

Diabetes

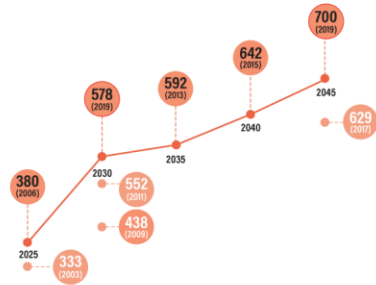
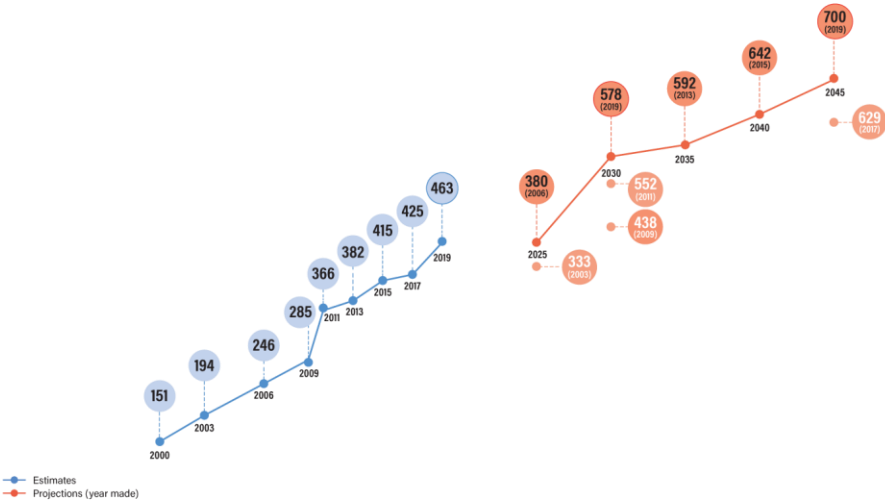
— 24 November 2020 —



PACIFIC LIFE RE

Overview

1. Diabetes as a global health concern



Millions
700
650
600
550
500
450
400
350
300
250
200
150
100
50
0

- **463** million diabetic adults in 2019 → projected¹ **700** million in 2045
- More than 60% contributed by Asia
- Projected numbers may increase due to improvements in screening

¹Projection based on urbanisation rate by the International Diabetes Federation

Overview

1. Diabetes as a global health concern

2. Drivers behind the rise in prevalence

- Aging population, increasing urbanisation, diets and physical activity
- Improved survival of diabetic patients

Takeaways from this session:

- ✓ **Diabetes and Obesity**
- ✓ **Future incidence trends**

Overview

1. Diabetes as a global health concern

2. Drivers behind the rise in prevalence

3. Economic Burden

- Treatment and related complications currently contribute 12% to the total global expenditure
- Impaired segment growing and underserved

Takeaways from this session:

- ✓ **Related complications & relative risks**
- ✓ **Insurance market & product design**

Overview

1. Diabetes as a global health concern

2. Drivers behind the rise in prevalence

3. Economic Burden

4. Increasing health expenditure leading to increased awareness

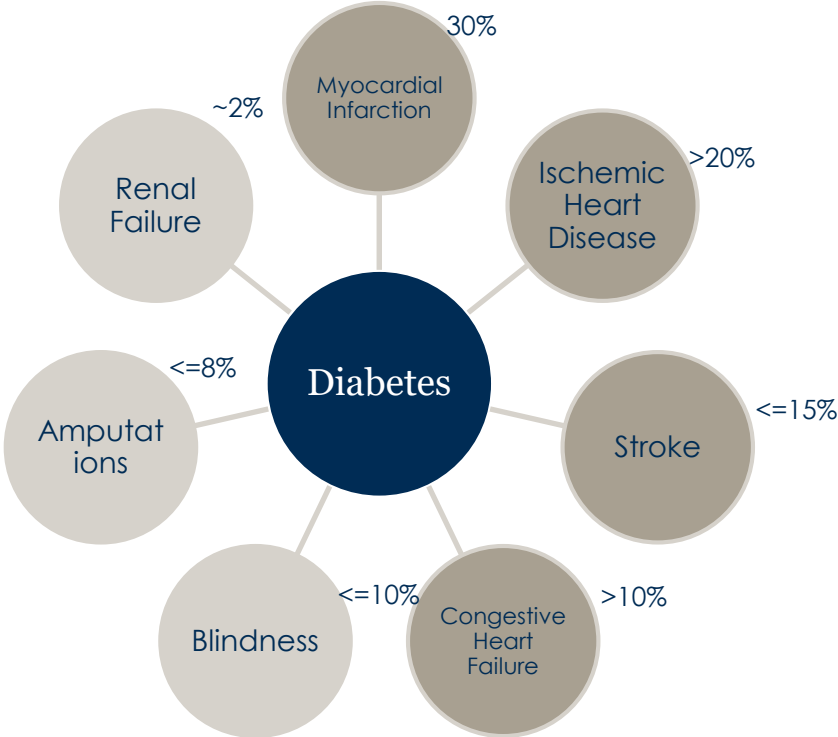
- Discovery of new methods and tools to manage this disease

