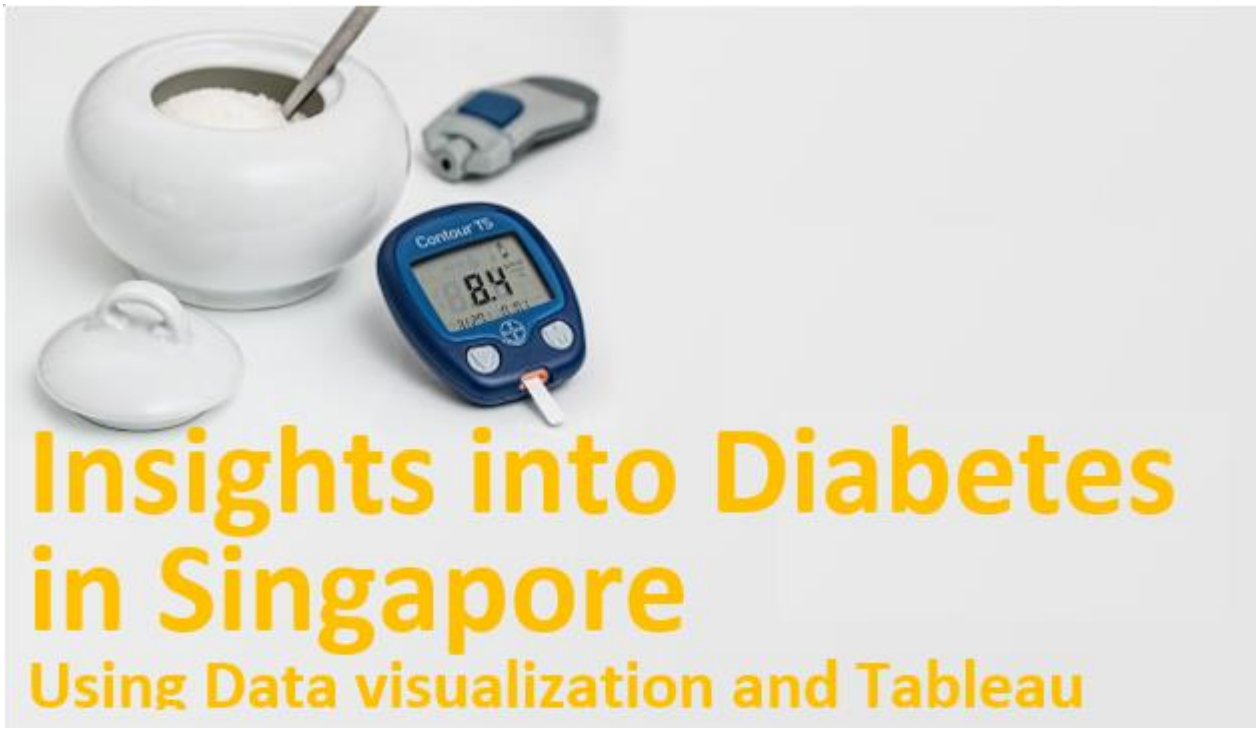

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Contents

Background and Motivation

The Diabetes Threat

Type 2 Diabetes is a worldwide epidemic, where the number of people with diabetes is huge and growing. About 440,000 Singapore residents who were 18 years and above had diabetes in 2014. Diabetes was the 4th and 8th most common condition of polyclinic attendances and hospitalisation respectively in 2014. Life years lost due to mortality and ill-health related to diabetes was the 4th largest among all diseases in 2010.

The cost burden from diabetes, including medical expenses and productivity loss, was expected to rise from beyond $940 million in 2014 to $1.8 billion in 2050.

Singapore's war on Diabetes

» The prevalence of diabetes among Singapore residents (Singapore citizens and Permanent Residents) has increased over the decade. This is largely attributed to our ageing population as the risk of diabetes increases with age.

1. Motivation

Type 2 diabetes has been in the top 10 conditions for hospitalization, as well as top 10 principal causes of death in Singapore for the recent decade. Currently more than 50,000 people in Singapore has been suffering from this disease, experiencing not only physical and emotional stress, but also economic burdens brought to the family.

However type 2 diabetes is preventable, and the government has launched multiple programmes to combat diabetes.

