Disease-free life expectancy: Sullivan versus Multi-state revisited

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Context (1)

- RIVM Chronic Diseases Model (CDM):

Dynamic population model:

- start: current population
- Applies disease incidences / mortalities
- dependent on risk factors

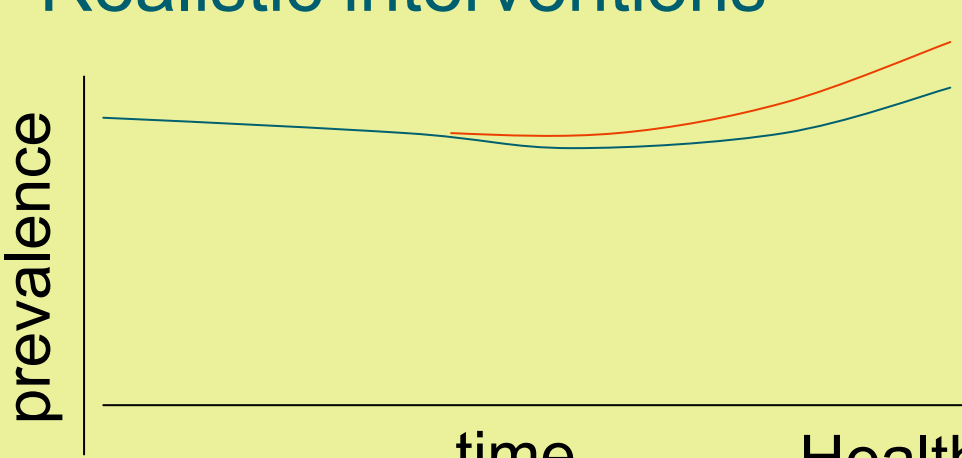
And projects into the future

Context (2)

Classical use of RIVM-CDM:

compare interventions;

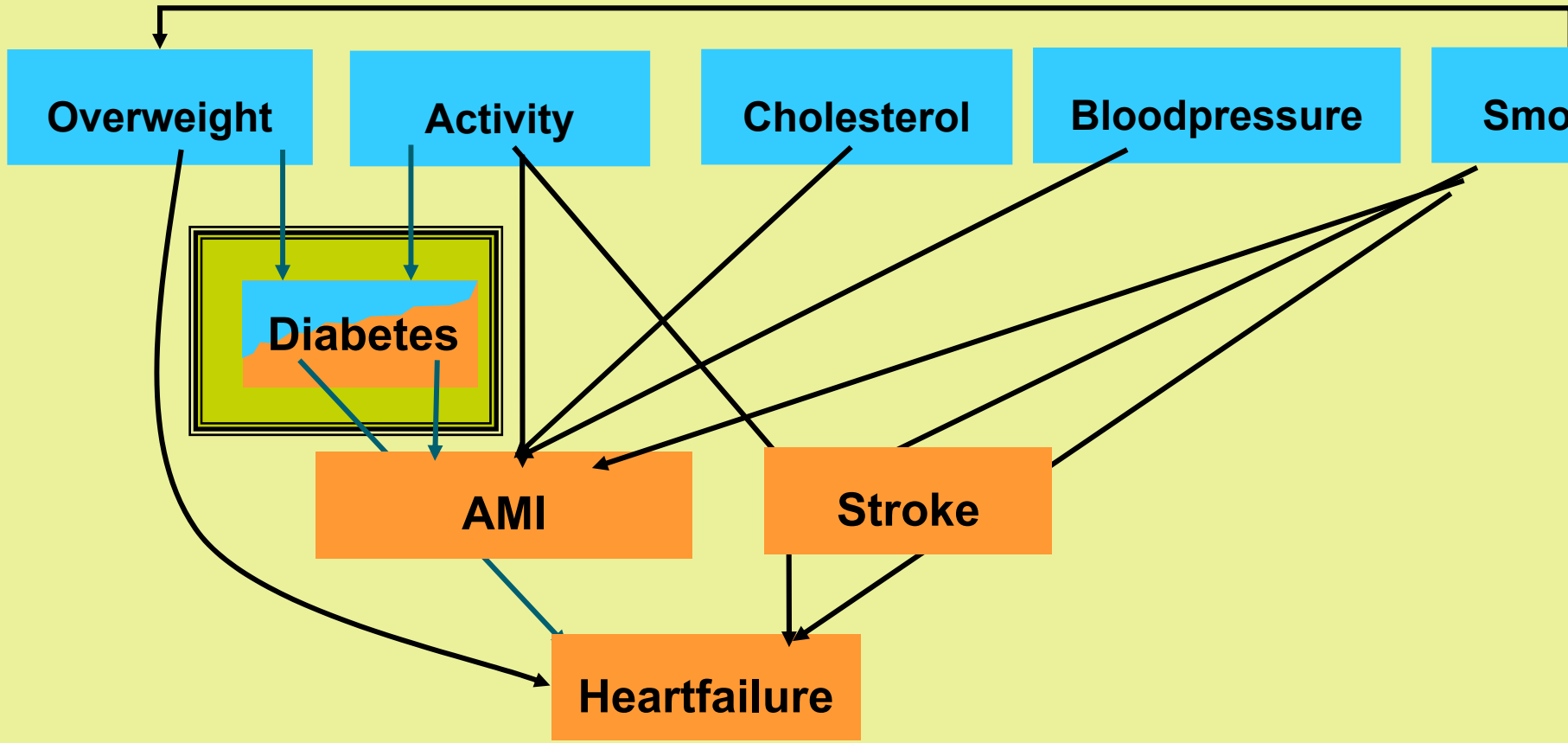
- Theoretical (burden due to smoking)
- Realistic interventions



Healthy life expectancy
(multi-state from current situation)

In 2005: used for projections → data on diseases are more critical

RIVM Chronic disease model: life expectancy free of diabetes multi-state, compared with Sullivan

