

Dokumentasi AOL Kelompok 2 LG09

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Dataset : <https://www.kaggle.com/datasets/uciml/pima-indians-diabetes-database>

UNPACKING THE MYTH: DOES OBESITY ALWAYS LEAD TO DIABETES?

Diabetes is a chronic metabolic disease characterized by hyperglycemia.

Type 1 diabetes is caused by insulin deficiency, often due to autoimmune conditions

Type 2 diabetes occurs when the body becomes resistant to insulin due to bad lifestyle and genetic factors



Increased Appetite



Weight Loss



Increased Urination



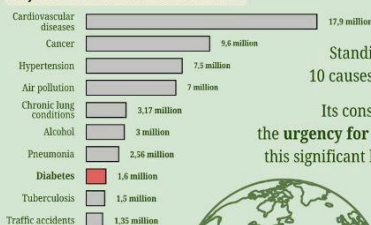
Excessive Thirst



Slow Healing Sores

How Critical Is Diabetes?

Major Death Causes Worldwide - 2018



Standing at **8th** out of the top 10 causes of death worldwide in 2018

Its consistent presence underscores the **urgency for global action** in addressing this significant health challenge in line with the third SDGs



Fun Fact



54.3% of obese Indian women don't suffer from diabetes

WHO are Indian women

Pima Indian women are known for having one of the **highest diabetes rates** in the world



Top 3 Factors Causing Diabetes

In Obese Population



Genetic Factor

Obese individuals with a family history of diabetes are **more prone** to be diagnosed

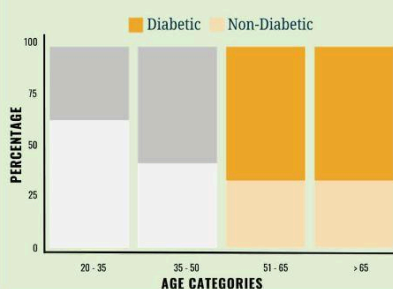


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Older People = Higher Risk

The majority of diabetes patients come from older age groups

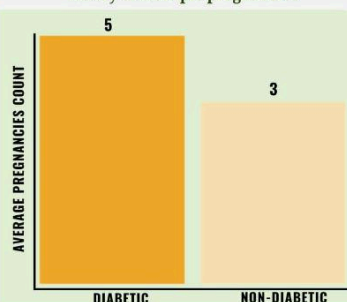


3



Number of Pregnancies

Data shows that **many diabetic women** have a history of **multiple pregnancies**



Preventive Measures



Regular health check-up

Have a healthy diet



Exercise and be active

Is It True, Obesity = Diabetes?



In conclusion, **obesity does not necessarily lead to diabetes**. Diabetes is influenced by both lifestyle choices and genetic factors, with a family history of diabetes increasing the risk.

Unpacking The Myth: Does Obesity Always Lead To Diabetes?

3rd SDGs Good Health and Well-Being



The Sustainable Development Goals (SDGs), established by the United Nations, aim to address global challenges and ensure a better and more sustainable future for all. The third goal in SDG is to ensure healthy lives and promote well-being for all at all ages. It promotes healthy lifestyles, preventive measures and modern, and efficient healthcare for everyone. Significant strides were made in increasing life expectancy and reducing some of the common killers associated with child and maternal mortality. But more efforts are needed to fully eradicate a wide range of diseases and address many different persistent and emerging health issues. By focusing on providing more efficient funding of health systems, improved sanitation and hygiene, and increased access to physicians, significant progress can be made in helping to save the lives of millions.

Diabetes intersects with the third SDGs (Good Health and Well-being) by contributing to premature mortality from non-communicable diseases (3.4) and impacting health equity and access to healthcare (3.8, 3.9). Addressing diabetes is crucial for achieving SDG 3's goal of ensuring healthy lives, promoting well-being for all, and reducing premature mortality from non-communicable diseases through prevention, treatment, and promotion of mental health and well-being.

Definition and Type of Diabetes

Diabetes is a chronic metabolic disease characterized by hyperglycemia.