By understanding the current trends of diabetes in Singapore, we would like to explore the key factors that leads to diabetes. In addition, by understanding the impact from different aspects of lifestyle, we would like to locate areas that the government could focus on and put more effort in so as to mitigate the effects of this national health crisis

2. Target Audience

We aim to present our findings to CEO of Health Promotion Board Mr Zee Yoong Kang, and Minister of Health Mr Gan Kim Yong. By showing the trends on diabetes in different groups of people, as well as cross comparison with other developed countries in asia, it would provide more insights that are helpful for them to make strategic decisions.

3. Assumptions

- Since most of the data come from official government sources and reports, we assume that the surveys and studies from which the data is taken was done on a representative population of Singapore.
- Regarding spending on diabetes, we have considered only the government spending and average estimate of spending by the patients. We assume that there are no significant private players in the diabetes market that may disrupt the situation.

4. GQM Analysis

4.1 Goals

- Explain the current situation of prevalence of diabetes in Singapore with summary on current trends
- Identify the key factors that lead to the prevalence of diabetes
- Understand the economic effort needed for the country and for each diabetic patient to live with diabetes
- Identify areas/ sectors where the Government can take actions to improve the situation

4.2 Questions

- What is the standing of prevalence of diabetes in Singapore in comparison with other nations ?
- What is the current trend of diabetes in Singapore?
- What are the main factors that leads to diabetes in Singapore?
- How much does it cost to live with diabetes?
- How to tackle current situation to combat diabetes?

4.3 Metrics

- Prevalence of diabetes
- Overweight prevalence
- Smoking rates
- Average annual working hours
- Alcohol consumption rate
- Physical activity participation rate
- Percentage of healthy eateries
- Financial burden due to diabetes
- Government spending on care and awareness

5. Architecture

The architecture of this project is having four layers which are as follows:

5.1 Source data layer: This layer contains the raw flat files in various formats like Excel, CSV, Text data. It was collected from different websites from Singapore and other nations.

5.2 Data Acquisition layer: This layer loads the raw data files and import them in to MS SQL Server using import wizard. The SQL Server uses AWS Cloud services for hosting and data management which is discussed in next layer. This can be used to create, read, update and delete records from the loaded database.

5.3 Data Management Layer: This layer provides the necessary database hosting platform. Here we deployed AWS Cloud Services for the purpose of managing the database, connecting to the MS SQL Server and connecting to Tableau which displays the data.

5.4 User Data Access Layer: This layer provides the front end to the data files in the form of various visualization and can be accessed using the Tableau dashboard. Users can drag and drop various fields to create powerful visualizations to answer various problems.

6. Data Strategy

6.1 Data Source

- Singapore Department of Statistics : singstat.gov.sg
- Ministry of Health : moh.gov.sg
- Data.gov.sg
- World Health Organization : who.int/news-room/diabetes
- World Bank : worldbank.org
- sportsingapore.gov.sg
- Straitstimes.com

6.2 Data Preparation Process

» **Identifying the trends**
Before digging into the details we read articles from different sources such as World Health Organization, International Diabetes Federation, as well has Singapore Health Promotion Board and Ministry of Health to get an understanding of the world diabetes, as well as the standing of Singapore's situation on diabetes. Tops factors that contributes to diabetes were identified.