Takeaways from this session:

- ✓ **AI as a management tool & implications on future trends**

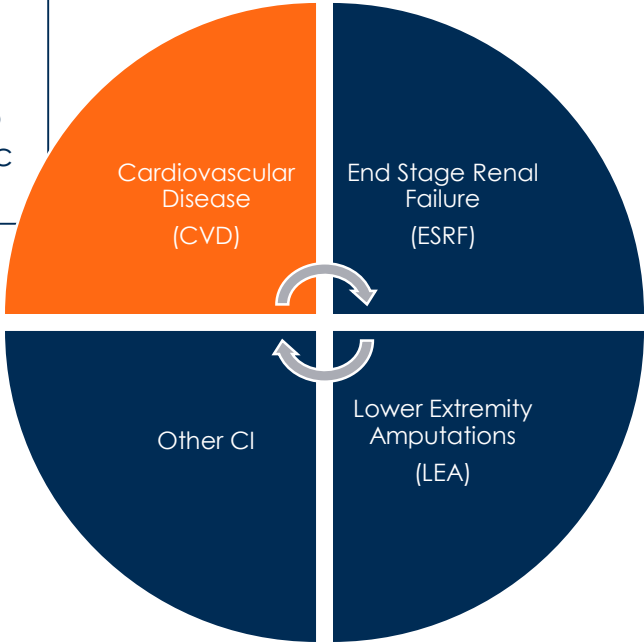
Co-morbidities Associated with Diabetes

First complication and prevalence based on 25 years of follow-up data

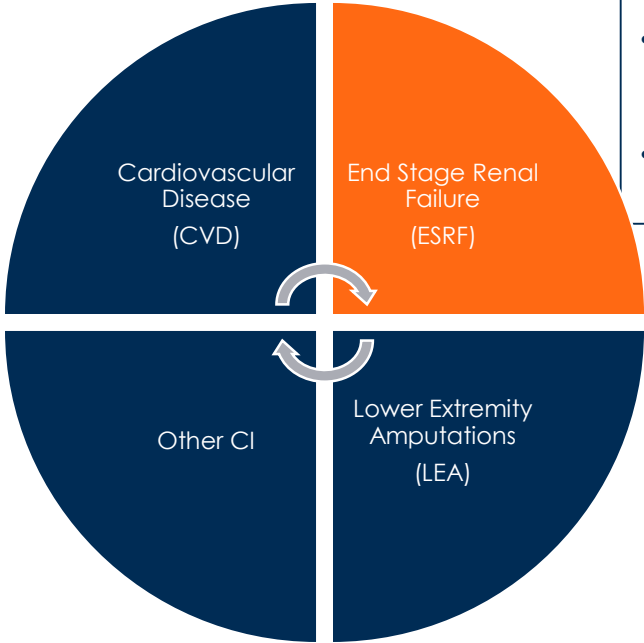


Relative Risk of Diabetic Complications

- Includes heart attack, stroke, all other diseases of the heart and circulation
- Direct / indirect association
- 2-4 times more likely to develop CVD compared to non-diabetic individuals

