

# Register, Prevalence, Incidence and Mortality of T1 and T2 Diabetes in Denmark 1996–2016 and beyond

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## Background

- ▶ Indications that T2D is plateauing or decreasing lately
- ▶ Little is established on the relative occurrence of T1D and T2D

### Key questions:

- ▶ How are trends in T1D resp. T2D prevalence and incidence
- ▶ Mortality by age, duration and diagnosis age
- ▶ Difference in mortality between T1D and T2D

**Remedy:** Population based registers in Denmark

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## Danish Diabetes Registers - short history

- ▶ **NDR** — established 2006, last year of update 2012  
no T1D/T2D distinction
- ▶ **RUKS** — Started 2015, initially not available for linkage  
has T1D/T2D distinction, based **only** on NPR & RMPS
- ▶ **DMreg** — established 2018 by SDCC Clinical Epidemiology  
using Statistics Denmark, has T1D/T2D distinction, based on  
DADD, NPR, NHSR, DiaBase & RMPS.  
Covers **1996–2016** incl.

DADD: Danish Adult Diabetes Database - quality register updated annually  
NPR: Nation Patient Register  
NHSR: National Health Services Register  
RMPS: Register of Medicinal Products Statistics - Prescription register  
DiaBase: Quality database for eye-screening of diabetes patients

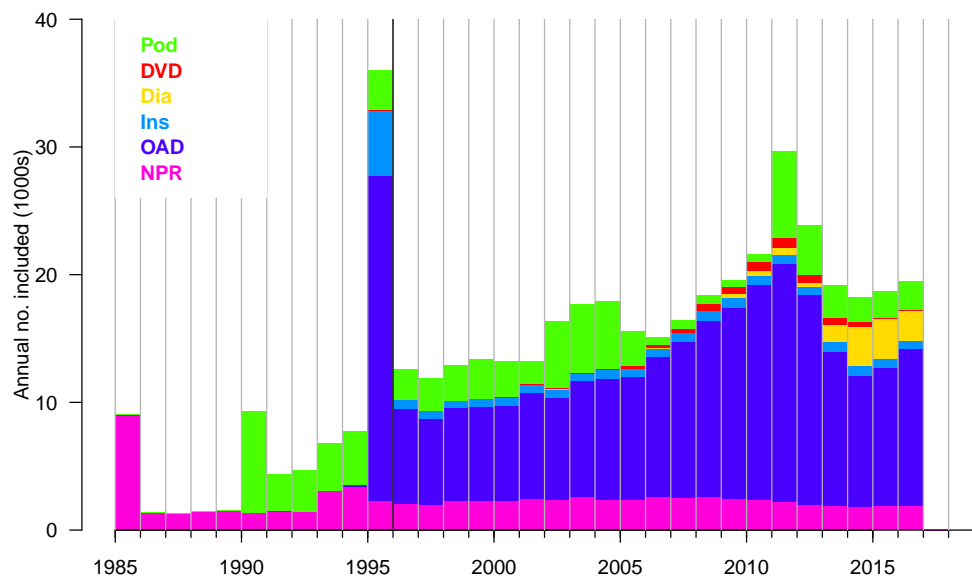
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## Sources for the DMreg

- ▶ NPR, National Patient Register
- ▶ RMPS, Register of Medicinal Product Statistics
- ▶ NHSR, National Health Services Register
- ▶ DADD, Danish Adult Diabetes Database
  - annual clinical status since 2005
  - complete for T1D, not for T2D
  - date only used if no other criteria met
- ▶ DiaBase, Eyescreening database
- ▶ **except** at least two recordings from NPR/RMPS are required
  - date/type of the second used as inclusion date/crit
  - similar to the RUKS requirements
- ▶ **Inclusion date:** first of any of these

