes Mellitus in Indonesia during the period 2000–2021 was 19.50 per 100,000 population with a standard deviation of 2.43. The minimum value was recorded at 15.62 per 100,000 population in 2000, while the maximum value was 23.40 per 100,000 population in 2019. The range of values indicates the presence of variations in ASMR during the observation period (Table 2).

Percentage Change in Mortality of Type 2 Diabetes Mellitus

The percentage change analysis was conducted to provide a quantitative picture of the magnitude of the change in the mortality of Type 2 Diabetes Mellitus (ICD-10: E11) in Indonesia between the initial year and the final year of the 2000–2021 observation period. This approach is used to assess the direction of change in the aggregate mortality burden in the long term based on the Age Standardized Mortality Rate (ASMR) per 100,000 population indicator.

Table 3. Percentage Change in Mortality of Type 2 Diabetes Mellitus (2000–2021)

Early years	Final year	Percentage change (%)
2000	2021	34,92%

The results of the calculation in Table 3 show that the percentage of change in ASMR Type 2 Diabetes Mellitus in Indonesia between 2000 and 2021 was 34.92%. The ASMR value increased from 15.62 per 100,000 population in 2000 to 21.04 per 100,000 population in 2021.

Temporal Trends in Mortality of Type 2 Diabetes Mellitus

The temporal trend analysis in this subchapter aims to describe the pattern of changes in the mortality of Type 2 Diabetes Mellitus (ICD-10: E11) in Indonesia based on the time sequence observed during the period 2000–2021. This approach provides a

dynamic picture of the development direction of mortality burden in the long term using the Age Standardized Mortality Rate (ASMR) per 100,000 population indicator.

Based on Figure 1, the ASMR value of Type 2 Diabetes Mellitus shows a gradual pattern of improvement from 2000 until reaching the highest value in 2019. After that, there was a decline in the value of ASMR in 2020 and decreased again in 2021. Visually, the graph shows a trend of increasing mortality during most of the observation period, with a decrease in the last two years.

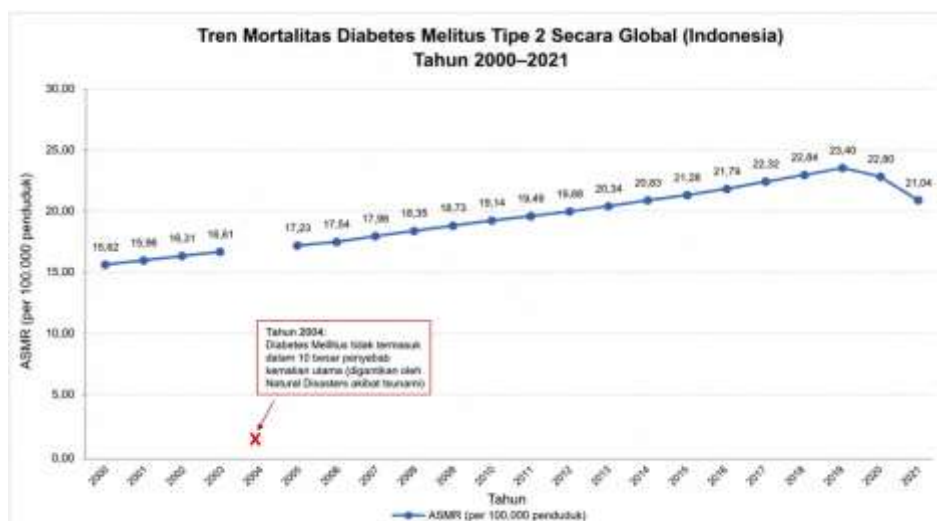


Figure 2. Type 2 Diabetes Mellitus Mortality Trend Graph (2000–2021)