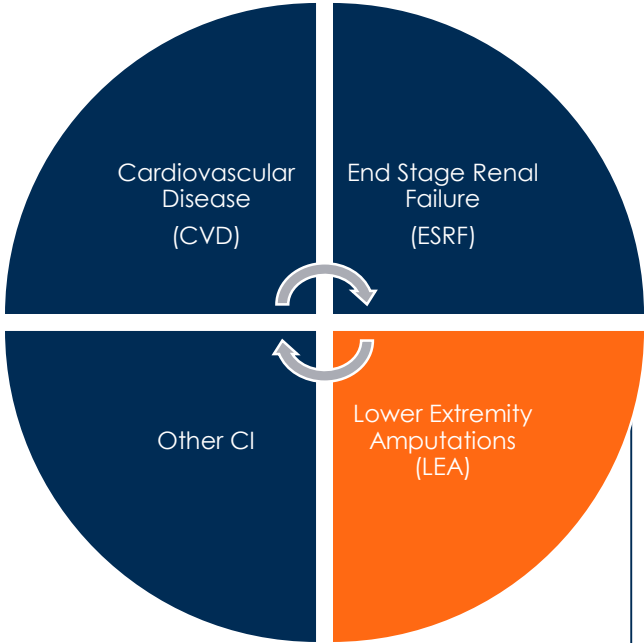


Relative Risk of Diabetic Complications



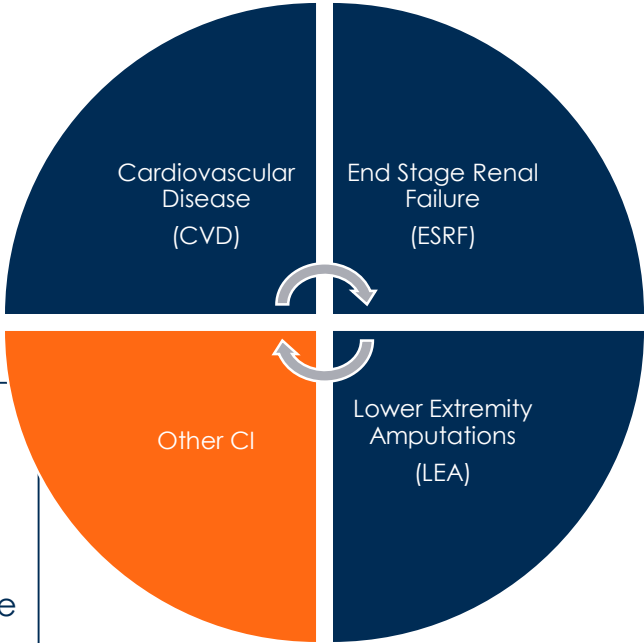
- Relative risk of ESRF in diabetic patients 1.5 times higher
- Highest incidence rates seen on average 10-20 years after diabetes diagnosis
- Mean age ~60 years, highest incidence rates 65-74 years

Relative Risk of Diabetic Complications



- 10 times higher in patients with diabetes than those without
- ~4% for patients with diabetes
- Highest incidence rates of LEAs among older patients, significant for age >75
- Twofold increased incidence rate for men

Relative Risk of Diabetic Complications



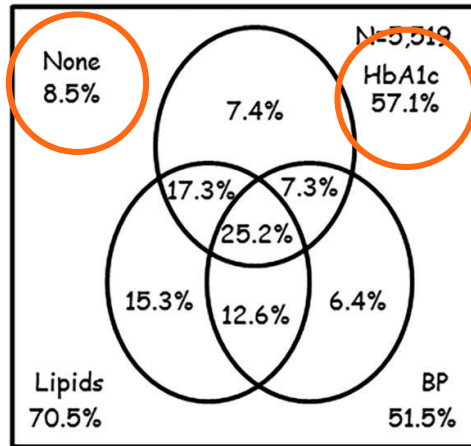
- Cancer
- Blindness
- Others
 - Depression
 - Dementia
 - Effect of drugs among Type 2 Diabetics