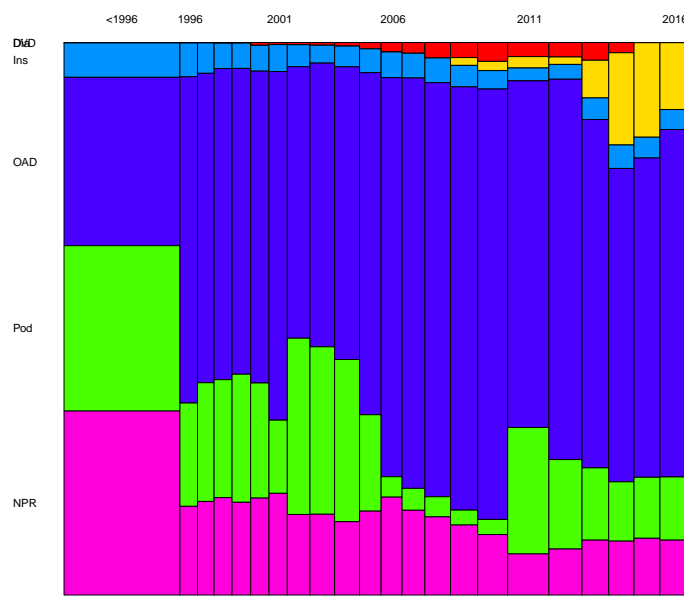
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## Inclusion criteria in DMreg



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## Inclusion criteria in DMreg



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## Sources for type classification in DMreg

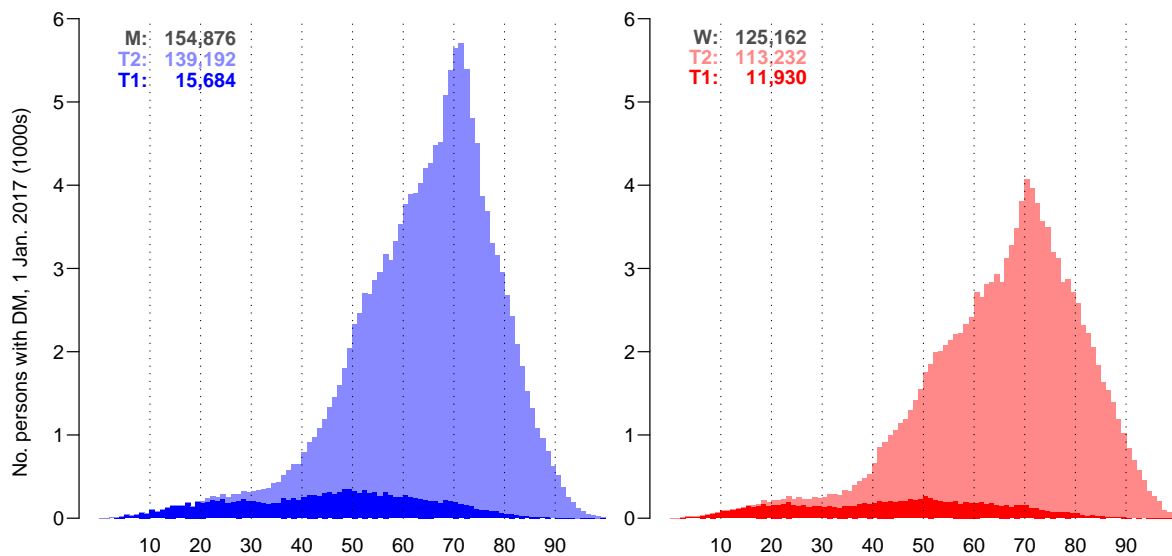
- ▶ **Clinical register, DADD:**  
T1D diagnosis (only persons alive > 2004)
- ▶ **National patient register:**  
T1D diagnosis if not known from the clinical register
- ▶ used if more than half records are T1D resp. T2D — otherwise unspec.
- ▶ **Prescription register:**  
any GLD < 15 years, any insulin < 30 years
- ▶ A person cannot be classified as T1D without insulin purchase

Persons not classified as T1D, are labeled T2D.

Note that we are formally conditioning on the future...