Type 1 diabetes is caused by **insulin deficiency**, often due to autoimmune conditions



Type 2 diabetes occurs when the body becomes **resistant to insulin** due to bad lifestyle and genetic factors

Diabetes or diabetes mellitus is a chronic metabolic disease characterized by hyperglycemia (high levels of sugar in the blood). The cause of type 1 diabetes is deficiency of insulin secretion due to an autoimmune condition where the body's immune system attacks and destroys insulin-producing beta cells in the pancreas. Insulin is a hormone produced by the pancreas that helps regulate blood glucose levels by facilitating the uptake of glucose into cells for energy production. People with type 1 diabetes need to take insulin injections or use an insulin pump to manage their blood glucose levels.

Besides that, there is type 2 diabetes, that is caused by a combination of resistance to insulin action and an inadequate insulin number. It is often associated with obesity,

physical inactivity, and genetics. Type 2 diabetes can often be managed with lifestyle changes, oral medications, and sometimes insulin therapy.

On the other hand, there is gestational diabetes that occurs during pregnancy when the body cannot produce enough insulin to meet the increased needs, leading to high blood glucose levels. Gestational diabetes usually resolves after the baby is born, but it can increase the mother's risk of developing type 2 diabetes later in life.

So, type 1 diabetes is caused by deficiency of insulin secretion due to autoimmune. While type 2 diabetes occurs when the body becomes resistant to insulin or when the pancreas doesn't produce enough insulin due to obesity, physical inactivity, and genetics.

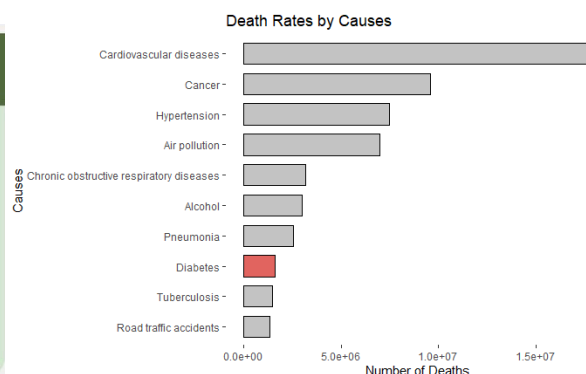
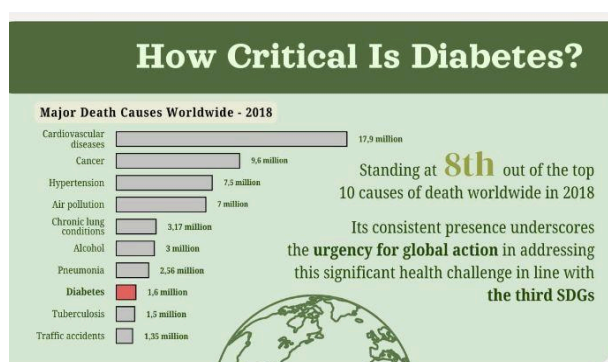
Symptoms of Diabetes



Symptoms of diabetes can include frequent urination, excessive thirst, extreme hunger, unexplained weight loss, fatigue, blurred vision, slow-healing sores, and frequent infections.

https://diabetesjournals.org/care/article/37/Supplement_1/S81/37753/Diagnosis-and-Classification-of-Diabetes-Mellitus

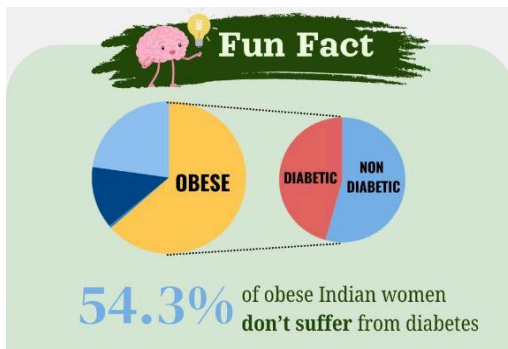
How Critical Is Diabetes?



