Lessons from a deep Morbidity Database

ICLAM 2016

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Disclaimer

RISK-CONSULTING Prof. Dr. Weyer GmbH is a commercial company offering analytical services, consulting and systems.

RISK-CONSULTING has developed, in collaboration with leading European insurers, one of the the largest databases of health insurance claims worldwide.

Knowledge from this database is offered as a commercial service.

This data is also the basis for evidence-based underwriting systems for health, life and disability insurance.

RISK-CONSULTING Morbidity Database

Over 10% of Germans opt out of the government health system and **have full private health insurance.** (9 million persons).

The private health insurers in Germany receive **full**, **individual claims data,** and can store it for an unlimited duration.

50% of the market **pools its data with RISK-CONSULTING**, some since 1992.

The RISK-CONSULTING data-base contains:

> 400 million contract-years of data

> 20 years of continuous medical histories

> 900 million medical claims

Example: High blood pressure

3 million cases with **14 observation years** per case on average

Example: Diabetes Mellitus (Type 2)

150,000 cases with **14 observation years** per case on average

Detailed data for each person and claim

Personal data (anonimized)
Customer number
Year of Birth
Gender
Occupation
Employment status
Region
Height
Weight
Missing and replaced teeth
Diopters left and right
Preexisting conditions 1 - n: Disease code (ICD)
Preexisting conditions 1 - n: Disease description
Preexisting conditions 1 - n:Treatment begin
Preexisting conditions 1 - n: Treatment end
Preexisting conditions 1 - n: In-patient treatment yes/no

Claims data (anonimized)
Plan name and type
Claim type (in-patient, out-patient, dental, etc.)
Benefit type (treatment, medication, aid, ...)
Treatment begin
Treatment end
Disease code (ICD-10)
Disease name
Accident yes/no
Prevention yes/no
Practitioner type (specialisation)
Date of invoice
Amount of invoice
Number of days disabled/hospitalised
Number of psychotherapy sessions
Transport costs

What can we learn from the data?

Future risk profile for each medical condition

Causal relationships <u>and correlations</u> between medical conditions

Interactions between conditions

Most important cost drivers per product type

Frequency and cost for each disease

Trends in morbidity and cost

Accurate risk predictions for applicants and insureds

Effectiveness of exclusions

How correct are my underwriting rules today ?

Cost drivers depend strongly on age, gender and product type

Medical expenses insurance
Out-patient costs, men, Germany

No.	Age 20-29	Age 30-34	Age 35-39	Age 40-44	Age 45-49	Age 50-54	Age 55+
1.	Spinal column / skeleton	Spinal column / skeleton	Spinal column / skeleton	Spinal column / skeleton	Spinal column / skeleton	Spinal column / skeleton	Spinal column / skeleton
2.	Spectacles	Spectacles	Psychological / nerves	Spectacles	Spectacles	Spectacles	Heart / circulation
3.	Respiratory tract	Respiratory tract	Spectacles	Psychological / nerves	Psychological / nerves	Psychological / nerves	Spectacles
4.	Fractures / luxations	Fractures / luxations	Respiratory tract	Respiratory tract	Respiratory tract	Heart / circulation	Glands / metabolism
5.	Psychological / nerves	Psychological / nerves	Fractures / luxations	Fractures / luxations	Glands / metabolism	Glands / metabolism	Cancer
6.	Skin / con. tissue	Urology	Urology	Urology	Fractures / luxations	Respiratory tract	Sensory organs
7.	Prevention	Prevention	Prevention	Prevention	Urology	Digestive system	Urology

Medical expenses insurance
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No.	Age 20-29	Age 30-34	Age 35-39	Age 40-44	Age 45-49	Age 50-54	Age 55+
1.	Fractures / luxations	Fractures / luxations	Fractures / luxations	Spinal column / skeleton	Heart / circulation	Heart / circulation	Heart / circulation
2.	Spinal column / skeleton	Spinal column / skeleton	Spinal column / skeleton	Psychological / nerves	Spinal column / skeleton	Cancer	Cancer
3.	Psychological / nerves	Psychological / nerves	Psychological / nerves	Fractures / luxations	Psychological / nerves	Spinal column / skeleton	Spinal column / skeleton
4.	Digestive system	Digestive system	Digestive system	Heart / circulation	Fractures / luxations	Psychological / nerves	Digestive system
5.	Respiratory tract	Respiratory tract	Respiratory tract	Digestive system	Cancer	Digestive system	Psychological / nerves
6.	Cancer	Cancer	Cancer	Cancer	Digestive system	Fractures / luxations	Glands / metabolism
7.	Skin / con. tissue	Skin / con. tissue	Heart / circulation	Respiratory tract	Respiratory tract	Glands / metabolism	Fractures / luxations