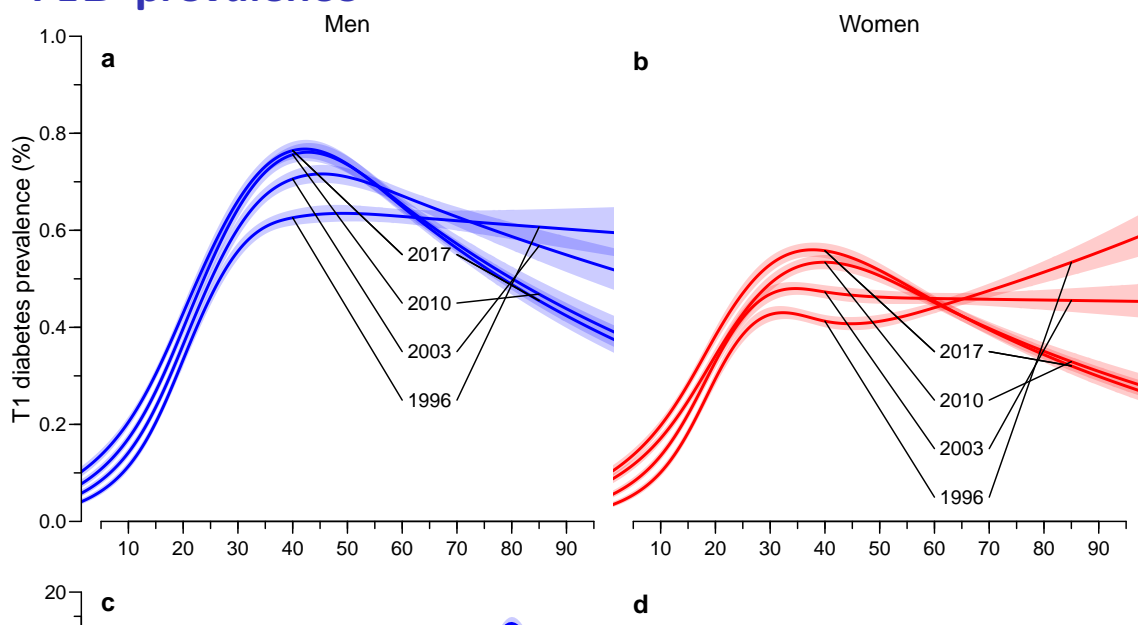
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## Prevalence of diabetes 2017-01-01



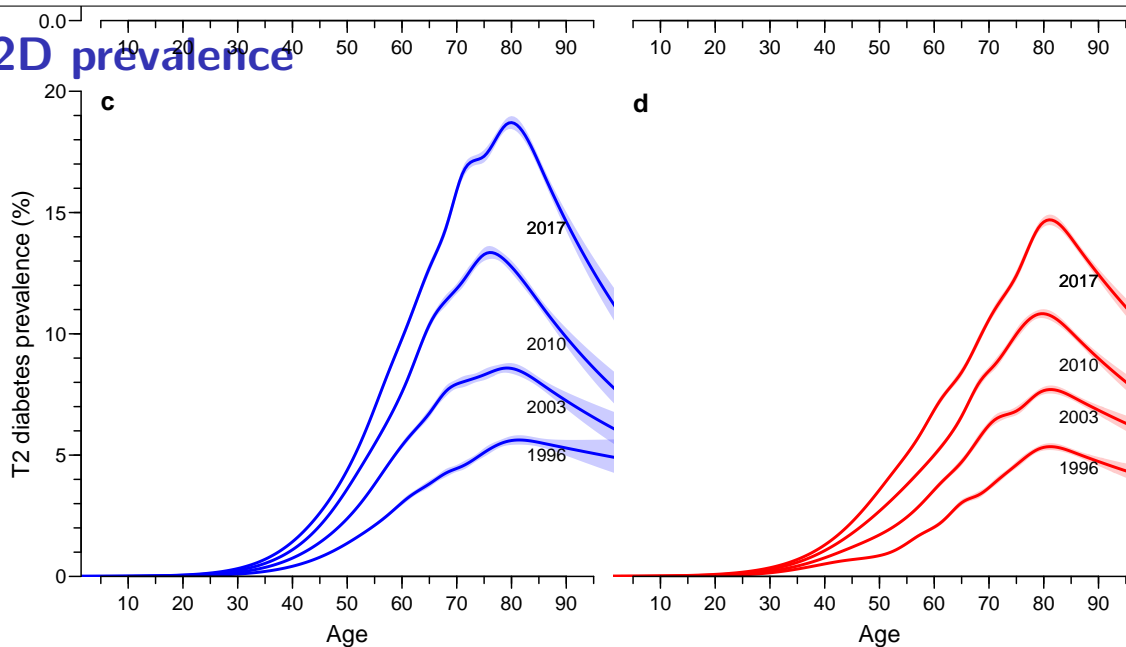
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## T1D prevalence