The results of temporal trend analysis show that the mortality of Type 2 Diabetes Mellitus in Indonesia during the period 2000–2021 has a general tendency to increase. This pattern can be seen from the movement of the Age Standardized Mortality Rate (ASMR) value, which has increased gradually since the beginning of the observation period until it reached its highest point in 2019, before then showing a decline in the last two years, namely 2020–2021. The increasing trend is in line with the results of the percentage change calculation, which shows an increase in mortality burden in the long term between the initial year and the final year of observation. Despite fluctuations at the end of the period, the dominant trend still shows an upward pattern over nearly two decades of observation. Epidemiologically, this condition indicates that Type 2 Diabetes Mellitus still contributes significantly to the burden of death due to non-communicable diseases in Indonesia. From the perspective of Surgical Medical Nursing, these findings reflect that the management of Diabetes Mellitus patients has not been fully optimal, especially in the progressive aspect of chronic complication prevention. Therefore, it is necessary to strengthen nursing interventions that not only focus on clinical management, but also include

ongoing education, increased therapy adherence, and strengthening patient self-management to reduce the risk of mortality in the future.

DISCUSSION

Overview of Diabetes Mellitus Mortality Trends in Indonesia

The results of the study show that the mortality of Diabetes Mellitus in Indonesia during the period 2000–2021 shows an increasing trend, marked by an increase in the Age Standardized Mortality Rate (ASMR) value from 15.62 per 100,000 population in 2000 to 23.40 per 100,000 population in 2019, before decreasing to 22.80 in 2020 and 21.04 in 2021. This pattern is the main finding of the study and shows a change in the mortality burden of Diabetes Mellitus over more than two decades of observation. The increase in mortality can be attributed to changes in people's consumption patterns that tend to be high in calories and sugar, the increasing prevalence of obesity, low physical activity, and the rapid urbanization process in Indonesia (Directorate of Business Development UGM, 2024). In the framework of epidemiological transition, these changes reflect a shift in disease dominance from infectious diseases to non-communicable diseases influenced by demographic, social, and behavioral changes in society (Ramadani et al., 2025).

These findings are in line with the research of Siswanto et al. (2023), Fortuna et al. (2023), and Purwandari, Wirjatmadi, and Mahmudiono (2022), which showed that the increase in Diabetes Mellitus mortality is not only influenced by the increasing number of cases, but also by the development of chronic complications such as cardiovascular disease, chronic kidney failure, neuropathy, and other microvascular complications. The decrease in ASMR values in 2020–2021 needs to be interpreted carefully because it does not necessarily indicate a decrease in the burden of Diabetes Mellitus. The decline may be related to changes in the pattern of recording causes of death, disruptions in access to health services, and shifts in service priorities during the COVID-19 pandemic. Therefore, an interpretation is needed that takes into account the context of the health system in that period.

Dalam perspektif Keperawatan Medikal Bedah, peningkatan mortalitas ini menunjukkan perlunya penguatan pengelolaan penyakit kronis melalui edukasi pasien, pemantauan glikemik secara berkelanjutan, deteksi dini komplikasi, serta penguatan kemampuan self-management untuk menurunkan risiko komplikasi dan kematian akibat Diabetes Melitus.

Linkage with the Epidemiological Transition in Indonesia

The increase in Diabetes Mellitus mortality reflects the advanced phase of the epidemiological transition in Indonesia, when non-communicable diseases have replaced infectious diseases as the main cause of health burden (Irwan, 2011; Roosiermiatie, 2023). The results of this study reinforce the concept of epidemiological transition, which states that socio-economic developments, urbanization, and lifestyle changes contribute to the increasing prevalence of chronic diseases. Increased consumption of high-calorie foods, high sugar intake, low physical activity, and increased prevalence of obesity are factors that contribute to the increased risk of Type 2

Diabetes Mellitus and its complications (Dinda et al., 2025; Purwandari, Wirjatmadi and Mahmudiono, 2022). These findings are consistent with various studies (Fortuna et al., 2023; Murtiningsih, Pandelaki and Sedli, 2021; Norsipa, Manto and Fazraningtyas, 2025) that show a strong link between changes in modern lifestyles and increased incidence and mortality of Diabetes Mellitus.