Changes in Morbidity over time
Psychological issues and spinal problems increasing

**Medical expenses insurance
In-patient costs, men, Germany**

10 years →

**Medical expenses insurance
In-patient costs, men, Germany**

No.	Age 20-29	Age 30-34	Age 35-39	Age 40-44	Age 45-49	Age 50-54	Age 55+
1.	Fractures / luxations	Fractures / luxations	Fractures / luxations	Heart / circulation	Heart / circulation	Heart / circulation	Heart / circulation
2.	Cancer	Digestive system	Digestive system	Digestive system	Digestive system	Digestive system	Digestive system
3.	Digestive system	Respiratory tract	Heart / circulation	Fractures / luxations	Spinal column / skeleton	Spinal column / skeleton	Cancer
4.	Spinal column / skeleton	Spinal column / skeleton	Spinal column / skeleton	Spinal column / skeleton	Fractures / luxations	Cancer	Spinal column / skeleton
5.	Respiratory tract	Heart / circulation	Cancer	Respiratory tract	Cancer	Fractures / luxations	Respiratory tract
6.	Wounds / Trauma	Psychological / nerves	Psychological / nerves	Psychological / nerves	Respiratory tract	Respiratory tract	Fractures / luxations
7.	Psychological / nerves	Infections	Respiratory tract	Infections	Psychological / nerves	Psychological / nerves	Veneral diseases

No.	Age 20-29	Age 30-34	Age 35-39	Age 40-44	Age 45-49	Age 50-54	Age 55+
1.	Fractures / luxations	Fractures / luxations	Fractures / luxations	Spinal column / skeleton	Heart / circulation	Heart / circulation	Heart / circulation
2.	Spinal column / skeleton	Spinal column / skeleton	Spinal column / skeleton	Psychological / nerves	Spinal column / skeleton	Cancer	Cancer
3.	Psychological / nerves	Psychological / nerves	Psychological / nerves	Fractures / luxations	Psychological / nerves	Spinal column / skeleton	Spinal column / skeleton
4.	Digestive system	Digestive system	Digestive system	Heart / circulation	Fractures / luxations	Psychological / nerves	Digestive system
5.	Respiratory tract	Respiratory tract	Respiratory tract	Digestive system	Cancer	Digestive system	Psychological / nerves
6.	Cancer	Cancer	Cancer	Cancer	Digestive system	Fractures / luxations	Glands / metabolism
7.	Skin / con. tissue	Skin / con. tissue	Heart / circulation	Respiratory tract	Respiratory tract	Glands / metabolism	Fractures / luxations

Hidden danger for insurers
Medical expenses for policy holders with recent haemorrhoids (out-patient)

| Index year	Following 3 years			
Benefits for haemorrhoids	Cases of treatment per person and year	Rate of illness haemorrhoids per person and year	Benefits total [€ / year]	Benefits haemorrhoids [€ / year]
Men no	3.2	2%	425	3
Men yes	8.4	51%	1075	60
Women no	6.4	2%	775	3
Women yes	13.1	25%	1625	25