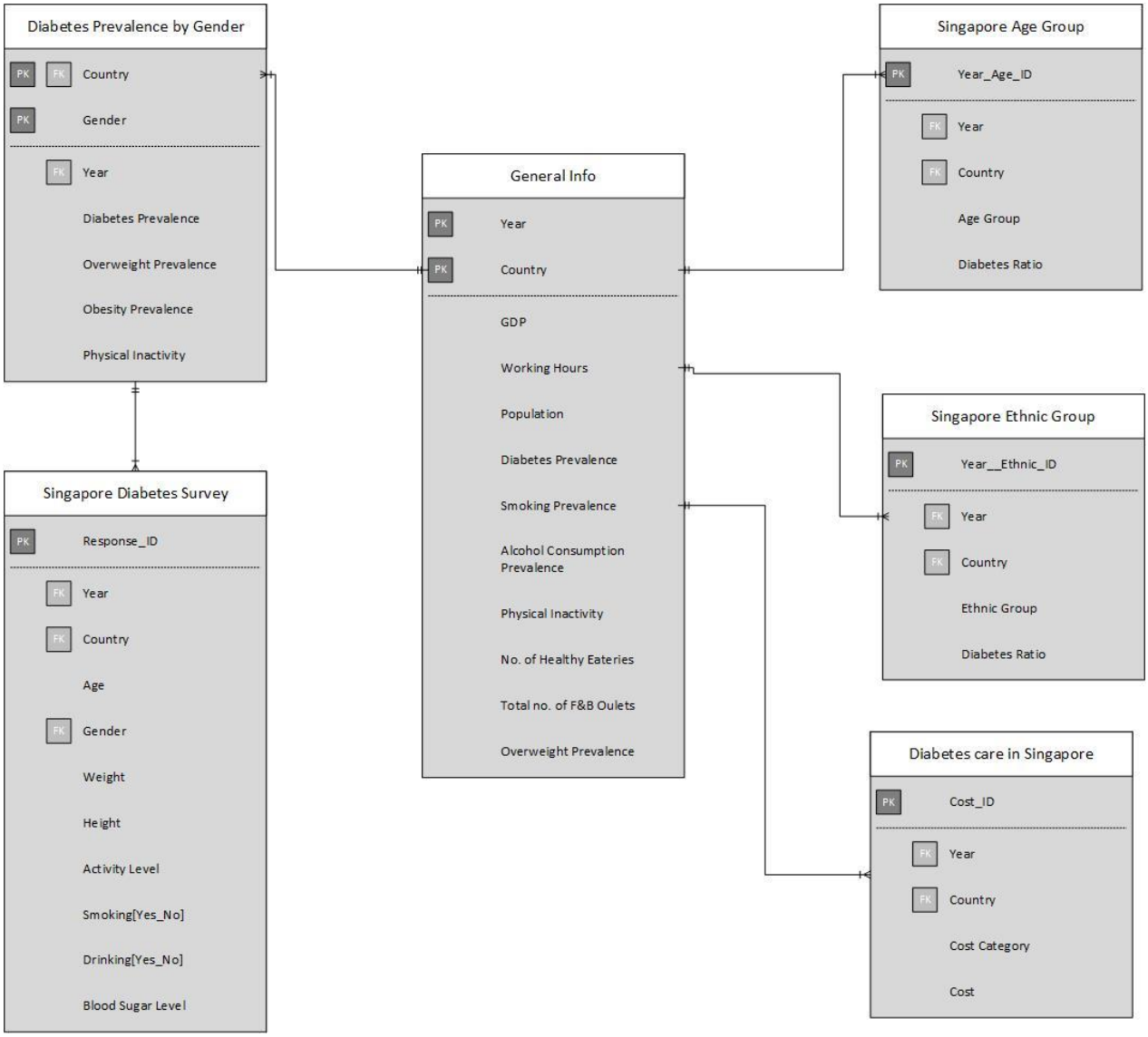
» **Understanding the trends in Singapore**
To identify trends of different factors that would contribute to diabetes, we searched through data.gov, worldbank.org and other various sources such as

smoking prevalence and alcohol consumption to identify the correlation between diabetic population and these factors.

» **Comparison with other countries**
From the world trends, we realized that prevalence of diabetes in Singapore is much more serious than other developed countries. In consideration of similarity in culture and lifestyle, we choose to find data for Japan and Korea for comparison with Singapore to understand which are the factors that makes the difference

» **Understanding the economic burden**
We found research done by National University of Singapore, National Healthcare Group and BMC Public Health on direct and indirect economic cost by diabetes to get a more complete understanding on various aspects of economic cost.

6.3 Data Modelling



Various factors of diabetes such as overweight prevalence, smoking prevalence are collected from World Health Organisation per country per year in the [General Info] table. It is linked to [Singapore Age Group], [Singapore Ethnic Group], [Diabetes care in Singapore] and [Diabetes Prevalence by Gender] table via one to many relationships.