Determinants of Increased Mortality of Diabetes Mellitus

Diabetes Mellitus mortality is the result of a complex interaction between biological factors, behavior, and health care systems (Fauzi and Isnawati, 2023). The findings of this study show a gradual increase in mortality during the observation period. Although this study did not directly analyze risk factors, various previous studies have shown that delayed diagnosis, low adherence to therapy, suboptimal glycemic control, and limited access to health services are factors that contribute to the increased risk of death in Diabetes Mellitus patients (Suryanti et al., 2025; Fauzi and Isnawati, 2023).

In addition, cardiovascular complications, chronic kidney disease, stroke, and infection are the main causes of death in Diabetes Mellitus patients, so early control of risk factors is an important component in reducing mortality. In Surgical Medical Nursing, this condition confirms the importance of the nurse's role in early detection, continuous monitoring, and comprehensive education to prevent the worsening of clinical conditions.

Interpretation of Fluctuations in 2020–2021

The decline in ASMR in 2020–2021 needs to be interpreted carefully in the context of the COVID-19 pandemic. The results showed that after reaching the highest score in 2019, ASMR declined in 2020 and 2021. This decline cannot be directly interpreted as a success in controlling Diabetes Mellitus because in the same period there was a COVID-19 pandemic that affected the

health service system, reporting of causes of death, and patient access to health services (Ramadhani, 2022; Ramadhani, Mahendradhata and Marthias, 2023). In addition, changes in the death recording system have the potential to cause misclassification and underreporting, so that the decline in numbers does not always reflect the actual epidemiological conditions (Rasiman et al., 2024).

Comparison with Previous Research

The findings of this study are in line with the global literature that shows an increase in the burden of Diabetes Mellitus, especially in countries with an epidemiological transition such as Indonesia (Sakul and Andriani, 2025). WHO also affirms Diabetes Mellitus as one of the main causes of death due to non-communicable diseases, either directly or through cardiovascular complications (Ministry of Health of the Republic of Indonesia, 2020; Ministry of Health, 2008; Ariantini et al., 2025). Previous studies (Murtiningsih, Pandelaki and Sedli, 2021; Norsipa, Manto and Fazraningtyas, 2025) have consistently shown that modern lifestyle changes, obesity, and low physical activity are the main determinants of the increase in Diabetes Mellitus. On the other hand, limited access to and quality of health services in developing countries have also worsened the control of chronic diseases (Purwandari, Wirjatmadi and Mahmudiono, 2022; Febriany, 2023). In Surgical Medical Nursing, the consistency of these findings reinforces the urgency of promotive-preventive interventions through education, behavior change, and strengthening self-management as the main strategies for controlling Diabetes Mellitus (Rasiman et al., 2024).

Implications of Surgical Medical Nursing

The findings of this study confirm that the management of Diabetes Mellitus requires a comprehensive and sustainable nursing approach (Rasiman et al., 2024). The role of nurses is not only curative, but also includes the prevention of complications through education, glycemic monitoring, and early detection of microvascular

and macrovascular complications (Rasiman et al., 2024). Strengthening self-management is key to the success of long-term therapy, with nurses acting as educators and facilitators of changes in patients' health behaviors. In addition, the integration of primary, secondary, and community services is important to ensure the continuity of care (Rasiman et al., 2024). Thus, the control of Diabetes Mellitus requires an evidence-based, promotive-preventive-oriented approach to Medical Surgical Nursing, and focusing on the prevention of mortality in a sustainable manner.

CONCLUSION

This study shows that the mortality trend of Diabetes Mellitus in Indonesia during the period 2000–2021 generally shows a long-term pattern of increase, with the peak mortality rate occurring in 2019 before decreasing in the 2020–2021 period. These findings support the hypothesis that the mortality burden of Diabetes Mellitus tends to increase over time as a consequence of epidemiological transitions, increased metabolic risk factors, as well as the complexity of controlling chronic disease complications.