Obesity as a major driver of the Type 2 Diabetes epidemic

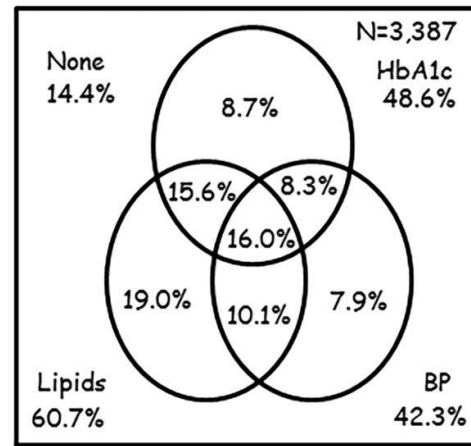
- Established link between Obesity and Type 2 diabetes
- Obesity and insulin resistance
- Diabetes becomes inevitable if insulin resistance is accompanied by the failure of pancreatic beta cells

Effect of Obesity on Diabetes Control

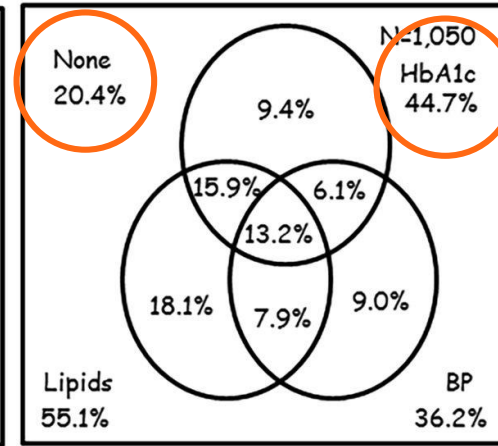
A BMI <25



B BMI 25- <30



C BMI ≥30



HbA1c

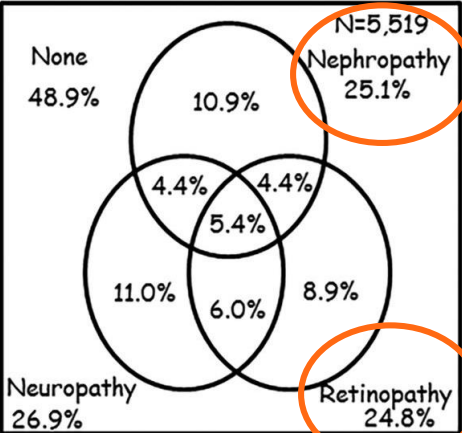
- Glycated haemoglobin which provides an indication of average blood sugar levels over a period of weeks/months
- Differs from **blood glucose level** which measures the concentration of glucose in the blood at a single point in time

Target achievements set by this study

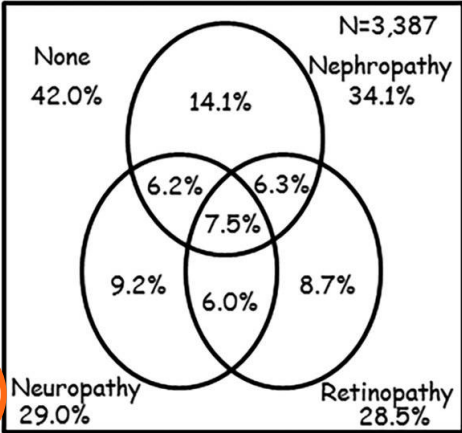
- HbA1c value of <7.0%
- BP <130/80 mm Hg
- LDL cholesterol <3.1 mmol/L, HDL cholesterol ≥1.0 mmol/L and non-HDL cholesterol <3.8 mmol/L

Effect of Obesity on Diabetic Complications

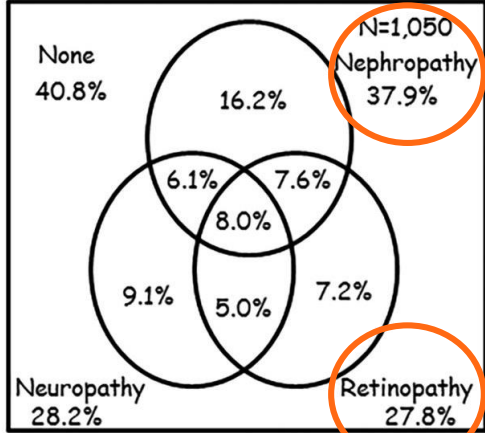
D BMI <25



E BMI 25- <30



F BMI ≥30



Nephropathy: Kidney related complication of diabetes
Retinopathy: Eye related complication of diabetes stemming from damage to the retina of the eyes
Neuropathy: damage or dysfunction of one or more nerves