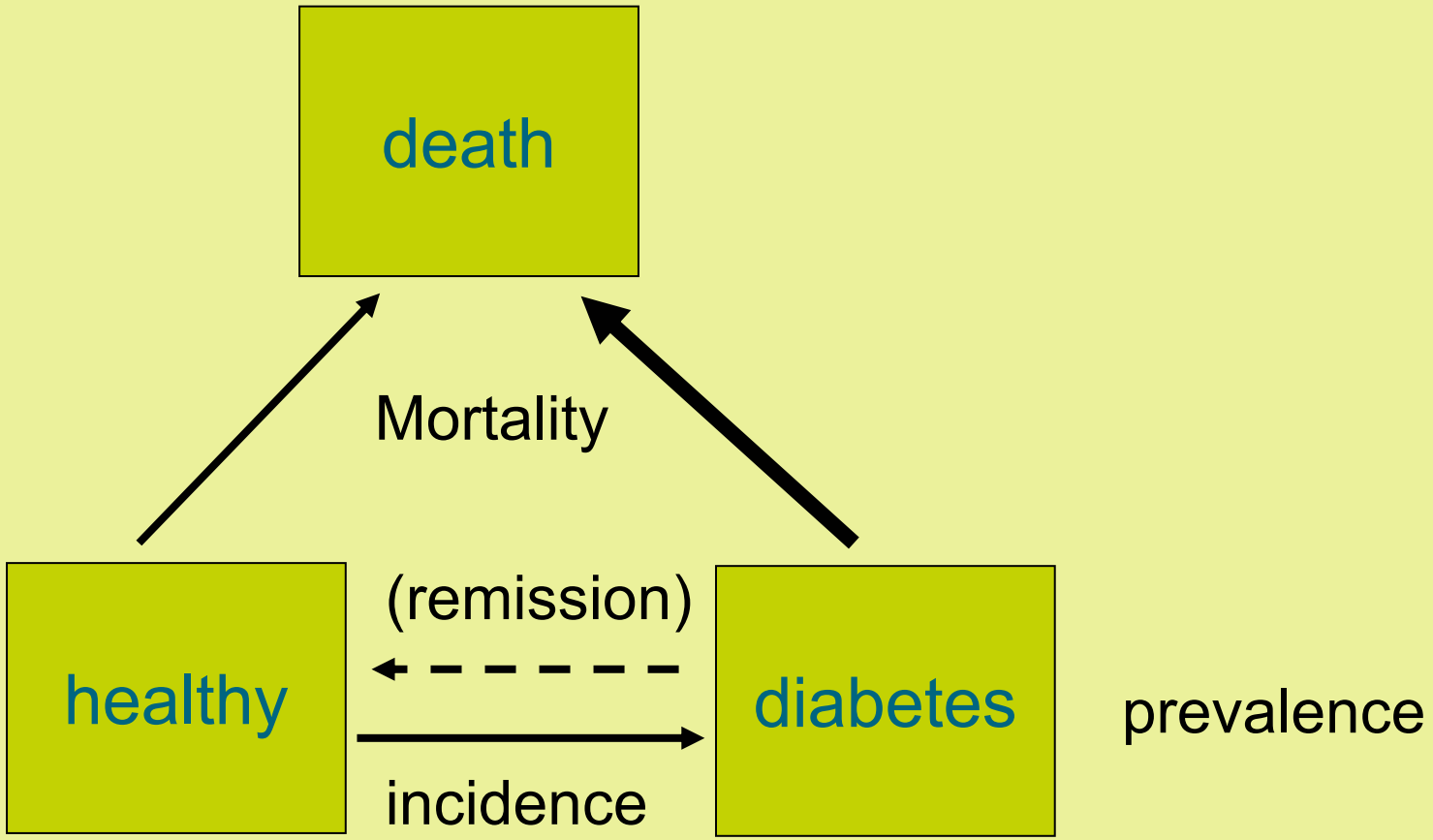


Multi-state versus Sullivan

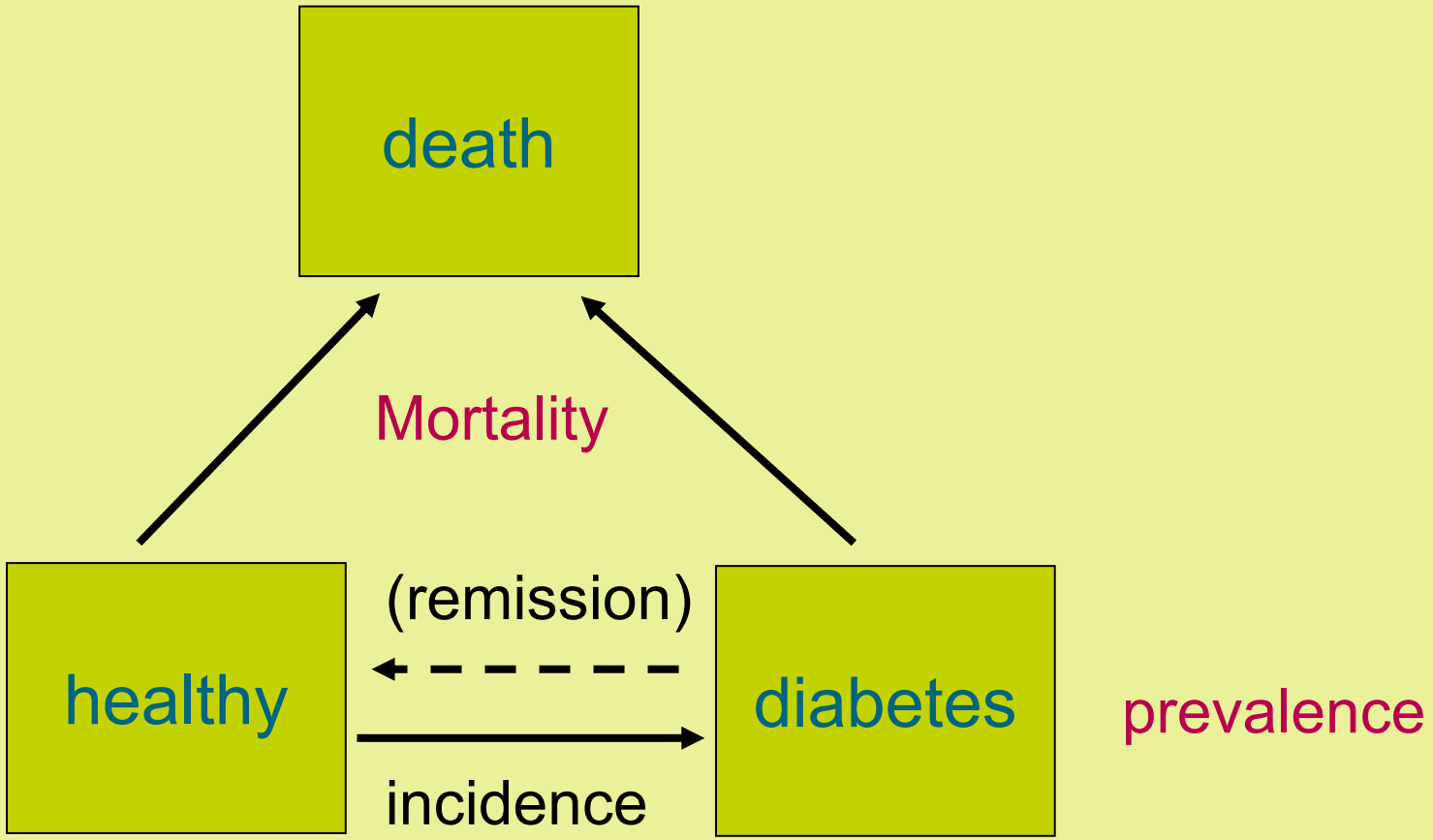
Multi-state: life-expectancy and healthy life expectancy based on constant mortality and incidence rates