Empirically, the results of the study confirm the upward trend in the Age Standardized Mortality Rate (ASMR), which reflects that Type 2 Diabetes Mellitus is still one of the main causes of death due to non-communicable diseases in Indonesia. These findings reinforce the evidence that increased mortality is not only influenced by disease incidence, but also by delayed diagnosis, non-adherence to therapy, as well as the high prevalence of systemic complications such as cardiovascular disease and chronic kidney failure.

The decrease in mortality in 2020–2021 cannot be interpreted as an improvement in epidemiological conditions, but is instead influenced by disruptions of the health service system and changes in death recording patterns during the COVID-19 pandemic. Thus, the new findings of this study confirm that short-term fluctuations do not change the tendency to increase mortality in the long term.

In the context of Surgical Medical Nursing, the results of this study show the urgency of strengthening promotive-based and preventive nursing interventions through health education,

strengthening patient self-management, and continuous monitoring to prevent further complications. Nurses also have a strategic role in strengthening the continuity of care across services to reduce the risk of Diabetes Mellitus mortality.

As a recommendation, health service institutions are expected to strengthen community-

based non-communicable disease control programs and increase access to early screening for Diabetes Mellitus. Researchers are then advised to conduct analyses based on social and economic determinants or use predictive modeling approaches to estimate the mortality burden of Diabetes Mellitus in the future more comprehensively.

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Declaration of Generative AI Use

Grammarly was used exclusively for language editing to improve the grammar, spelling, punctuation, and readability of the manuscript. It was not used to generate scientific content, analyze or interpret data, or develop the study's conclusions. The authors carefully reviewed all revisions and assume full responsibility for the accuracy and integrity of the final manuscript.

Referensi

- Ahmed, G.U. Dkk. (2025) "Evaluating Mortality Burden Of Diabetes Mellitus And Peripheral Arterial Disease In The US: Insights From 26 Years Of National Data," *Annals Of Medicine & Surgery* [Preprint]. Tersedia Pada: <https://doi.org/10.1097/Ms9.0000000000004611>.
- Alanazi, S., Wiechula, R., dan Foley, D. (2024) "Perceptions Of Followership Among Nurses: A Qualitative Study," *International Journal Of Nursing Studies Advances*, 7. Tersedia Pada: <https://doi.org/10.1016/J.Ijnsa.2024.100222>.
- Ariantini, A.D. Dkk. (2025) "Program Pencegahan Dan Pengendalian Penyakit Diabetes Melitus Dan Gangguan Metabolik (Pdmgm) Di Indonesia: Studi Kualitatif," *Media Kesehatan Masyarakat Indonesia*, 23(3). Tersedia Pada: <https://doi.org/10.14710/Mkmi.23.3.255-261>.
- Depkes, Ri. (2008) "Pedoman Pengendalian Diabetes Melitus Dan Penyakit Metabolik," Jakarta: Depkes Ri [Preprint].
- Dinda, F. Dkk. (2025) "Studi Literatur: Pengaruh Obesitas Terhadap Kejadian Diabetes Melitus," *Jurnal Ilmu Kedokteran Dan Kesehatan*, 12(2).
- Direktorat Pengembangan Usaha Ugm (2024) *Diabetes Penyebab Kematian Tertinggi Di Indonesia: Batasi Dengan Snack Sehat Rendah Gula*, Direktorat Pengembangan Usaha Ugm.
- Fauzi, A. Dan Isnawati (2023) "Faktor-Faktor Yang Mempengaruhi Kejadian Mortalitas Pada Pasien Diabetes Militus Dengan Komplikasi Masuk Di Ruang Icu Rs. Pelabuhan Jakarta," *Jurnal Ilmiah Keperawatan (Scientific Journal Of Nursing)*, 9(4). Tersedia Pada: <https://doi.org/10.33023/Jikep.V9i4.1609>.
- Febriany, F. (2023) "Kualitas Hidup Peserta Program Penyakit Kronis Diabetes Melitus Tipe Ii Di Indonesia : A Systematic Review," *Jurnal Jaminan Kesehatan Nasional*, 3(2).
- Fortuna, T.A. Dkk. (2023) "Faktor – Faktor Yang Mempengaruhi Komplikasi Pada Pasien Diabetes Mellitus Di Rsud Dr. Moewardi," *Pharmacon: Jurnal Farmasi Indonesia*, 20(1). Tersedia Pada: <https://doi.org/10.23917/Pharmacon.V20i1.21877>.
- Irwan (2011) "Transisi Epidemiologi," *Wacana, Journal Of The Humanities Of Indonesia*, 2(1).
- Islamsiasih, I. (2022) "Gambaran Self Management Pada Penderita Diabetes Mellitus Di Wilayah Kerja Puskesmas Karanganyar Purbalingga," *Universitas Muhammadiyah Surakarta*, 2507(February).
- Kementerian Kesehatan Ri (2020) "Pengendalian Diabetes Melitus Dan Penyakit Metabolik," *Pedoman Pengendalian Diabetes Melitus Dan Penyakit Metabolik* [Preprint].
- Moleong, L.J. (1989) *Metodologi Penelitian Kualitatif*. Pt Remaja Rosdakarya.
- Murtiningsih, M.K., Pandelaki, K. Dan Sedli, B.P. (2021) "Gaya Hidup Sebagai Faktor Risiko Diabetes Melitus Tipe 2," *E-Clinic*, 9(2). Tersedia Pada: <https://doi.org/10.35790/Ecl.V9i2.32852>.