Applicability to Insurers

- Consider country adjustment for application to Singapore context
- Population based statistics
- Consider Type 1 and 2 diabetes separately
- Age-gender specific loading by complication
- Future trend considerations
- Underwriting
- Risk of diabetic complications should not be viewed independently

The current insurance market for diabetics

Diabetics are typically declined for CI products

Two types of products currently available to diabetics

Generic CI

- Accepts diabetics (higher premiums)
- Less specific cover for diabetic complications & CI

Diabetes-specific

- Diabetic complications
- Diabetes-related CI
- Medical expenses

Product features

- Typical criteria: up to age 85, non-smoker, HbA1c \leq 8-10%, BMI?
- Integrated services to help diabetes management
- Underwriting
 - Simplified issue
 - We believe medical reports should form part of the underwriting process
 - UK study showed self-reporting to be unreliable

Sales volumes

However, there have been low sales volumes for both types of products

Generic CI

- High premiums
- Non-diabetics can get cheaper rates elsewhere
- Correlation between diabetes and lower socio-economic groups

Diabetes-specific

- High premiums
- Denial about complications
- Idea of “paying more for less”

Strict underwriting criteria -> most declined?

Future trend of diabetes

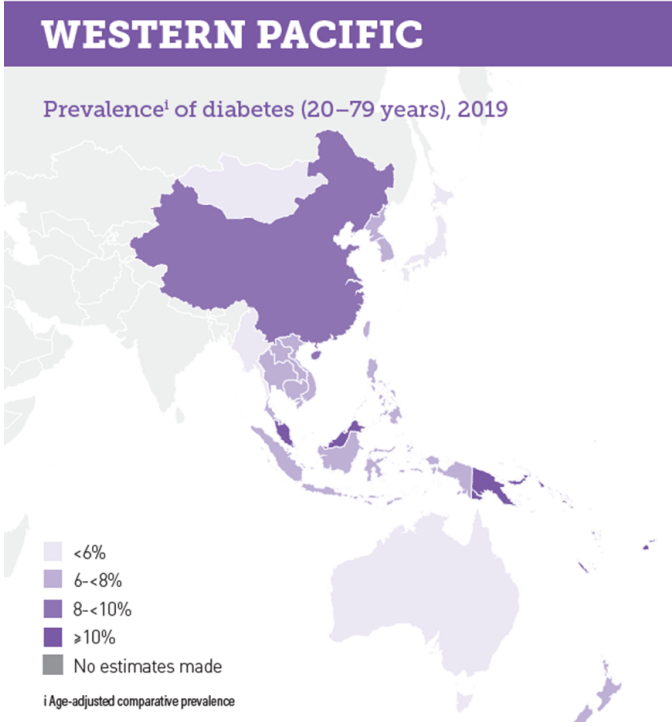
Different ways of looking at this:

- Projecting diabetes prevalence using urbanisation rate (Diabetes Atlas)
- Projecting diabetes prevalence using risk factors (Saw Swee Hock School of Public Health)
- Looking at diabetes incidence rather than prevalence (BMJ)

Prediction is very difficult, especially if it's about the future.
— Nils Bohr, Nobel laureate in Physics