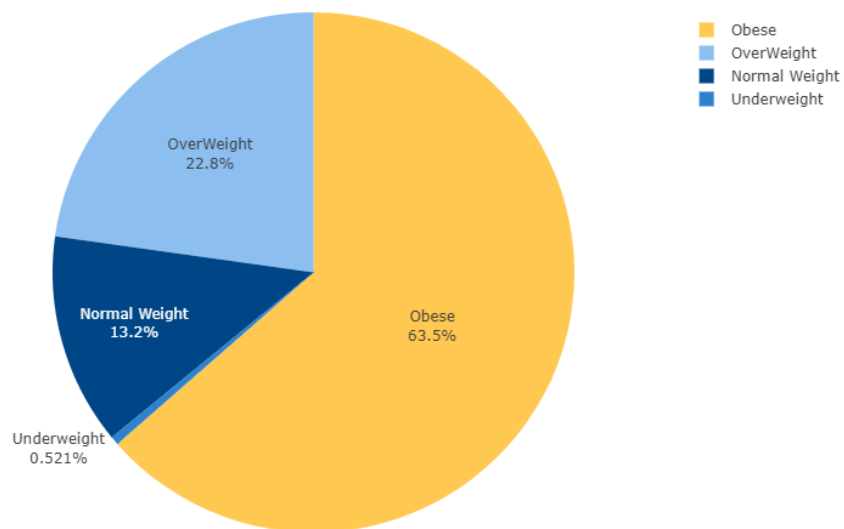
Diabetes continued to hold its position as one of the top 10 leading causes of death worldwide in 2018. Its significance is underscored by the fact that it retained its standing among the top 8 major causes of mortality. This persistent prominence highlights the urgent need for attention and action to address the challenges posed by diabetes on a global scale. This aligns with the goal of SDG 3, which is to ensure healthy lives and promote well-being for all at all ages.

https://www.researchgate.net/publication/342898491_Neglected_Major_Causes_of_Death_Much_Deadlier_Than_COVID-19

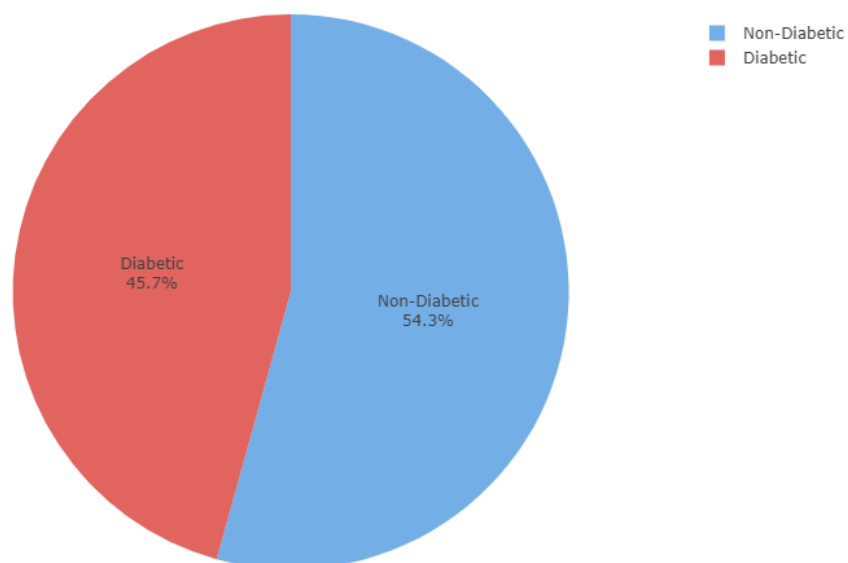
Fun Fact Section



Here is a pie chart represented BMI distribution in PIMA Indian women population.



Diabetic Composition in Obese Individuals



1. The following is a simple pie chart that shows the composition of diabetics and non-diabetics in the obese range.
2. The chart shows a slightly higher number of non-diabetics as opposed to diabetics, with a 54.3% being diabetics, and the other 45.7% being non-diabetics;
 - a. These results do not follow other trends, hence gives new insight to how BMI affects the chances of developing diabetes.
 - b. However, we should also consider sample sizes and possible sampling methods in case of biases.
 - c. If no biases were found, then it could be concluded that there is far more when diagnosing diabetes than just BMI and other small factors.

Who Are Indian Women?