- Naibaho, A.R.O. Dkk. (2025) "Kajian Teoritis Mengenai Morbiditas Dan Mortalitas Dalam Perspektif Ekonomi Demografi," Riggs: Journal Of Artificial Intelligence And Digital Business, 4(2). Tersedia Pada: <https://doi.org/10.31004/Riggs.V4i2.1071>.
- Nikpour, S. Dkk. (2022) "Challenges Of Type 2 Diabetes Mellitus Management From The Perspective Of Patients: Conventional Content Analysis," Interactive Journal Of Medical Research, 11(2). Tersedia Pada: <https://doi.org/10.2196/41933>.
- Nofi Susanti Dkk. (2024) "Faktor Risiko Dan Penatalaksanaan Diabetes Melitus Tipe 2," Healthy Tadulako Journal (Jurnal Kesehatan Tadulako), 10(4).
- Norsipa, S., Manto, O.A.D. Dan Fazraningtyas, W.A. (2025) "Faktor Gaya Hidup Terhadap Risiko Terjadinya Diabetes Melitus Tipe 2 Pada Remaja," Journal Of Nursing Practice And Education, 6(01). Tersedia Pada: <https://doi.org/10.34305/W022nv87>.
- Purwandari, C.A.A., Wirjatmadi, B. Dan Mahmudiono, T. (2022) "Faktor Risiko Terjadinya Komplikasi Kronis Diabetes Melitus Tipe 2 Pada Pra Lansia," Amerta Nutrition, 6(3). Tersedia Pada: <https://doi.org/10.20473/Amnt.V6i3.2022.262-271>.
- Ramadani, S. Dkk. (2025) "Analisis Faktor Penyebab Penyakit Degeneratif (Diabetes Mellitus) Pada Metabolisme Karbohidrat," Indonesian Journal Of Science And Public Health, 2(2).
- Ramadhani, A.F. (2022) "Rapid Assessment: Resiliensi Sistem Pelayanan Kesehatan Penyakit Tidak Menular Terhadap Pandemi Covid-19 Di Puskesmas Kabupaten Sleman," Jurnal Kebijakan Kesehatan Indonesia, 11(3). Tersedia Pada: <https://doi.org/10.22146/Jkki.76385>.
- Ramadhani, A.F., Mahendradhata, Y. Dan Marthias, T. (2023) "Rapid Assessment : Resiliensi Sistem Pelayanan Penyakit Tidak Menular Terhadap Pandemi Covid-19 Health System Resilience Of Non-Communicable Disease," Jurnal Kebijakan Kesehatan Indonesia, 11(03).
- Rao, A.G. Dkk. (2025) "Trends And Disparities In Mortality Due To Diabetes Mellitus And Sepsis In The US Adults: 1999–2023," Endocrinology, Diabetes And Metabolism, 8(5). Tersedia Pada: <https://doi.org/10.1002/Edm2.70082>.
- Rasiman, N.B. Dkk. (2024) Buku Ajar Konsep Keperawatan Komunitas (Berdasarkan Kurikulum Pendidikan Ners Indonesia Tahun 2021), Eureka Media Aksara.
- Roosihermatie, B.R. (2023) "Faktor Risiko Dan Pencegahan Penyakit Tidak Menular Di Indonesia," Airlangga University Press [Preprint].