Projections using urbanisation rate

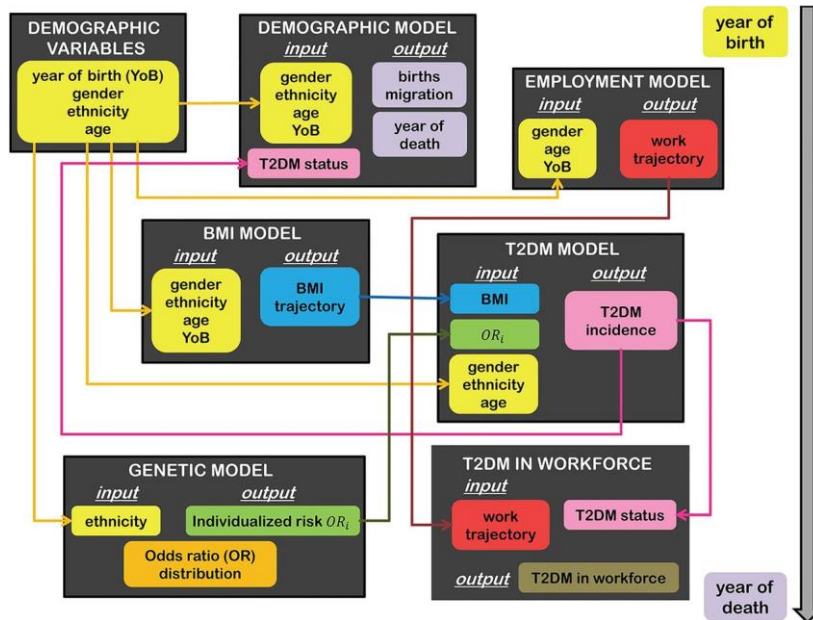
Projections from IDF Diabetes Atlas



- Diabetes prevalence will rise from 11.4% (2019) to 12.4% by 2030 and 12.8% by 2045
- Projections based on expected changes in population age structure and urbanisation rate
- Does not allow for changes in risk factors
- Age-specific diabetes prevalence assumed to be stable
- Likely to underestimate diabetes prevalence

Projections using risk factors

Projection model from Saw Swee Hock School of Public Health



- Diabetes prevalence among Singapore adults will double from 7.3% in 1990 to 15% in 2050
- Sub-models projecting risk factors such as ageing, BMI and genetic risk
- Age-specific diabetes prevalence changes over time due to expected increase in obesity levels
- Future development to include sub-model of interventions e.g. healthy eating or active lifestyle programmes

Looking at diabetes incidence

Systematic review of diabetes incidence studies (BMJ)

- Growing prevalence = increasing risk?
- Growing prevalence partly reflects better survival of diabetics
- Think about incidence rates instead – incidence is only affected by risk of the population and amount of screening
- Since 2005, diabetes incidence has been falling or stable in 2/3 of populations studied including Switzerland, Canada, UK, Hong Kong & Korea
- Some cause to be optimistic for high-income countries
- However:
 - More studies needed
 - Data focus on high-income countries
 - Undiagnosed cases: 1 in 2 in Western Pacific region and Singapore, 1 in 5 in the UK

Developments in AI and technology

Systematic review of literature on AI & diabetes

- Around 80% of health data is unstructured
- A need for more engaging care and personalised medicine to improve adherence
- Many AI developments will help to better prevent, diagnose and manage diabetes and diabetic complications

Fun fact: each person will generate more than 1 million gigabytes of health-related data in their lifetime (equivalent to 300 million books)

Examples

Detection & prevention

- Algorithms to assess diabetes risk
- Identify proteins and genes associated with diabetes
- Diagnose diabetes using facial and tongue features
- Models to predict CHD (>70%) and kidney disease (>70%)
- Automated retinal screening (>90%) e.g. IDx-DR

Examples

Management

- Smartphone apps
- Continuous glucose monitors (CGMs)
- Artificial pancreas

Impact of AI

On future trend

- Improved detection and screening programmes will lead to increase in diabetes incidence
- On the other hand, better detection at the pre-diabetes stage will boost prevention strategies
- Better management of conditions will reduce morbidity/mortality rates in future

On product development

- Improving the quantity and richness of data on diabetes -> better pricing
- Anticipate a decline in diabetes-specific products
- Anticipate a rise in generic CI products that accept diabetics

Conclusion

- **Diabetes and obesity continue to be global health concerns**
- **Diabetics have increased risk of CI and thus have difficulty getting insurance**
- **Protection gap not likely to be resolved in the short-term due to high premiums and strict underwriting criteria**
- **Diabetes incidence will continue to rise in the short-term but may stabilise in the long-term**
- **New solutions help diabetics to manage their condition better and reduce their level of risk**
- **End goal: reduce risk enough so that they can access generic CI products at more affordable and competitive terms**

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Note: Numbers refer to slide numbers

Contact

For more information, please contact:

Cindy Gwee

R&D Actuary

Pacific Life Re | Asia

T: +65 6311 5334

E: Cindy.Gwee@PacificLifere.com

W: www.pacificlifere.com

Kirstie Mok

R&D Actuary

Pacific Life Re | Asia

T: +65 6311 5347

E: Kirstie.Mok@PacificLifere.com

W: www.pacificlifere.com