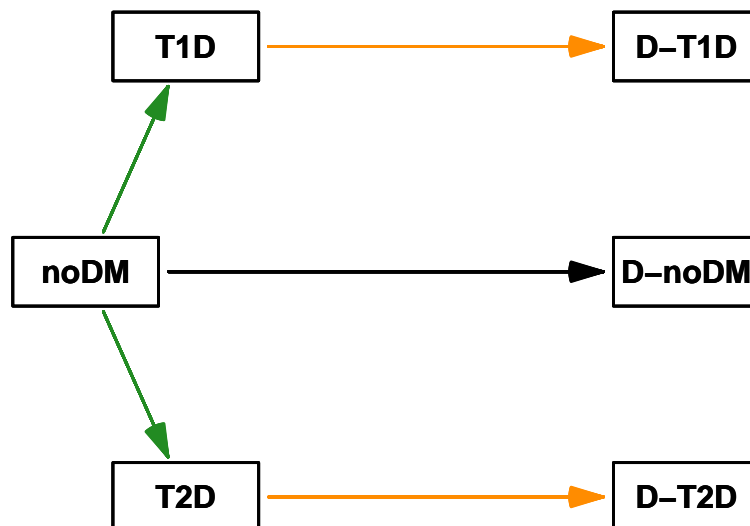
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## T2D prevalence



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## Incidence and mortality rates



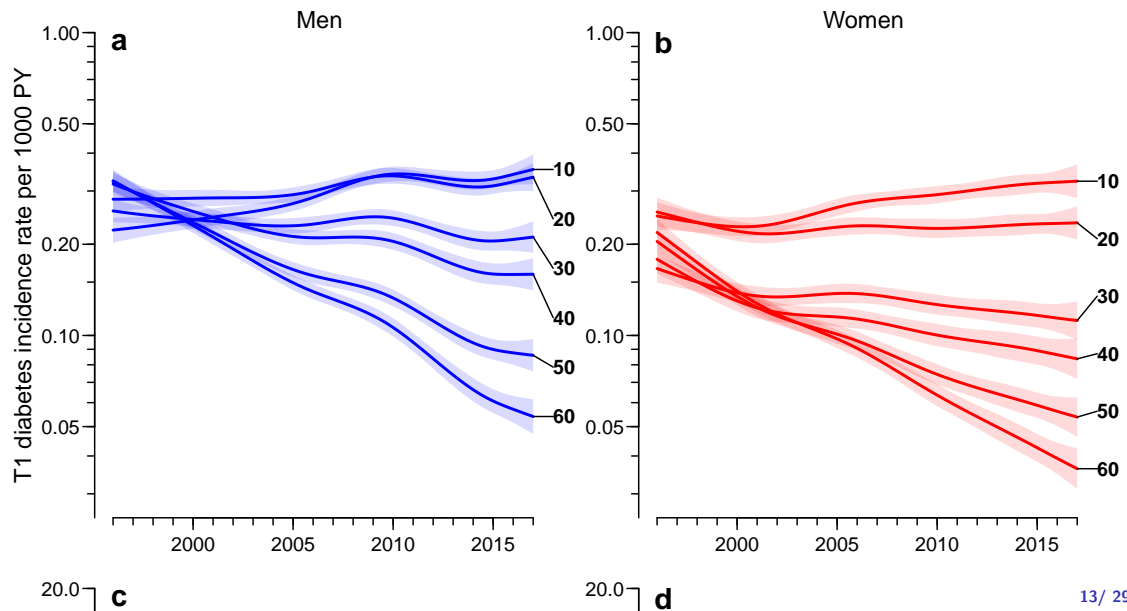
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## Methods for incidence and mortality rates