WHO are
Indian women

Pima Indian women are known for having one of the **highest diabetes rates** in the world

PIMA Indian women refer to women from the PIMA tribe, a Native American group. PIMA Indian women are often studied in medical research due to their high prevalence of type 2 diabetes. Here are some reasons why we use the PIMA Indian women dataset:

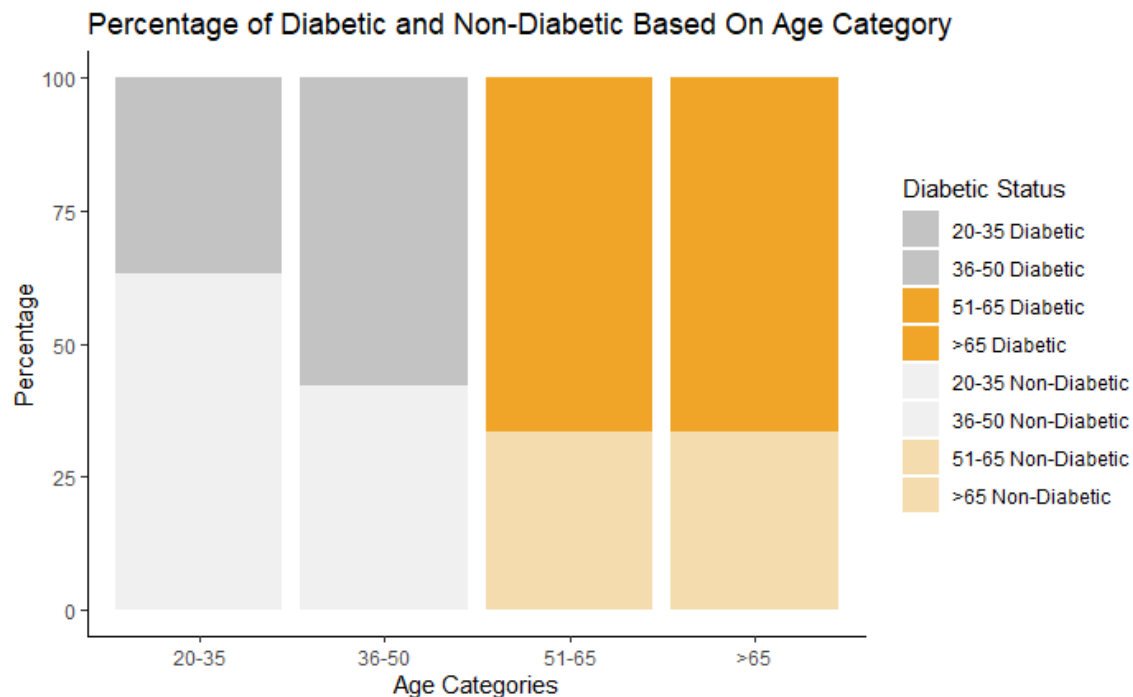
1. High Diabetes Rate: The Pima Indian tribe has the highest rate of type 2 diabetes in the world. The focus on this group allows for a deeper understanding of the genetic and environmental factors that contribute to the disease.
2. Maternal and Child Health: Women play a key role in family health who have a tendency to pass on diabetes to their children. Detecting and managing diabetes in women will also have an impact on the health of children and their families.

Researching genetically homogeneous populations helps in the identification of specific risk factors that may be more difficult to find in more diverse populations. These insights can be applied to understand and manage diabetes in other populations as well. This dataset is often used for educational purposes to understand and predict diabetes risk factors.

<https://core.ac.uk/download/pdf/234670023.pdf>

Top 3 Factors Causing Diabetes In Obese Population

1. Age



The stacked bar chart shows the diabetes trend in obese samples by age categories.

a. The four categories are:

- i. 20-35
 - $20 < \text{Age} \leq 35$
- ii. 36-50
 - $35 < \text{Age} \leq 50$
- iii. 51-65
 - $50 < \text{Age} \leq 65$
- iv. >66
 - $\text{Age} > 65$