- Sakul, W.P. Dan Andriani, H. (2025) "Prevalensi Global Diabetes Mellitus: Tinjauan Sistematis Negara-Negara Dengan Beban Tinggi Dan Strategi Penanganannya," Jurnal Ners, 9(3). Tersedia Pada: <https://doi.org/10.31004/Jn.V9i3.47890>.
- Sapra, A. Dan Bhandari, P. (2021) "Diabetes Mellitus - Statpearls - Ncbi Bookshelf," Starpearls Publication [Preprint].
- Sinaga, M. Dkk. (2025) "Pemberdayaan Keluarga Dalam Perawatan Luka Diabetes Dengan Terapi Sulfur Di Wilayah Kerja Puskesmas Kampung Baru," Jurnal Pengabdian Masyarakat 360 Derajat, 2(1). Tersedia Pada: <https://doi.org/10.35328/Em0ntd93>.
- Siswanto Dkk. (2023) Farmakoterapi Pada Gagal Jantung, Pt Scifintech Andrew Wijaya.
- Slater, P., dan Hasson, F. (2025) "Quantitative Research Designs, Hierarchy Of Evidence And Validity," Journal Of Psychiatric And Mental Health Nursing, 32(3). Tersedia Pada: <https://doi.org/10.1111/Jpm.13135>.
- Soewondo, P., Ferrario, A., dan Tahapary, D.L. (2013) "Challenges In Diabetes Management In Indonesia: A Literature Review," Globalization And Health. Tersedia Pada: <https://doi.org/10.1186/1744-8603-9-63>.
- Suryanti At Al (2025) Diabetes Mellitus Dan Pencegahan Komplikasi, Ferri's Clinical Advisor 2020.
- Tomic, D., Shaw, J.E. Dan Magliano, D.J. (2022) "The Burden And Risks Of Emerging Complications Of Diabetes Mellitus," Nature Reviews Endocrinology. Tersedia Pada: <https://doi.org/10.1038/S41574-022-00690-7>.
- Varaei, S. Dkk. (2024) "Outcomes Of Professional Misconduct By Nurses: A Qualitative Study," BMC Nursing, 23(1). Tersedia Pada: <https://doi.org/10.1186/S12912-024-01859-3>.
- Wahidin, M. Dkk. (2024) "Projection Of Diabetes Morbidity And Mortality Till 2045 In Indonesia Based On Risk Factors And Ncd Prevention And Control Programs," Scientific Reports, 14(1). Tersedia Pada: <https://doi.org/10.1038/S41598-024-54563-2>.
- Wijonarko Dan Jaya Putra, H. (2025) "Gambaran Tingkat Pengetahuan Dan Self Management Pada Penderita Diabetes Mellitus Di Puskesmas Kota Karang, Bandar Lampung," Jurnal Keperawatan Bunda Delima, 7(1). Tersedia Pada: <https://doi.org/10.59030/Jkbb.V7i1.129>.
- World Health Organization (2024) "Global Health Estimates 2021: Deaths By Cause, Age, Sex, By Country And Region, 2000–2021." Geneva, Switzerland. Tersedia Pada: <https://www.who.int/data/global-health-estimates>.
- Zakir, M. Dkk. (2023) "Cardiovascular Complications Of Diabetes: From Microvascular To Macrovascular Pathways," Cureus [Preprint]. Tersedia Pada: <https://doi.org/10.7759/Cureus.45835>.