Sullivan: based on constant mortality and prevalence rates

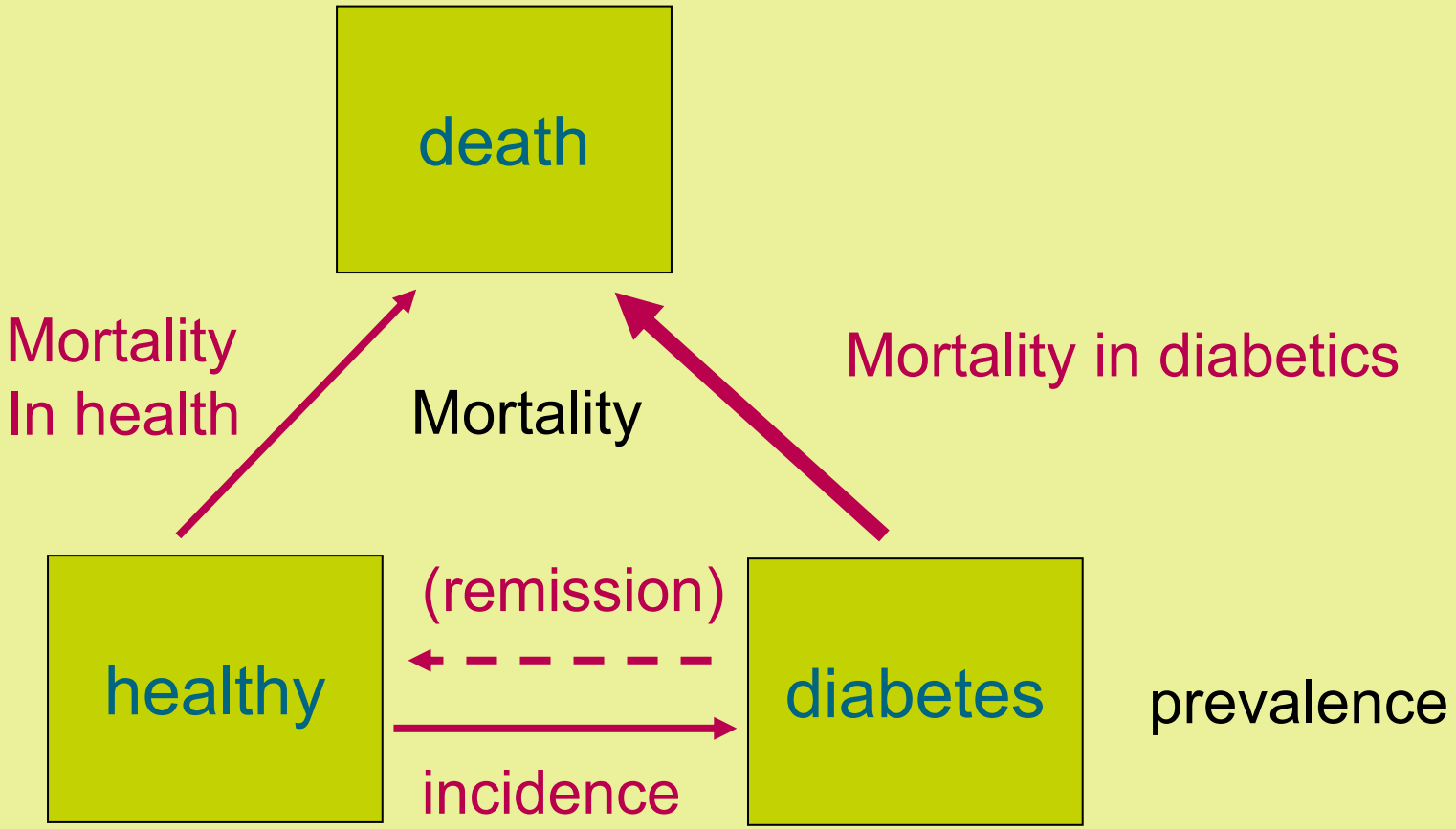
General structure



Sullivan


death
Mortality
healthy
(remission)
diabetes
prevalence
incidence

Multi-state


death
Mortality
In health
Mortality
Mortality in diabetics
healthy
(remission)
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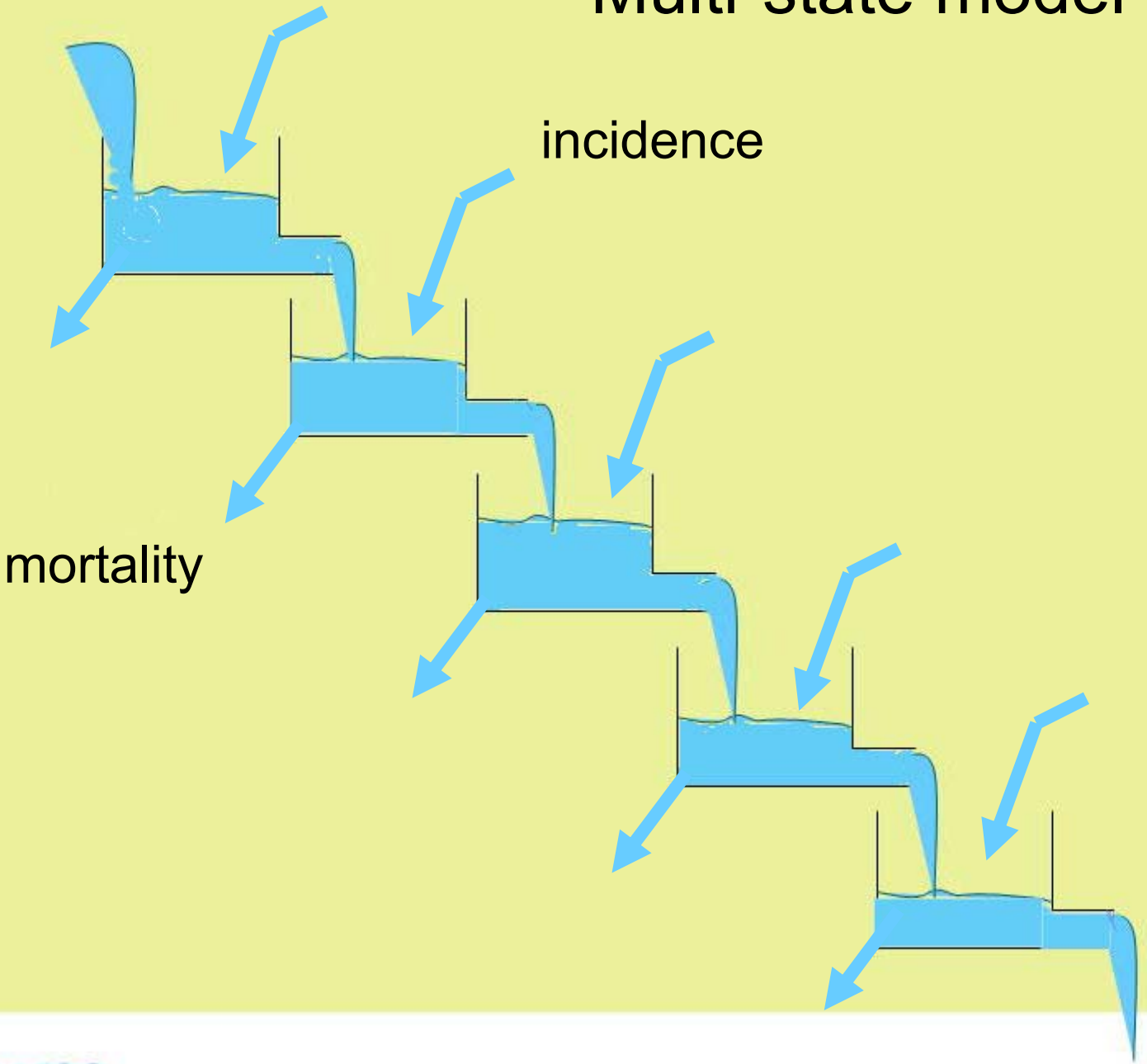
Multi-state model



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Differences

Steady-state situation:
Sullivan = multistate

Non-steady state: changing incidences:
Model goes to new steady state

How fast?
-Incidence and remission , and incidence >> incidence-remission :
→ fast