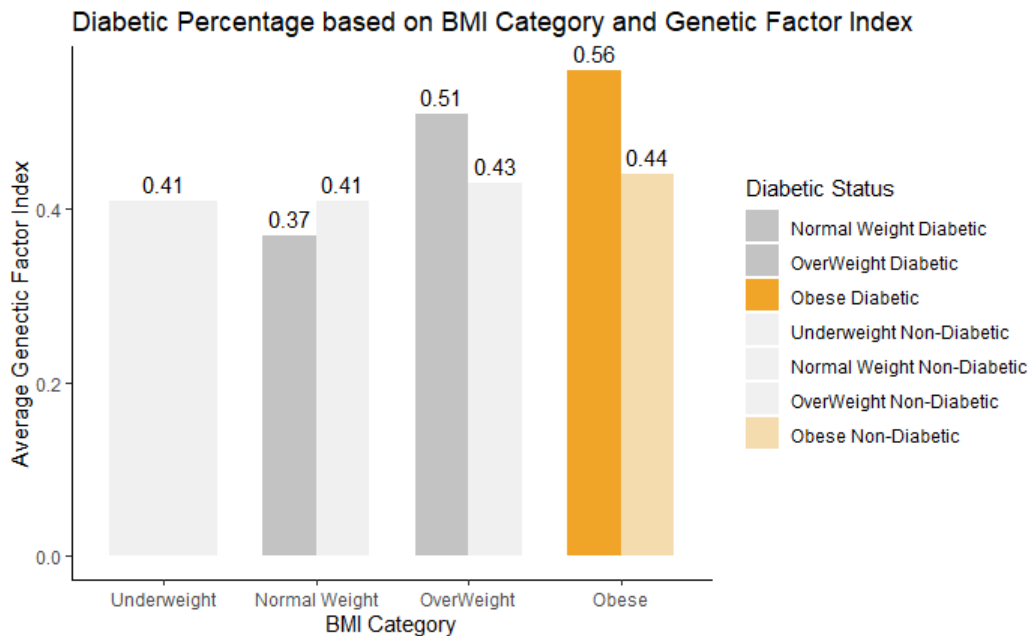
b. A stacked bar chart represents the composition of diabetics and non-diabetics in every age category.

- i. The x-axis represents the age categories.
- ii. The y-axis represents the percentages of diabetics and non-diabetics.
 - Acknowledging percentages as mentioned earlier, each bar makes up a total of 100% of the age category

c. A clear increasing trend is visible, showing a higher chance of having diabetes as obese individuals progress with age, with both 51-65 and >66 categories having an identical percentage of 66%.

- d. Aging is associated with decreased insulin production and increased levels of inflammation in the body. Over time, individuals may accumulate various risk factors such as obesity, high blood pressure, sedentary lifestyles, and poor nutrition.

2. Genetic Factor

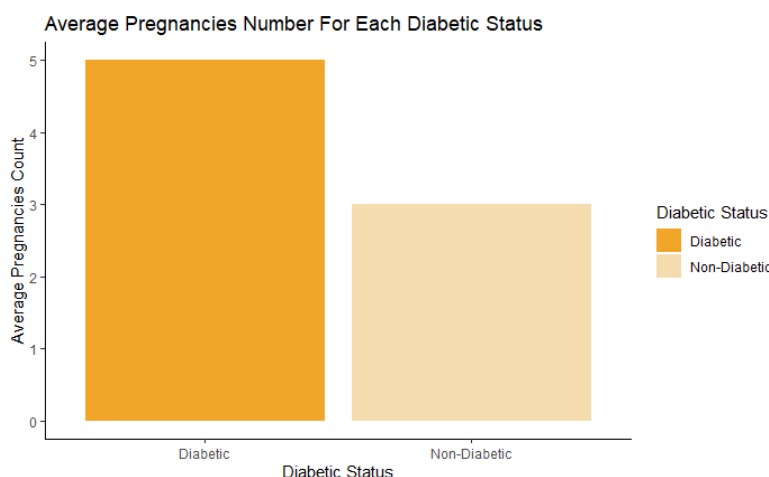


The grouped bar chart shows how large genetic factor indices between diabetic and non-diabetic across various BMI categories.

- a. The four categories are:
 - i. Underweight
 - BMI < 18.5
 - ii. Normal weight
 - $18.5 \leq \text{BMI} < 24.9$
 - iii. Overweight
 - $24.9 \leq \text{BMI} < 29.9$
 - iv. Obese
 - BMI ≥ 29.9
- b. A grouped bar chart allows a comparison of genetic factor indices between diabetics and non-diabetics within each BMI category.
 - i. Each group on the x-axis corresponds to a specific BMI category.
 - ii. The y-axis represents the genetic factor index.
- c. The chart shows the distribution of genetic factor indices between diabetic and non-diabetic across different BMI categories:

- i. Underweight
 - Non-diabetics: 0.41
 - Diabetics: 0
 - ii. Normal Weight
 - Non-diabetics: 0.41
 - Diabetics: 0.37
 - iii. Overweight
 - Non-diabetics: 0.43
 - Diabetics: 0.51
 - iv. Obese
 - Non-diabetics: 0.44
 - Diabetics: 0.56
- d. Insights :
- From the data, genetic factor indices appear to be higher in individuals with overweight and obese conditions.
- i. Diabetics who have a high BMI (obese and overweight category) does not necessarily reflect a bad lifestyle, but it can also be due to the influence of diabetes hereditary history.
 - ii. On the other hand, a high genetic factor index does not automatically cause diabetes, for example in individuals with normal and underweight conditions who have index 0.41, but they are non-diabetics.
- e. In conclusion, these trends suggest that as BMI and genetic factor index increases, the likelihood of developing diabetes also increases significantly. This emphasises the importance of maintaining a healthy weight to reduce the risk of diabetes.

3. Number of Pregnancy



The bar chart shows the distribution of average number of pregnancies for obese diabetic and non-diabetic people.

- a. To find the effects of pregnancies towards diabetes, the diabetic and non-diabetic data are grouped and the averages of both categories are calculated.
- b. The results are then placed into a bar graph, with the y-axis representing the average number of pregnancies, and the x-axis showing the diabetic status.
- c. The presented data shows that the average number of pregnancies among diabetics is higher than that of non-diabetics.
- d. During pregnancy, hormones can interfere with the work of insulin so that the body cannot regulate blood sugar levels properly, thus causing gestational diabetes. Women who have had gestational diabetes in a previous pregnancy are at a higher risk of developing it in subsequent pregnancies. The likelihood of gestational diabetes increases with the number of pregnancies, especially for women who have other risk factors, such as obesity, advanced maternal age, or a family history of diabetes.
- e. Additionally, those who develop gestational diabetes are at an increased risk of developing type 2 diabetes later in life, and this risk persists even after the pregnancy ends. Another possibility is that the more offspring the individual has, they might not have enough time or help to care for their own physical condition.

<https://www.halodoc.com/kesehatan/diabetes-gestasional>

How to Prevent Diabetes



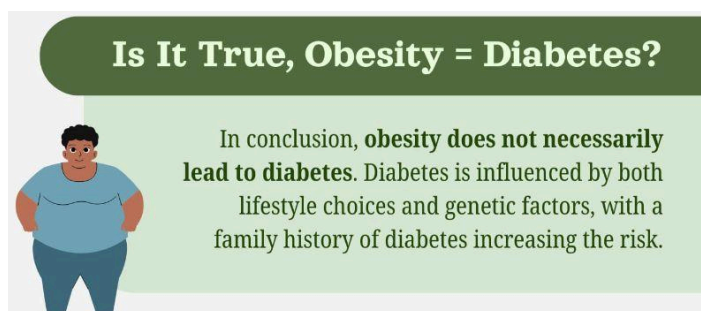
1. Individuals with a family history of diabetes should be particularly vigilant about monitoring and maintaining a healthy lifestyle. Regular visits to healthcare providers for comprehensive health check-ups can help detect diabetes risk factors early.
2. Implementing weight loss programs and nutritional counselling to manage obesity. Following a healthy eating plan, by adopting a balanced diet rich in whole grains,

fruits, vegetables, lean proteins, and healthy fats, also reducing the intake of sugary foods and refined carbohydrates is crucial.

3. Engaging in regular physical activity, such as walking, jogging, swimming, or other exercises, to improve insulin sensitivity and maintain a healthy weight. Get regular exercise. Exercise has many health benefits, including helping you to lose weight and lower your blood sugar levels. These both lower your risk of type 2 diabetes.
4. Using medications to minimize risk factors, such as high blood pressure. For those at high risk or with early signs of diabetes, medications that improve insulin sensitivity (like metformin) may be prescribed. In cases where insulin production is significantly impaired, insulin therapy may be necessary.

<https://medlineplus.gov/howtopreventdiabetes.html>

Conclusion



In conclusion, obesity does not necessarily lead to diabetes. Diabetes is influenced by both lifestyle choices and genetic factors, with a family history of diabetes increasing the risk.