Claims costs increase after Diabetes diagnosis
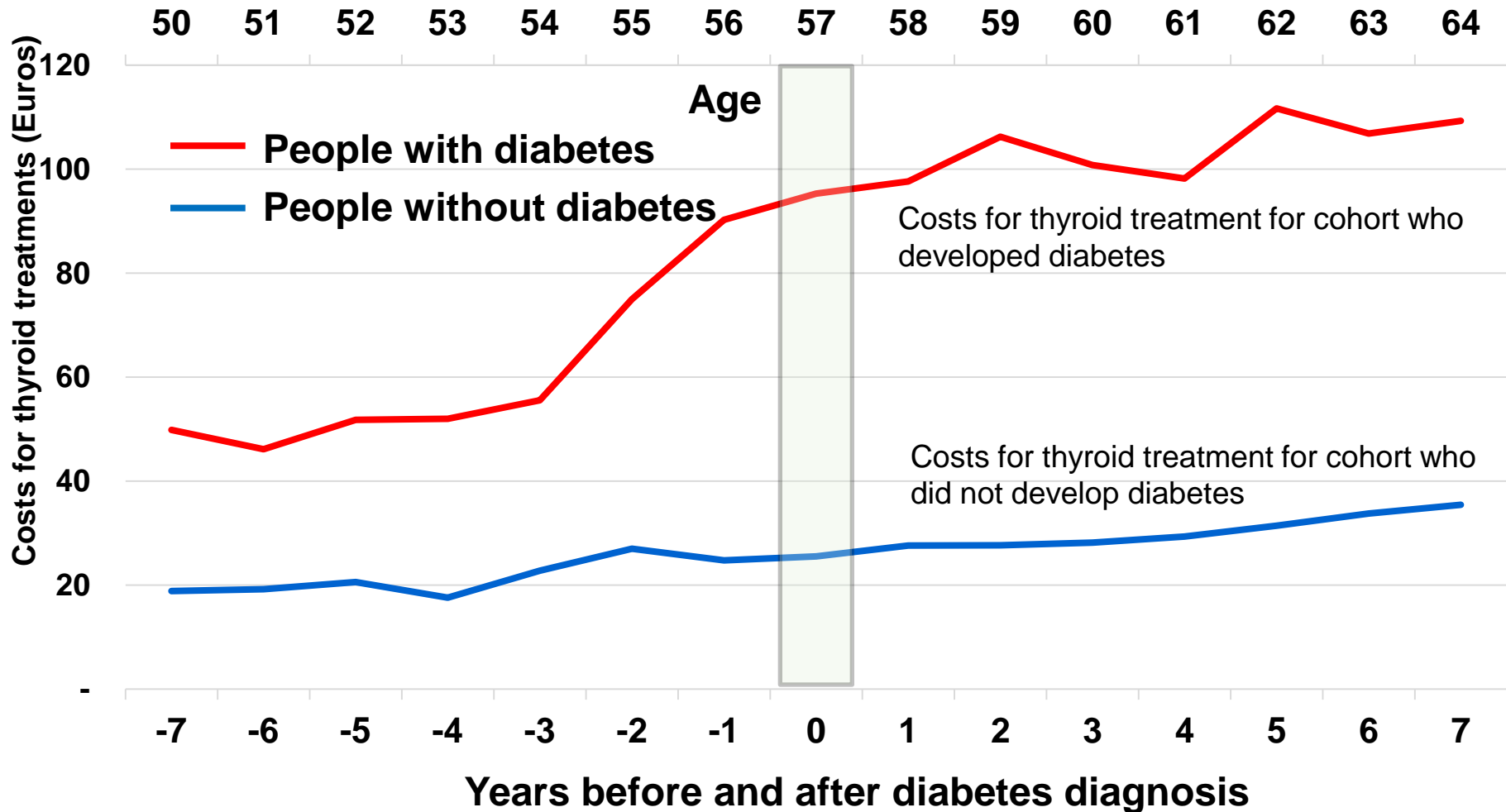
(Germany, full health insurance)