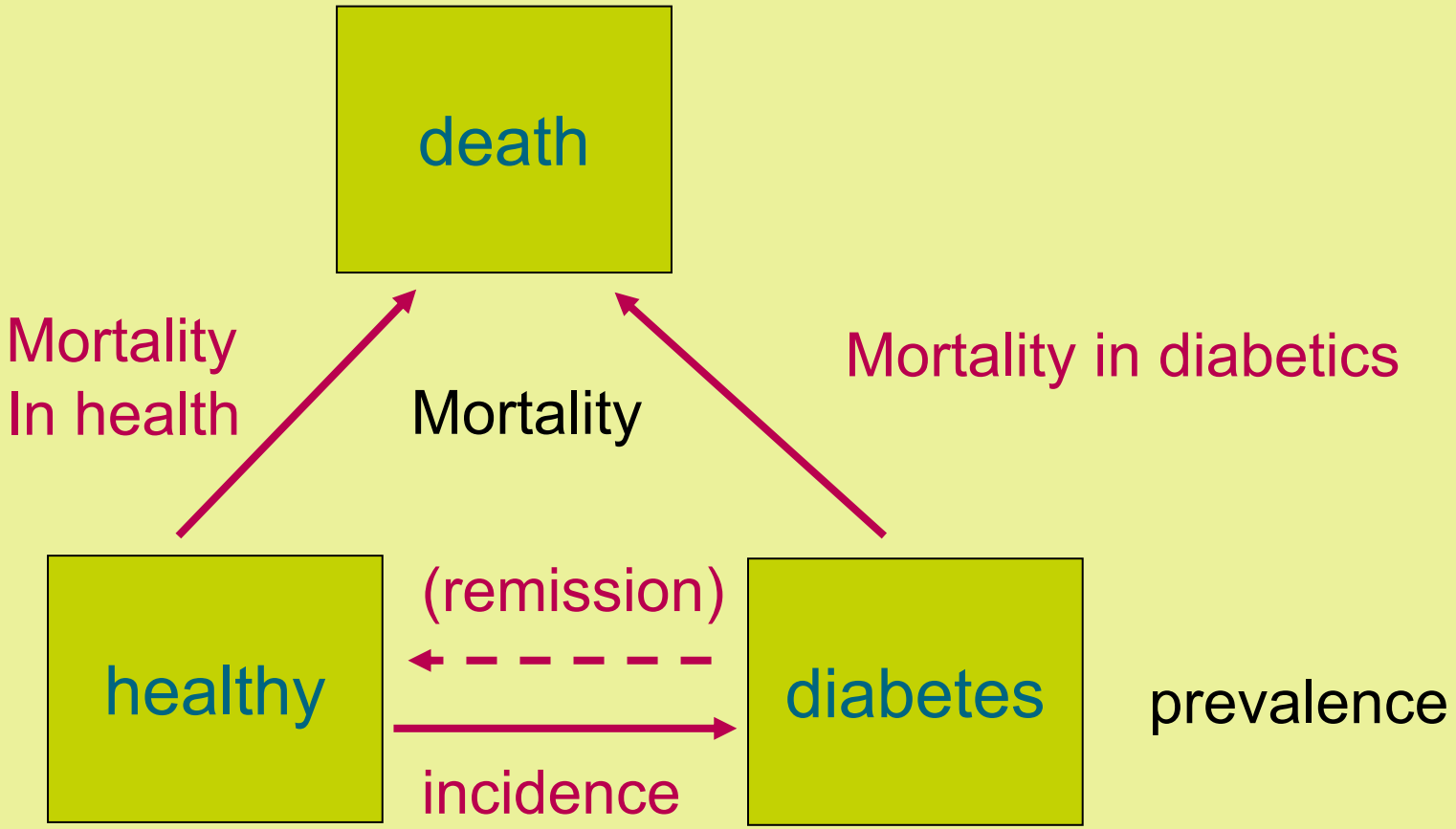
-Only incidence: takes a life time to reach a new steady state

Life expectancy free of diabetes

- No remission
- Steady state not realistic
- For projections multi-state better

Need adequate data

Multi-state


death
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Data on diabetes

Incidence rate

from sentinel General Practitioners Registrations

Prevalence rate

from sentinel General Practitioners Registrations

Total mortality

Statistics Netherlands

Mortality in those with and without diabetes: ????

Excess mortality = Mortality in those with diabetes – mortality in those without diabetes

Excess mortality: 4 methods

1. From literature: Relative risks on mortality
2. From IPM (“DISMOD”)- model
3. From cause-specific mortality (as registered on death certificate)
4. As 3, but related mortality from cardiovascular diseases added

Method 1: from relative risks (by age)

Comparison mortality:
non-diabetic with regular (unselected) diabetics
unadjusted for BMI

Excluding:
-Only data before 1980
-Non-caucasion study population
-Men and women reported together
-Age-groups wider than 30 years