[Singapore Age Group] shows the diabetes prevalence per age group per year in Singapore

[Singapore Ethnic Group] shows the diabetes prevalence per ethnic group per year in Singapore

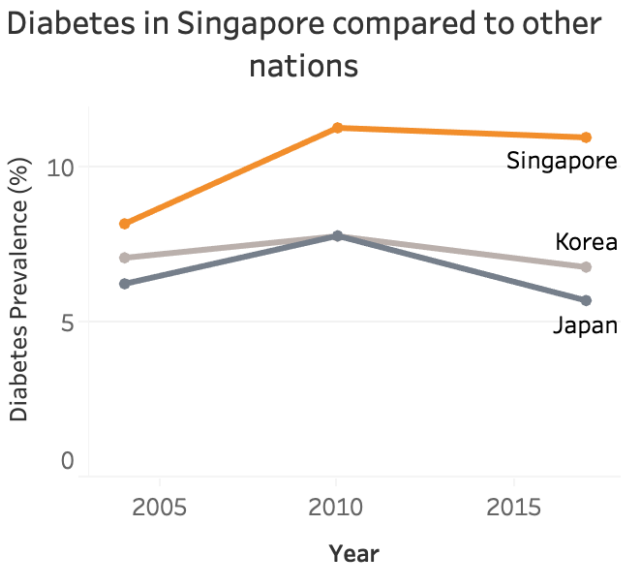
[Diabetes Care in Singapore] shows the average cost born by diabetic patient per year in Singapore

[Diabetes Prevalence in Singapore] shows the diabetes prevalence for each gender in Singapore

[Singapore Diabetes Survey] shows the result of a survey we conducted to find out the factors leading to diabetic condition

7. Dashboard Design

7.1 What is the standing of prevalence of diabetes in Singapore in comparison with other nations?

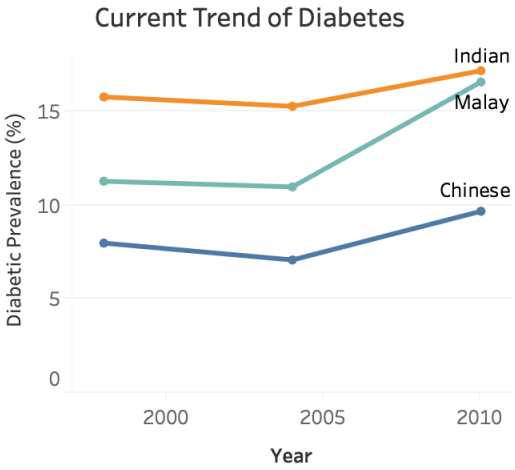


To answer this question, data from Japan and South Korea has been chosen for comparison with Singapore. This is because both countries are of similar income group and standard of living. From the diagram we can see that prevalence of diabetes in Singapore is much higher than these two countries despite the similarity in standard of living. This could due to the difference in lifestyle, such as eating habit and physical activities.

One thing that needs to be taken into consideration, although there is a slight decrease in diabetes prevalence of 0.41% from the 2010 to 2017, the increase in total population of Singapore has made the total number of diabetic patients increased. The number would reach 1 million by 2050 if the trends continues.

7.2 What is the current trend of diabetes in Singapore?

From the diagram we can see that the prevalence of diabetes is much higher in ethnic groups of Malays and Indians in comparison with Chinese. Possible underlying reasons may be difference in the staple food consumed, and genetic predisposition. One thing in common is that we see increase in diabetes patients year on year from 2004 to 2010 for all ethnic groups, albeit at a different rate for each group. No data partitioned by ethnic group after 2010 is available yet.