Costs already **7 years before Diagnosis** significantly higher
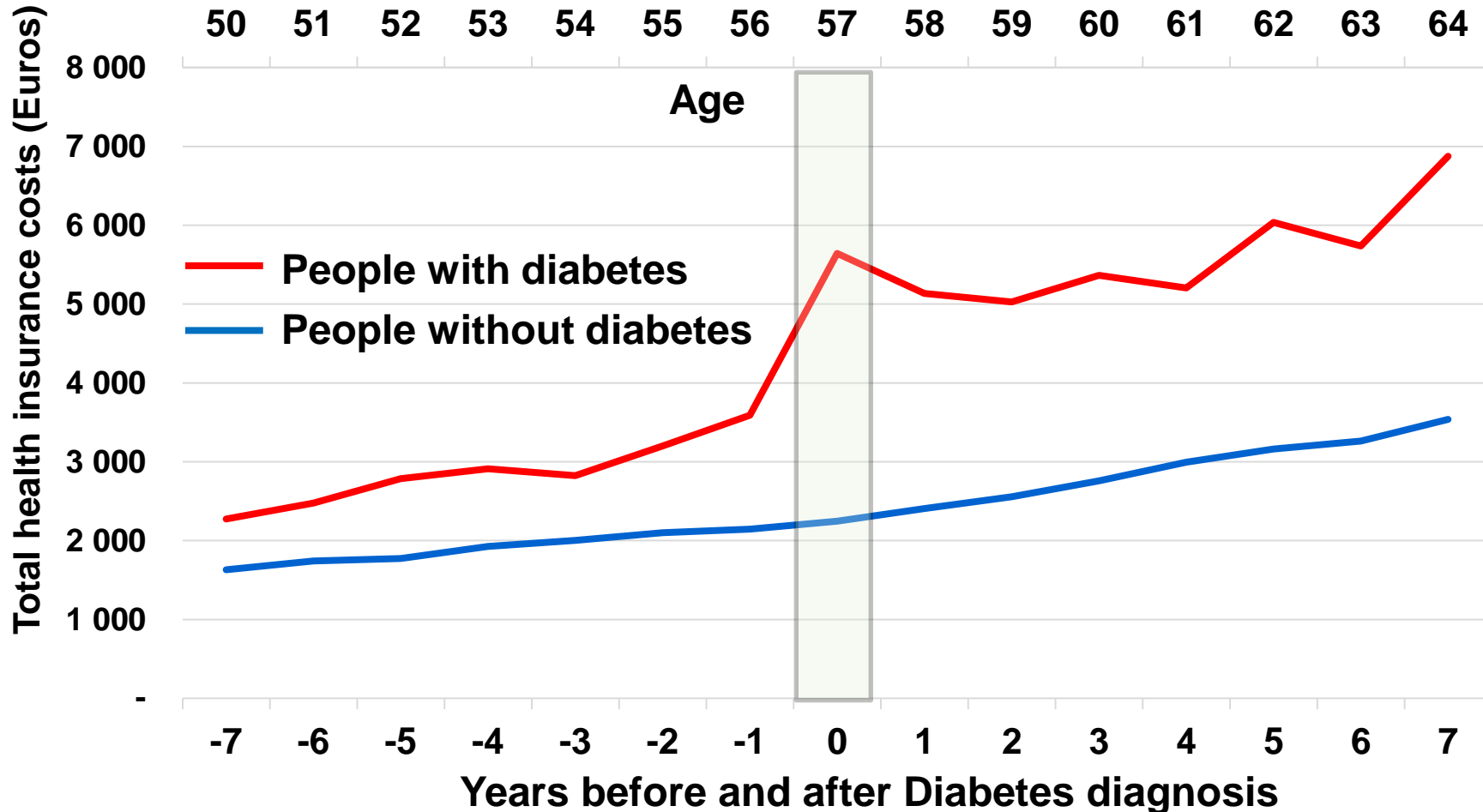
Higher costs for thyroid dysfunction indicate diabetes 7 years before it is diagnosed