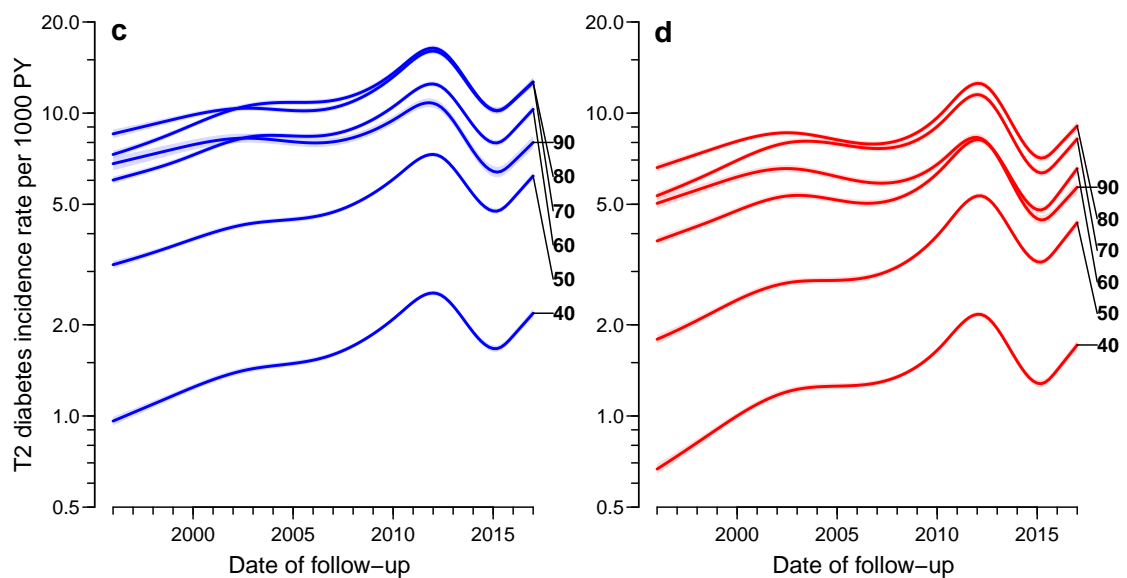
- ▶ Entire Danish population followed 1996-01-01 → 2016-12-31
- ▶ Follow-up classified as noDM, T1D, T2D
- ▶ Tabulation by age, calendar time, date of birth, and duration of T1D/T2D, 1-year classes (PY, deaths, T1D, T2D diagnoses)
- ▶ Poisson models with smooth effect of age, date of follow-up, date of birth, age at diagnosis and duration of diabetes
- ▶ **Incidence** rates at different ages by calendar time
- ▶ **Mortality** rates by age for different ages at diagnosis — RR by calendar time

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## Time trends in T1D incidence



## Time trends in T2D incidence



## Incidence conclusion

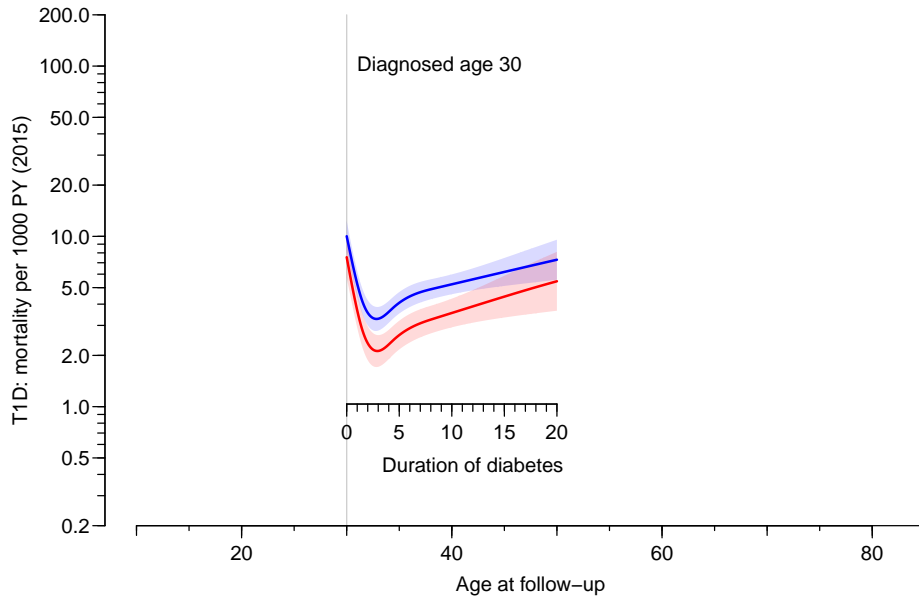
T1:

- ▶ slight increase in younger ages
- ▶ decrease in older ages
- ▶ registration artefact?

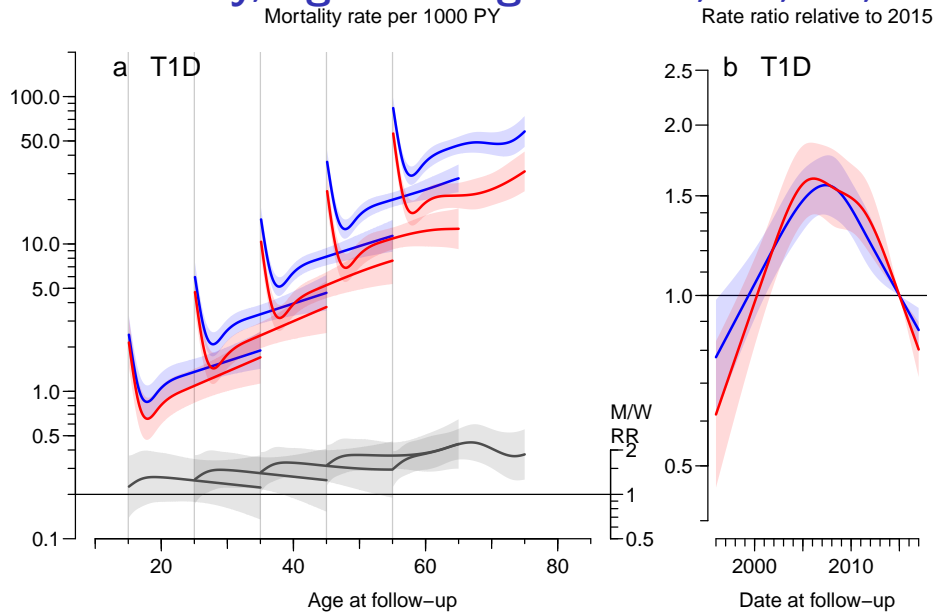
T2:

- ▶ increase till 2011, dip till 2014, increase again
- ▶ same pattern in all ages
- ▶ influence of HbA<sub>1c</sub> criteria — no data (yet)