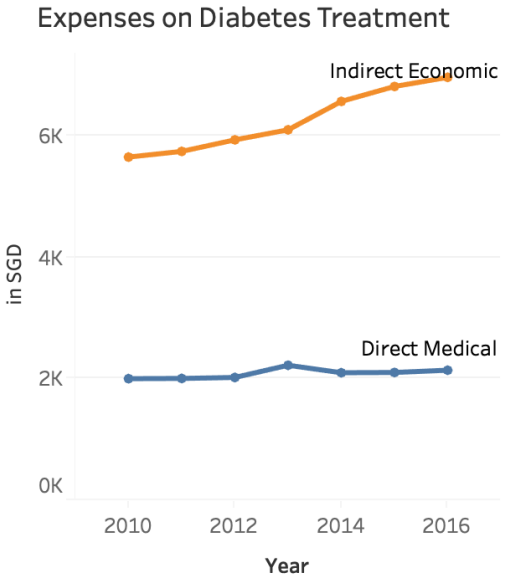


7.3 What are the main factors that lead to diabetes in Singapore?

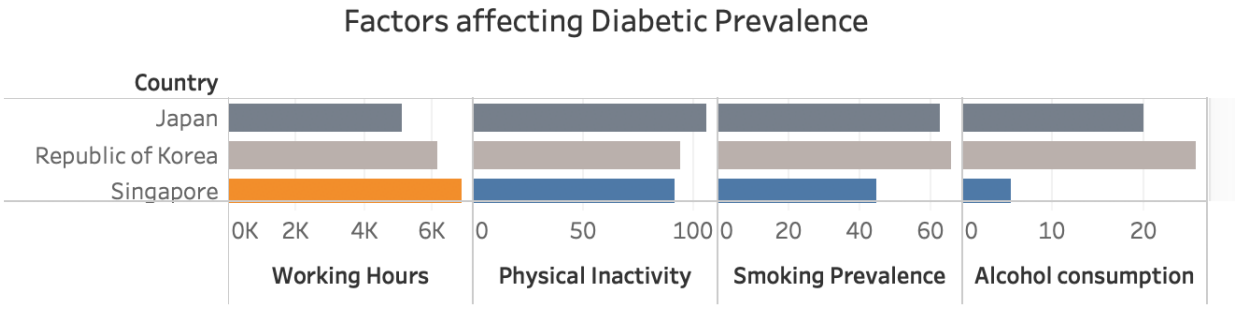
From the regression line based on survey data, where orange refers to female Singapore and blue refers to Male Singaporean, we found that higher weights and lower physical activity level are positively correlated to diabetes. This is true for both genders.

7.4 How much does it cost to live with diabetes?

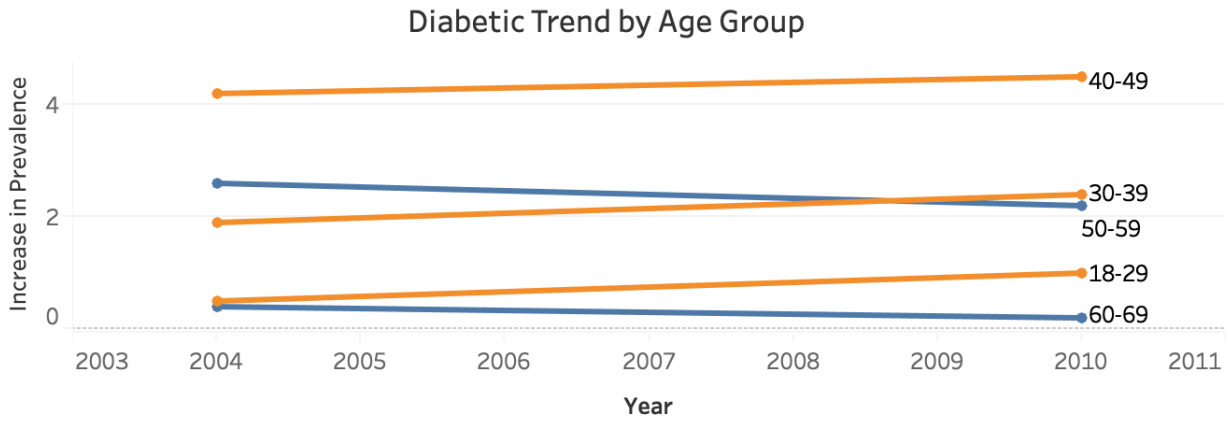
In 2010, total economic cost inclusive of direct medical course and indirect economic cost (because of loss of productivity) is 787 million. When averaged out across the total number of diabetic patient, the time trend shows an increase in cost for an average diabetic patient. It is notable that increase in indirect economic cost outpaced the increase in direct medical cost, and the former forms a larger bulk of the total cost.