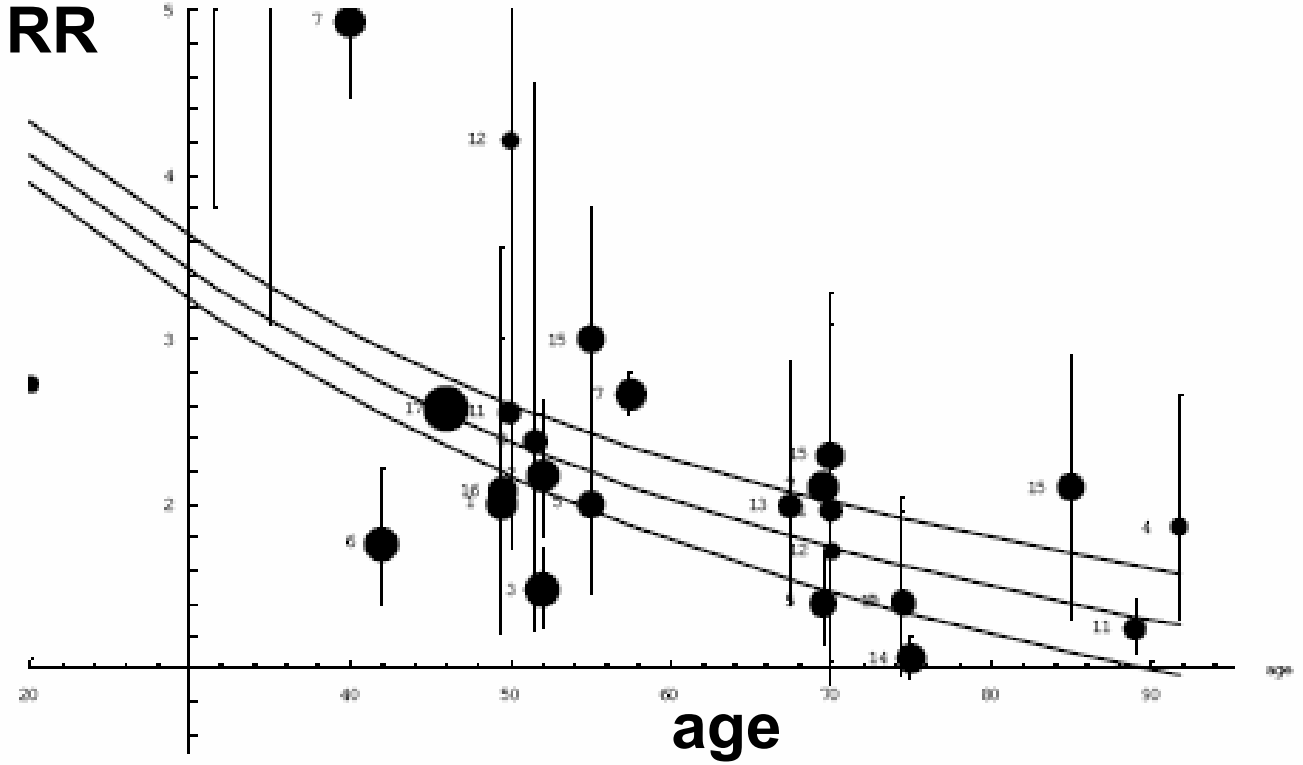

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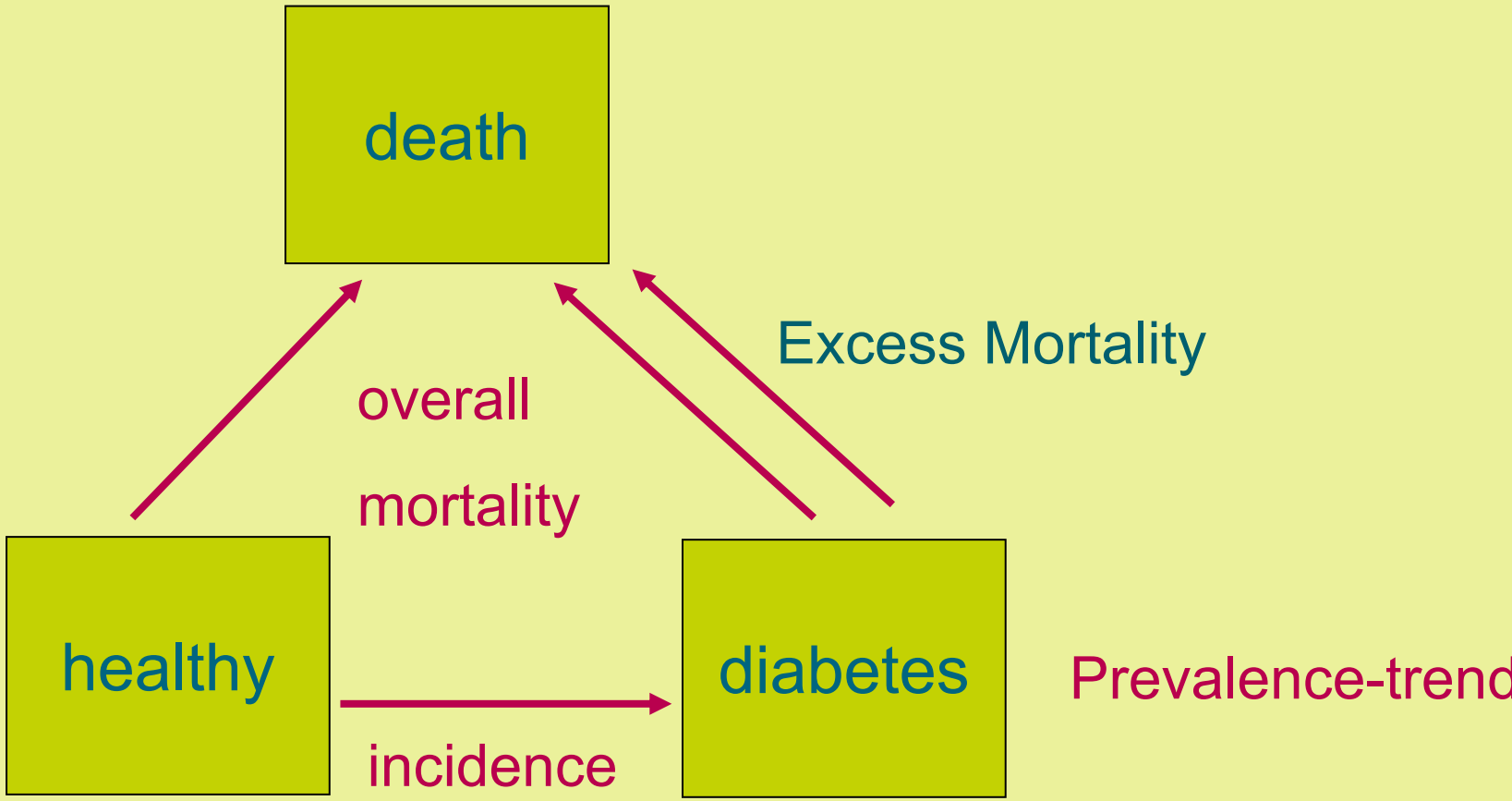
Figure 4.7: All cause mortality risks for males (unadjusted for BMI)

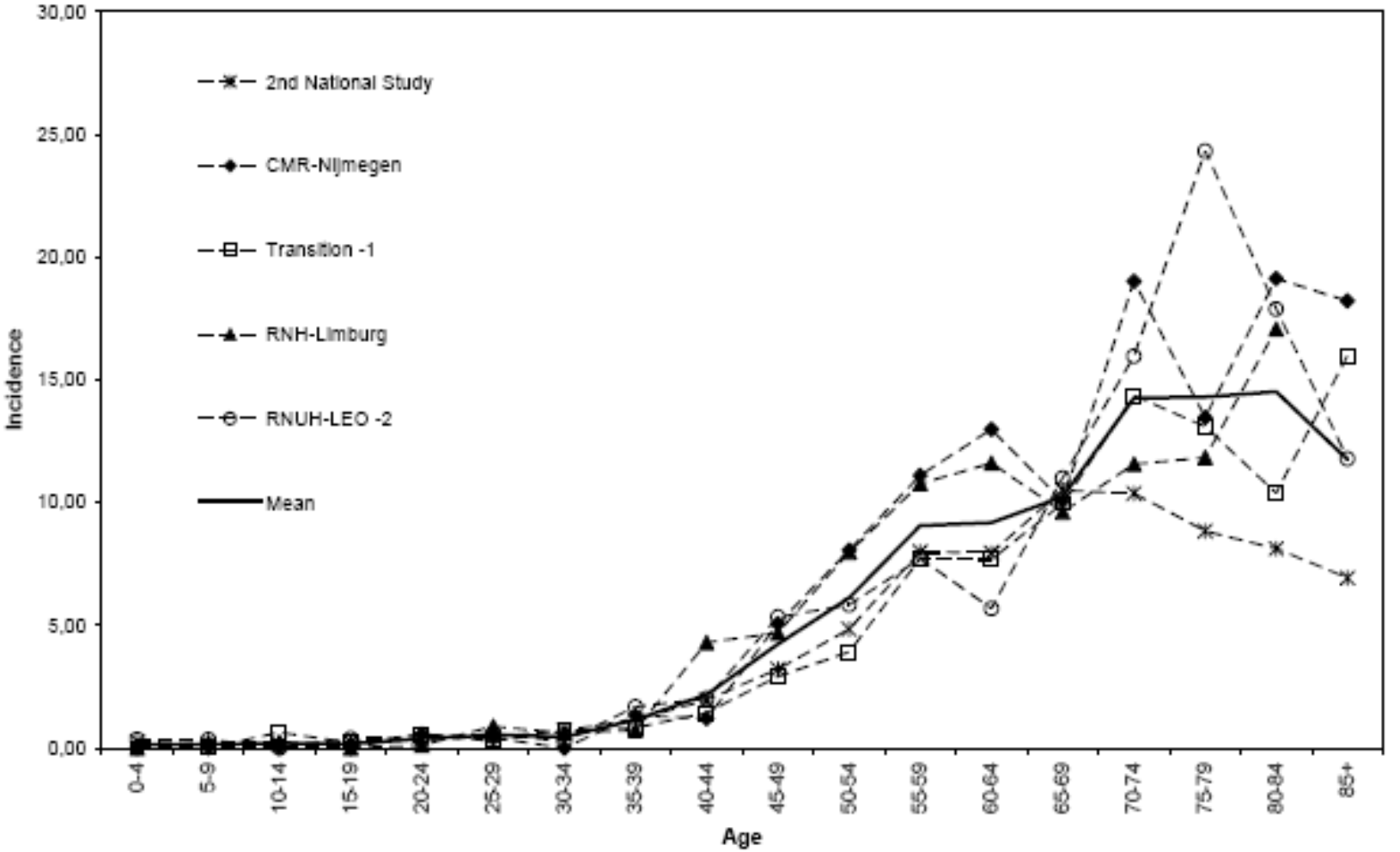
Method 2: using IPM ("DISMOD") model



Data used

5 sentinel networks of GP practices:

- **CMR- Nijmegen (2000-2004)**
- **LINH, contactregistration (2004)**
- **Transition project (2000-2004)**
- **RNH-Limburg (2001-2004)**
- **RNUH-LEO (2001-2004)**



Incidence estimates of diabetes mellitus in the 5 data sources selected and the mean of these estimates (men)