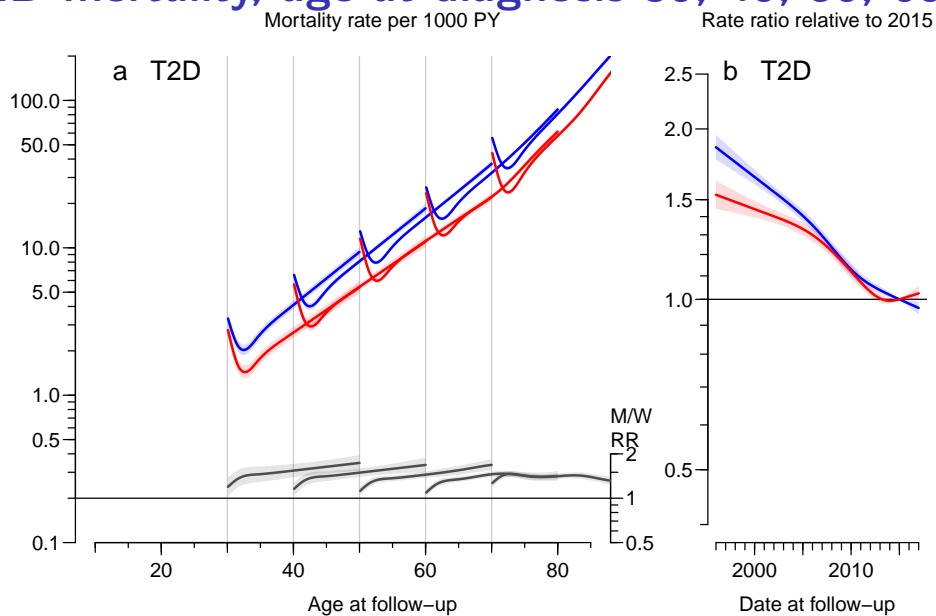
# T1D mortality

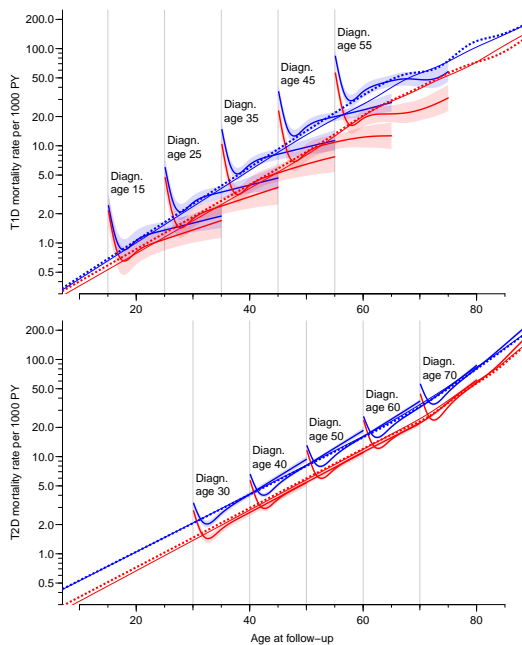


# T1D mortality, age at diagnosis 15, 25, 35, 45 and 55



# T2D mortality, age at diagnosis 30, 40, 50, 60 and 70





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## Mortality conclusion

- ▶ T1D mortality decreasing after 2009
  - early T1D deaths may be misclassified as T2
- ▶ T2D mortality decrease by calendar time
- ▶ Mortality increased the first 2 years after diagnosis
  - likely a clinical artifact: severely ill persons over-represented in newly diagnosed
- ▶ T1D: early diagnosis associated with lower mortality
- ▶ T2D: early diagnosis associated with higher mortality for men, no effect for women
- ▶ M/W mortality RR is about 1.5 regardless of sex and type

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## Summary of time trends in DK — % per year

% change per year	T1D	T2D	no DM
Prevalence	0.5	5.5	
Incidence rate	-3.5	3.8	
Mortality rate	-0.3	-2.9	-2.6