7.5 How to tackle current situation to combat diabetes?



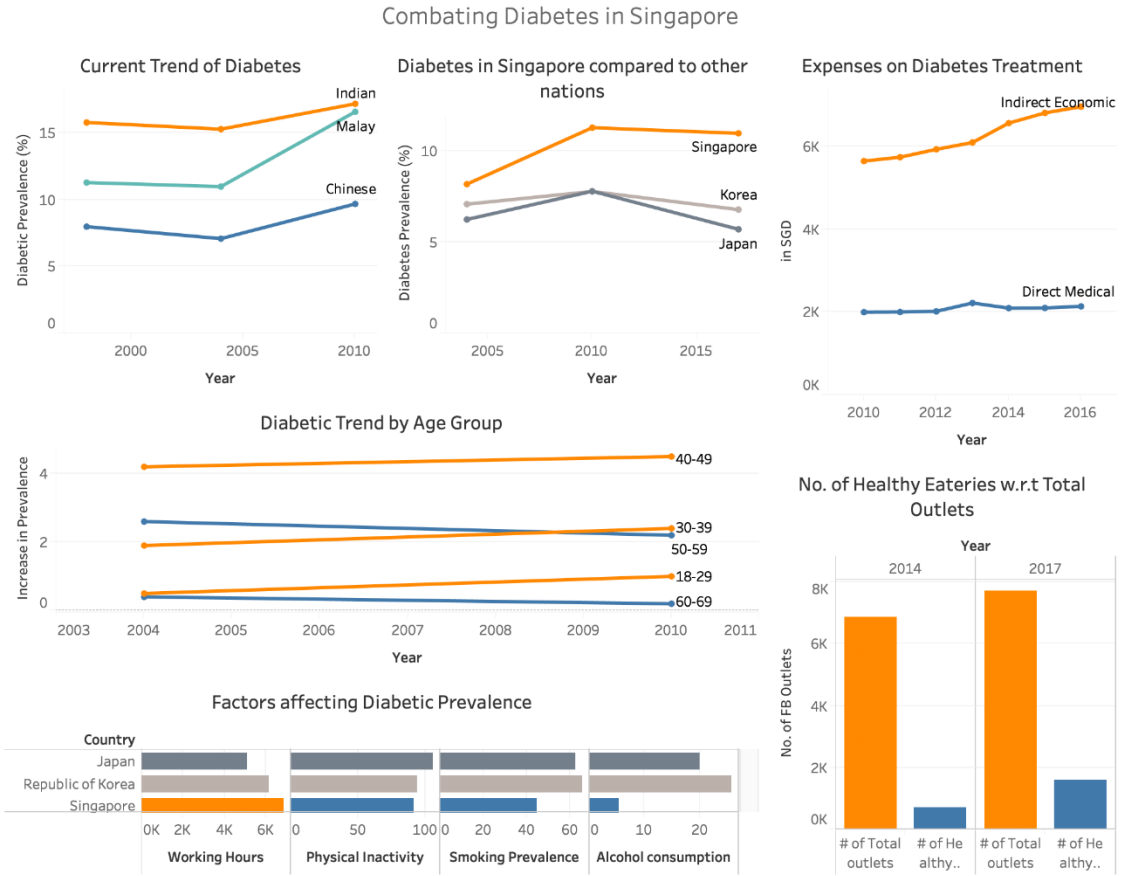
Among the 4 known factors that lead to diabetes: stress (related to long working hours), smoking, alcohol consumption and physical inactivity, Singapore has the longest working hours compared to Korea and Japan, while it has the lowest rate of physical inactivity, smoking prevalence and alcohol consumption. Hence, government should focus its effort on reducing working hours among the working adults.



As the diabetic patients are getting younger, the government needs to pay more attention on age groups from 20-49. Programmes to promote education on impact on diabetes, healthy dieting and importance of regular physical activities.

The indirect cost by inability to work and needs of caregivers is much higher than medical bills. This should not be neglected. Government should invest on providing aids to help patients to reduce the indirect cost such as providing free training for family caregivers.

8. Insights and Conclusion



- Diabetic patients are getting younger. The prevalence of diabetes in age group 20-49 is increasing.
- Prevalence of diabetes is more in ethnic groups of Malay and Indian, in comparison with Chinese.
- Singaporeans are working longer hours than their peers in Japan and Korea, and this is often related to stress, which in turn increases the risk of getting diabetes.
- Prevalence of diabetes is more among males than females
- Indict economic cost by inability to work and dependency on family caregivers is much more than medical bills

9. References and Tableau Public Link

- Tableau Public Link for Dashboard: https://public.tableau.com/profile/saurabh.senwal#!/vizhome/CombatingDiabetesinSingapore/Dashboard1?publish=yes
- Amazon Webservice Database Sever : myhealthdb.cq6ywlp9ixth.us-east-1.rds.amazonaws.com
- Username: saurabh
- Password: saurabh1234