Strong increase 2 years before diabetes is diagnosed

Big data and diabetes

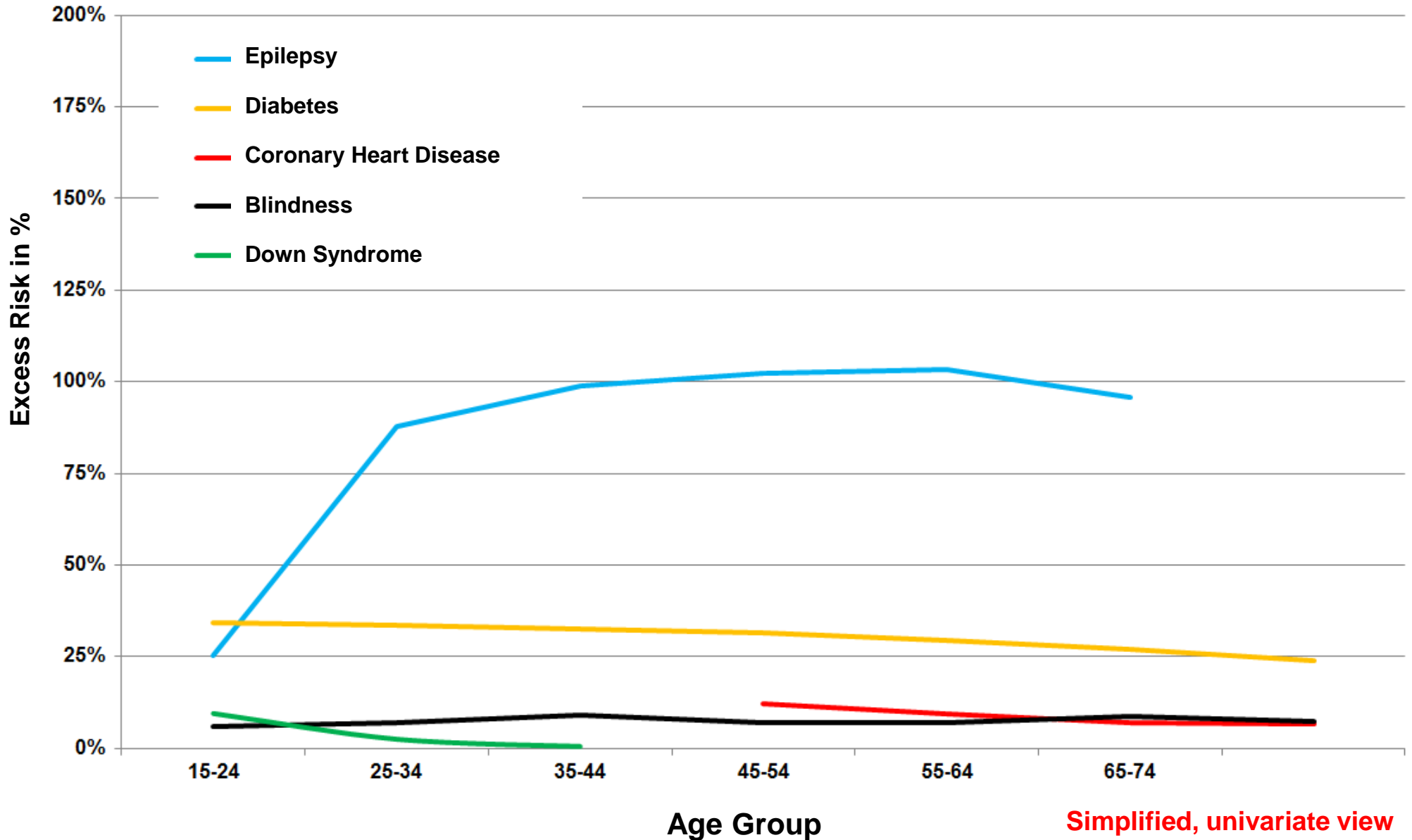**Increased diabetes risk is evident over 7 years** before it is diagnosed

Strong indicators are:

- high BMI (32+)
- thyroid disorders
- high blood pressure
- coronary artery disease
- and several other disease categories

Using a large database, a model to predict the risk of future serious disease can be developed. This has uses for:

- disease management
- underwriting
- cross- / up-selling

Health Insurance data allows accurate risk assessment for Personal Accident Insurance

Excess Risk in %

- **Epilepsy**
- **Diabetes**
- **Coronary Heart Disease**
- **Blindness**
- **Down Syndrome**

Age Group

Simplified, univariate view

200%
175%
150%
125%
100%
75%
50%
25%
0%

15-24   25-34   35-44   45-54   55-64   65-74

Personal Accident: Significant potential to improve Underwriting

Underwriting often driven by simple rules: e.g. Persons with disabilities or ongoing medical treatments are declined.

Many injustices through lack of data. Examples:

Condition	Typical decision	Real excess risk
Down syndrome	Reject	~ 0%
Coronary Heart Disease	Reject	~ 10%
Blindness	Reject	~ 10%
Diabetes (w/o complications)	Reject	~ 30%
Epilepsy	Reject	~ 100%

"Evidence-based" underwriting vs "Opinion-based" underwriting"

Evidence-based underwriting brings many advantages:

- ➢ Better decisions improve portfolio quality and profitability
- ➢ Each applicant is offered the "right premium"
- ➢ Automation and Digitalisation of the application process saves time and money
- ➢ Instant decisions at the Point-of-Sale increases uptake

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