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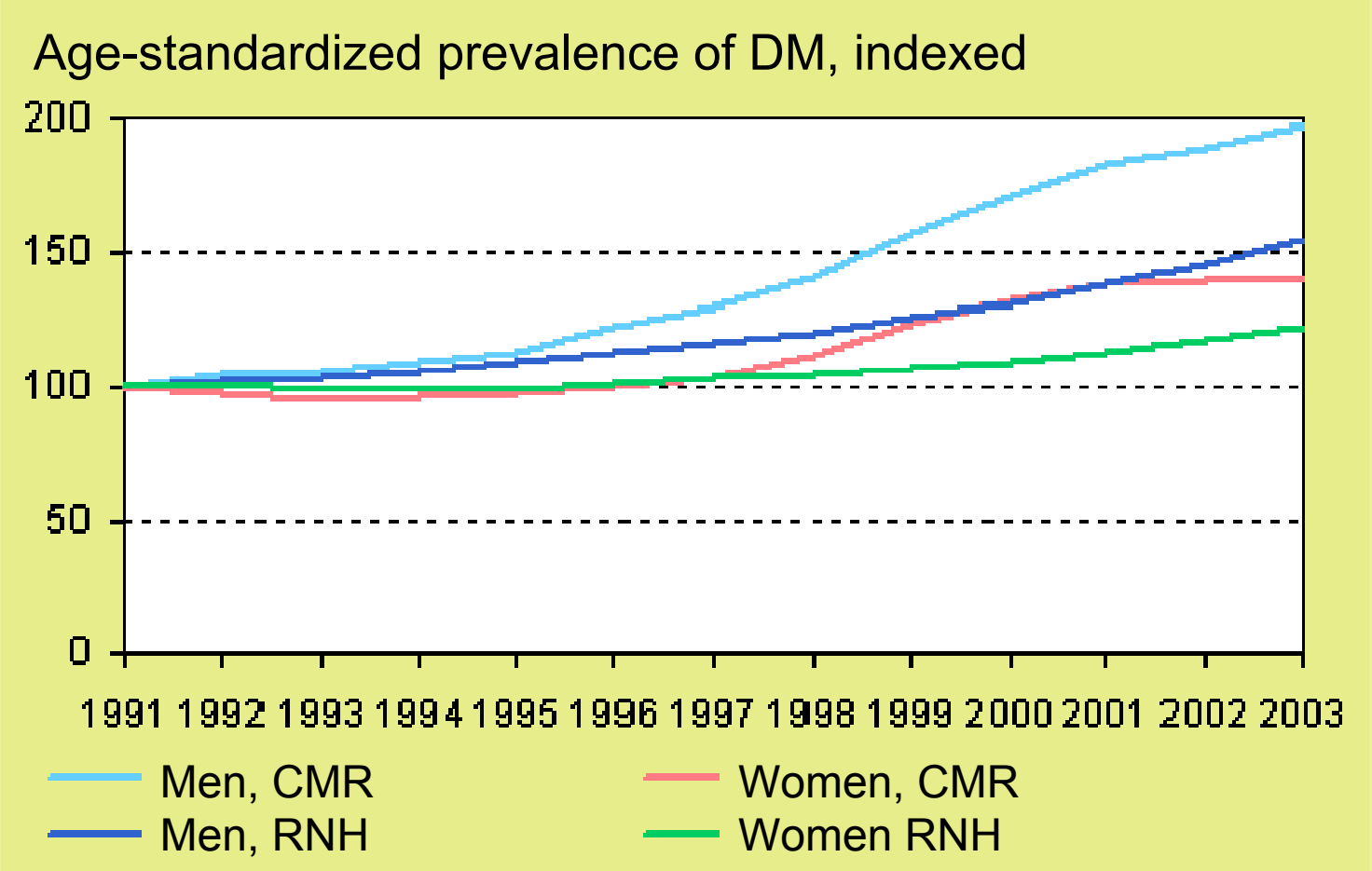
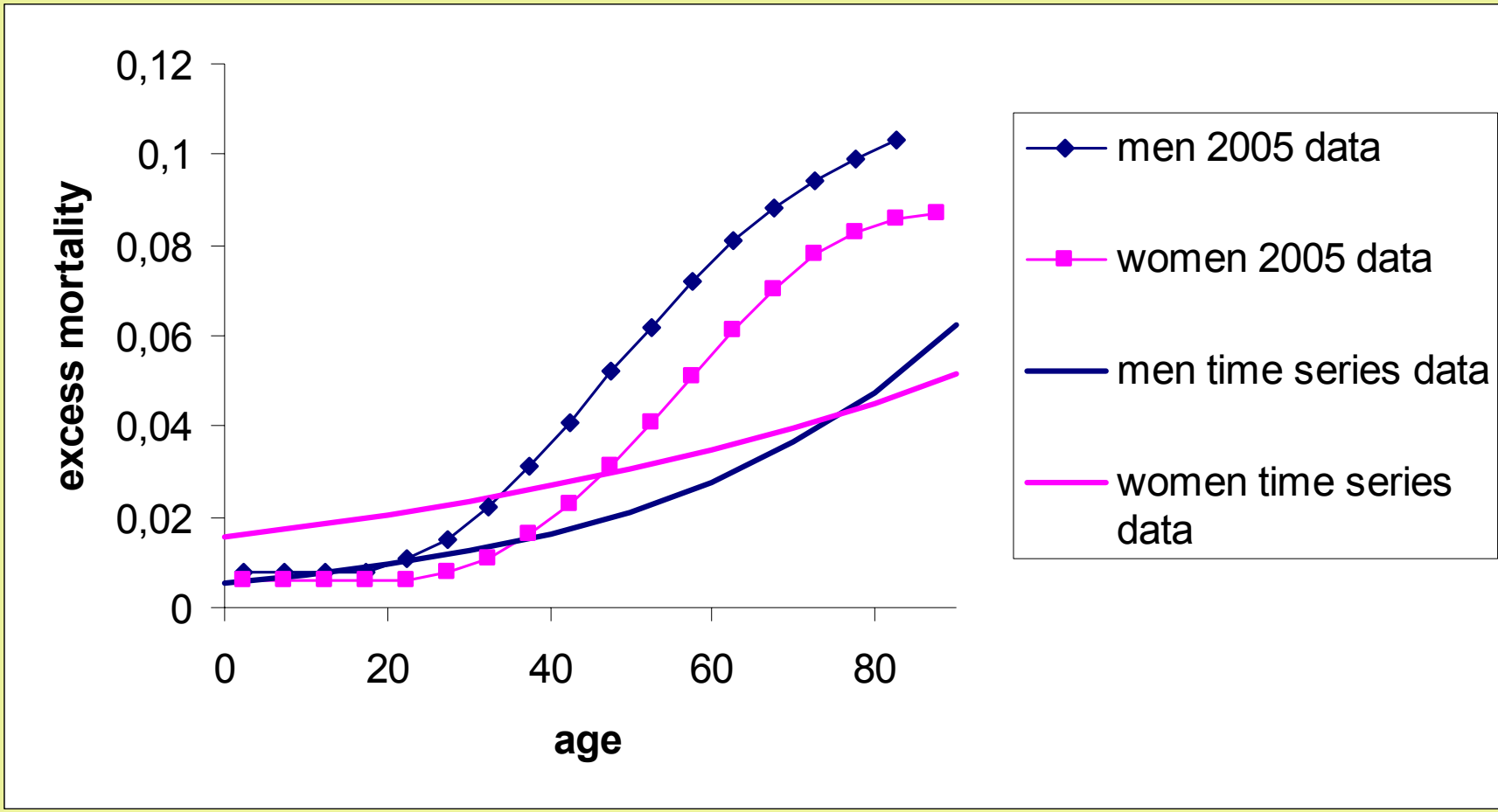
Steady state = Sullivan