Shiny Documentation

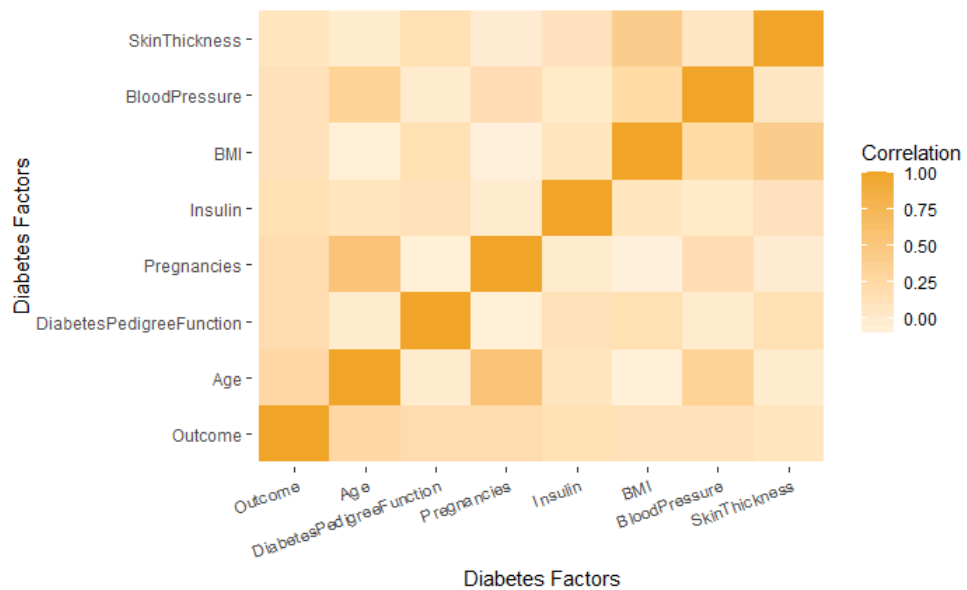
Link : <https://doesobesityalwaysleadtod diabetes.shinyapps.io/aol-kelompok2/>

This Shiny Dashboard contains 3 pages : Diabetes, Pima Indians, and Conclusion with all the charts in it are interactive charts.

1. Diabetes

In this page, you will gain knowledge about what diabetes is and types of diabetes—type 1, type 2, and gestational diabetes. You will also know why diabetes is a critical health issue globally. This page also highlights diabetes symptoms and explores its top contributing factors through a detailed heatmap. And you will also see the top 3 factors—age, genetic factors and numbers of pregnancies—and its explanation along with their charts.

We can see the relationship between the factors that cause diabetes and the outcome variables through correlation heatmap.



- a. The outcome column and row are then checked to find the lightest gradient
 - i. With age having a darker gradient, it can be concluded that when someone gets older, there is also a higher chance of having diabetes.
 - ii. Skin thickness has a light gradient, showing that its presence has a negligible effect in indicating diabetes.
 - iii. Below are the correlating factors in descending order:
 1. Age is the factor most related to outcome, compared to other factors. The correlation between age and outcome variable is 0.243, showing that it is more likely to diagnose diabetes in older individuals.
 2. The same can be said for diabetes pedigree history, with a correlation factor of approximately 0.178. Although not as high of a correlation as age, the data shows that it is more likely to diagnose diabetes in individuals with a hereditary history of diabetes.
 3. While the number of pregnancies has a correlation factor of approximately 0.175. It means the number of pregnancies influences a person's risk of diabetes.
 4. The same can be said for BMI values, with a correlation factor of approximately 0.31. Although not as high of a correlation as glucose, the data shows that it is more likely to diagnose diabetes in individuals with higher BMI values.
 5. The remaining factors in descending order are as follows:
 - a. Insulin levels ≈ 0.161

- b. BMI ≈ 0.114
- c. Blood pressure ≈ 0.106
- d. Skin thickness ≈ 0.078

2. Pima Indians

In this page, you will know who Pima Indian Women are and what's so special about them. Their BMI distribution will also be shown in this page and there will be answers for our main problem, "Does obesity always lead to Diabetes?". This page will also provide prevention steps for obese individuals in order not to get diabetes.

3. Conclusion

In this final section, the correlation between Sustainable Development Goals (SDGs) and the diabetes rate among Pima Indian Women is examined. It summarizes the insights gained from the dashboard, providing a holistic understanding of the interplay between diabetes risk factors, the specific case of Pima Indian Women, and broader health goals. This section ties together the information presented across the dashboard, reinforcing key takeaways and actionable steps for diabetes prevention.