Here : including trend of last 10 years



Excess mortality



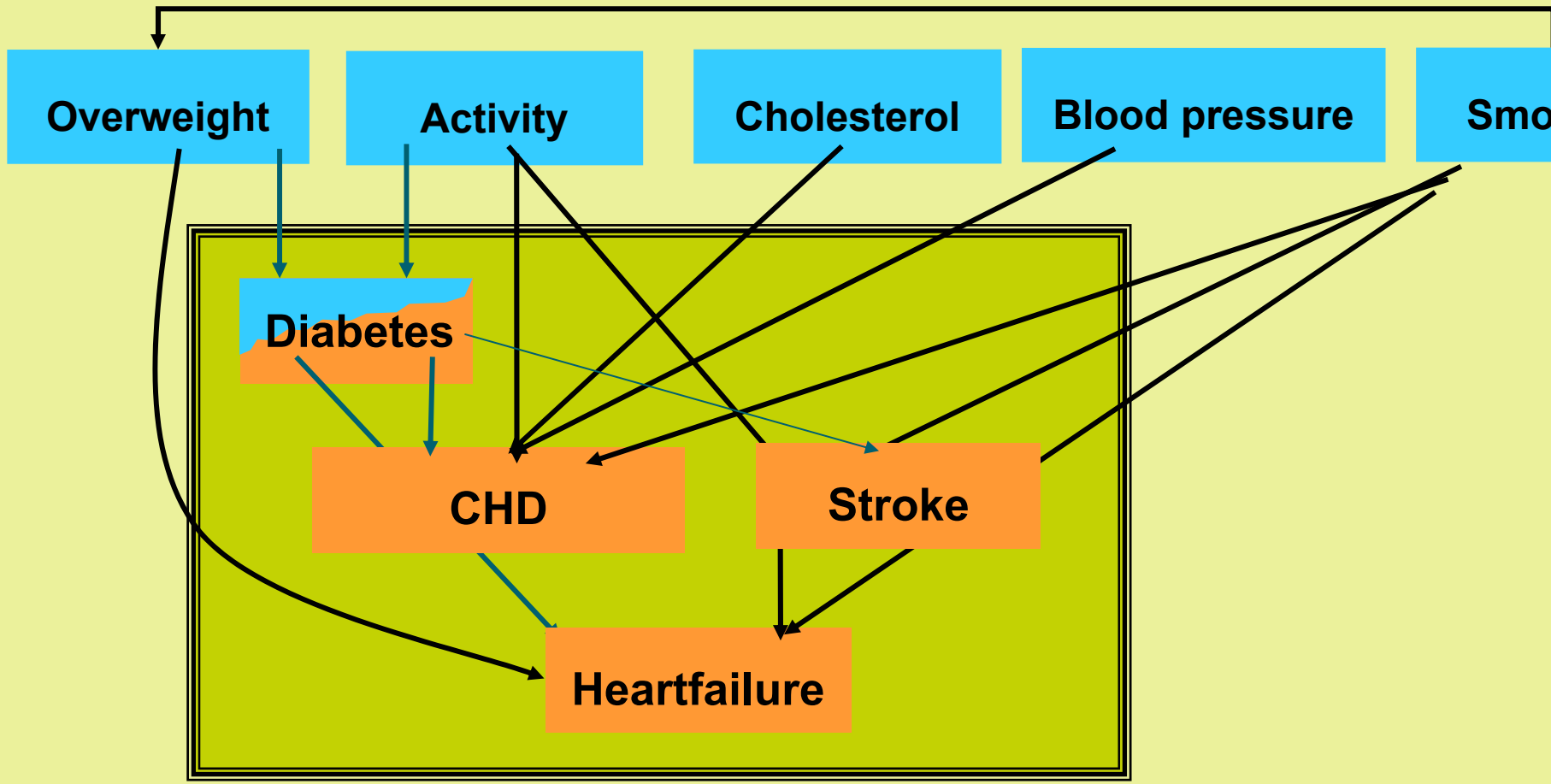
3. Estimated from diabetes as cause of death

- Primary cause of death as given on death certificate (after applying recoding rules of statistics Netherlands)

Published as rate per population number

$$\text{Excess mortality} = \frac{\text{rate per population}}{\text{prevalence rate}}$$

4: cause specific mortality from CVD included

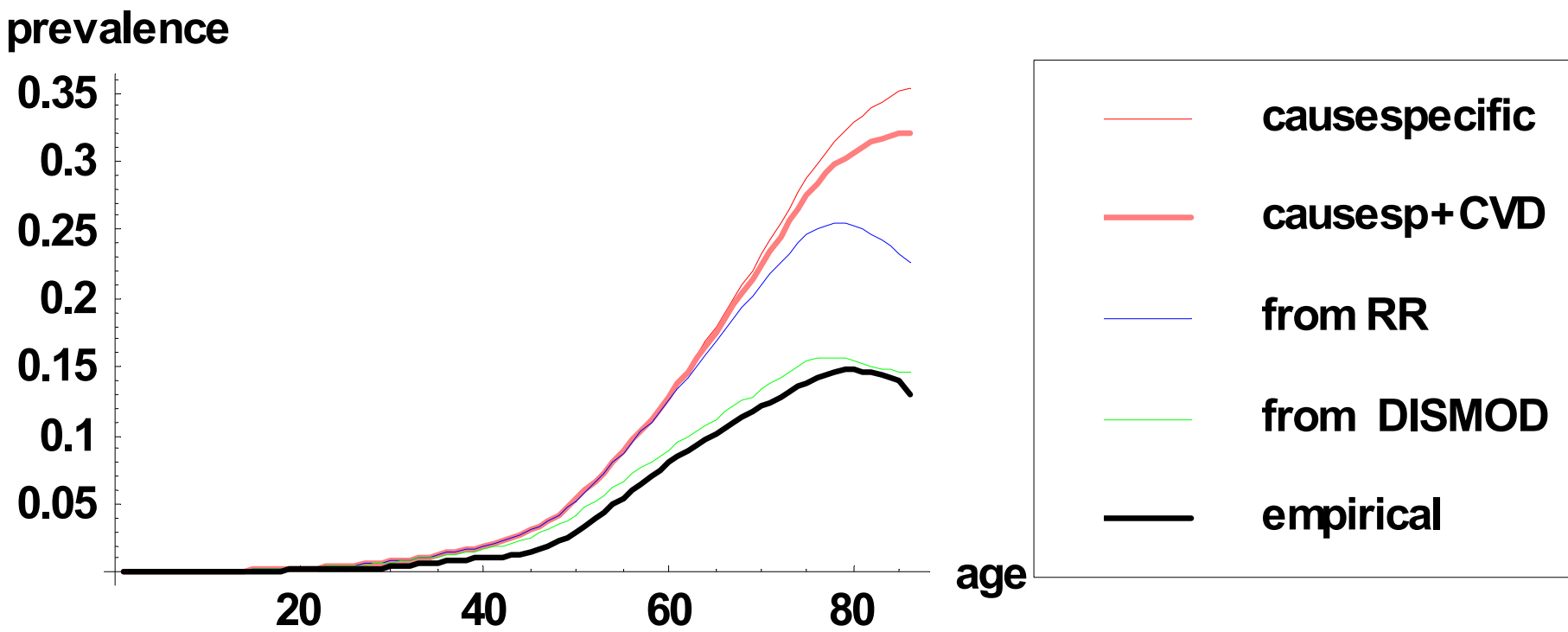


Including CVD:

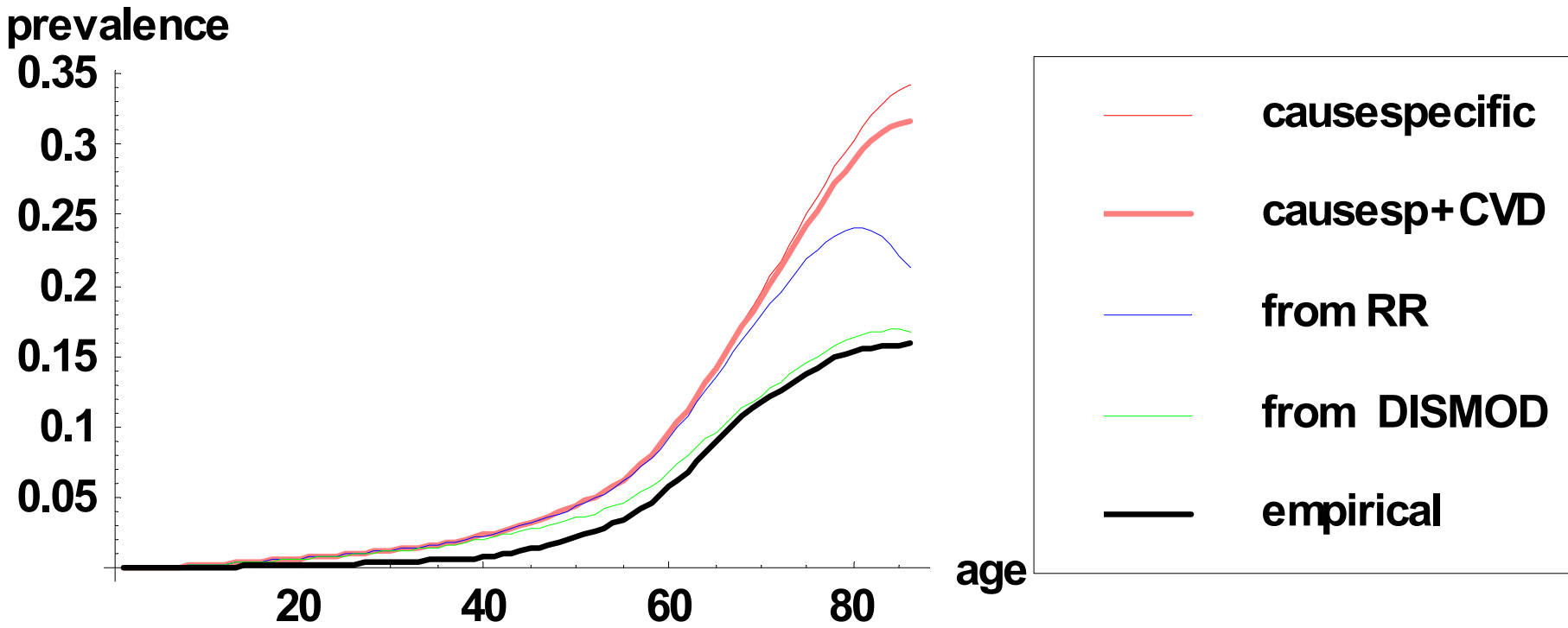
- Calculate CVD excess mortality from cause-specific mortality
- Calculate excess prevalence of CVD in diabetics, using relative risks of DM on CVD

→ Can be used to calculate extra excess mortality in diabetics due to CVD

Predicted prevalence of diabetes, men (multistate model)



Predicted prevalence of diabetes, women



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	LE		With diabetes		Without diabetes	
	Men	Women	Men	Women	Men	Wome
Sullivan	77.5	82.2	3.1	3.6	74.4	78.7
MS based on RR	76.8	81.2	5.4	6.0	71.4	75.5
MS dismod	76.9	81.3	3.7	4.3	73.2	77.0
MS cause-specific	77.3	81.7	6.5	7.1	70.8	74.6
MS cause-specific	77.0	81.4	6.2	6.7	70.9	74.7

Summary

- Increasing prevalence in multistate model leads to increasing mortality → lower life expectancy
- Including time trend in DISMOD moderate influence on prevalence, but still appreciable in life expectancy without diabetes
- Including cardiovascular mortality not very much influence
- Predicted life expectancy with diabetes can be twice as high depending on method used

Discussion and conclusion

- DISMOD used to doctor excess mortality, but can also be used to doctor incidence
- direct data necessary on excess mortality

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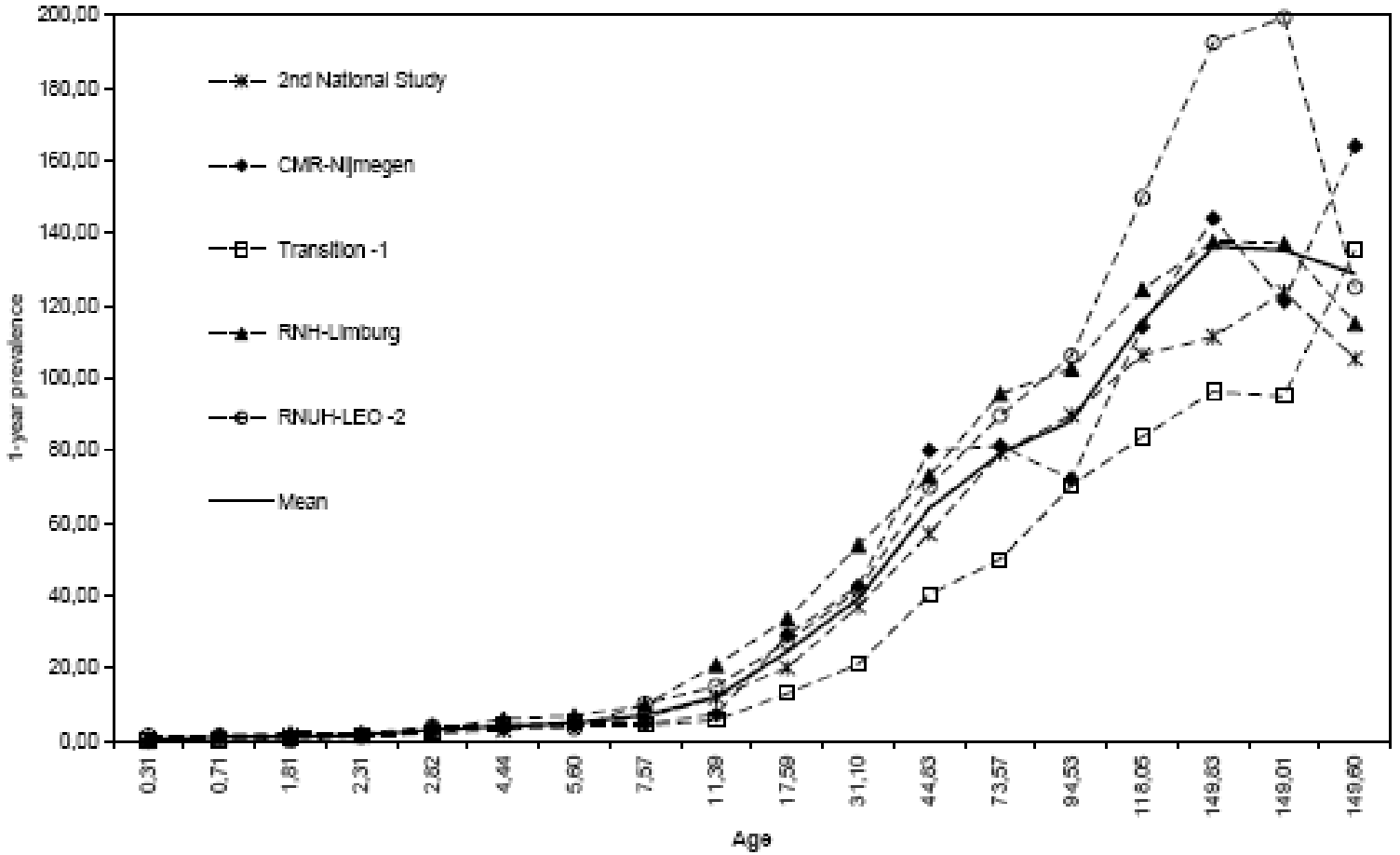

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