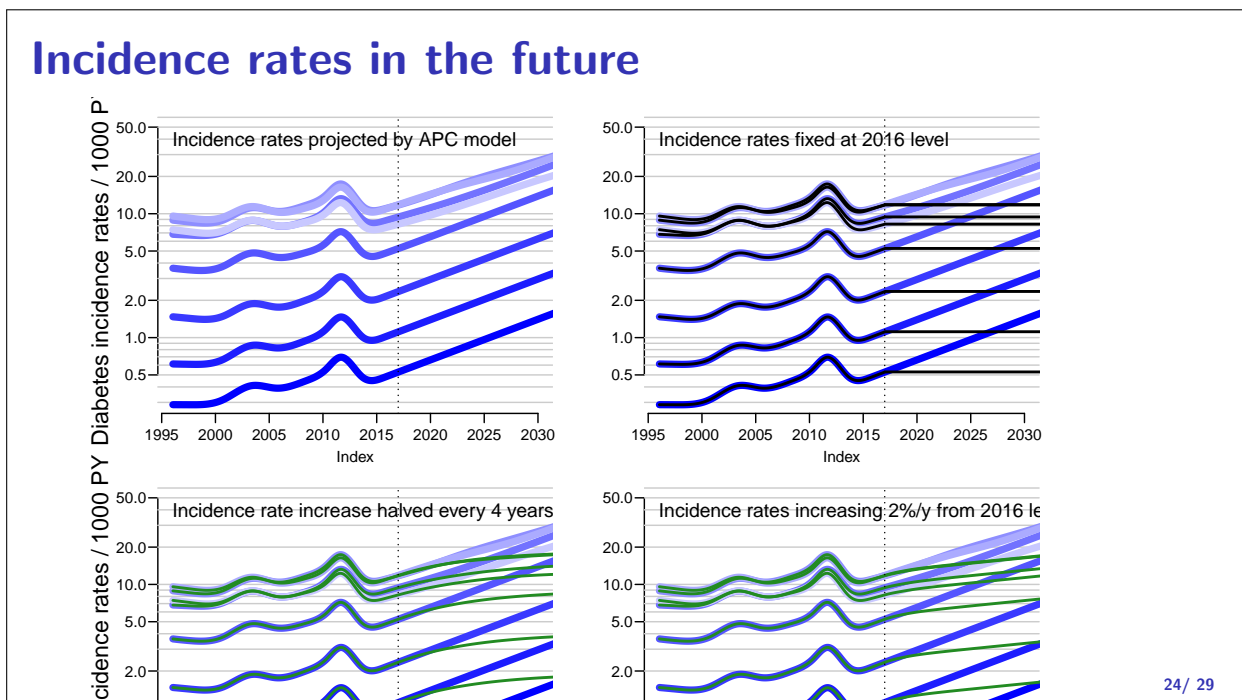
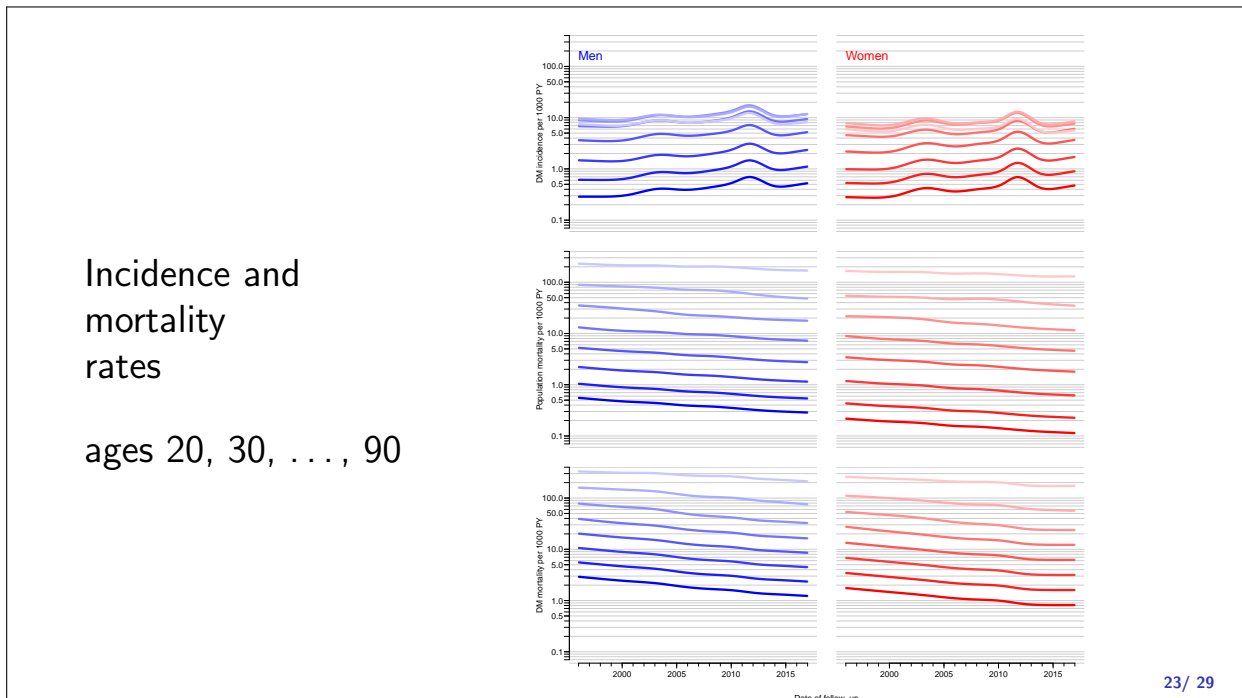
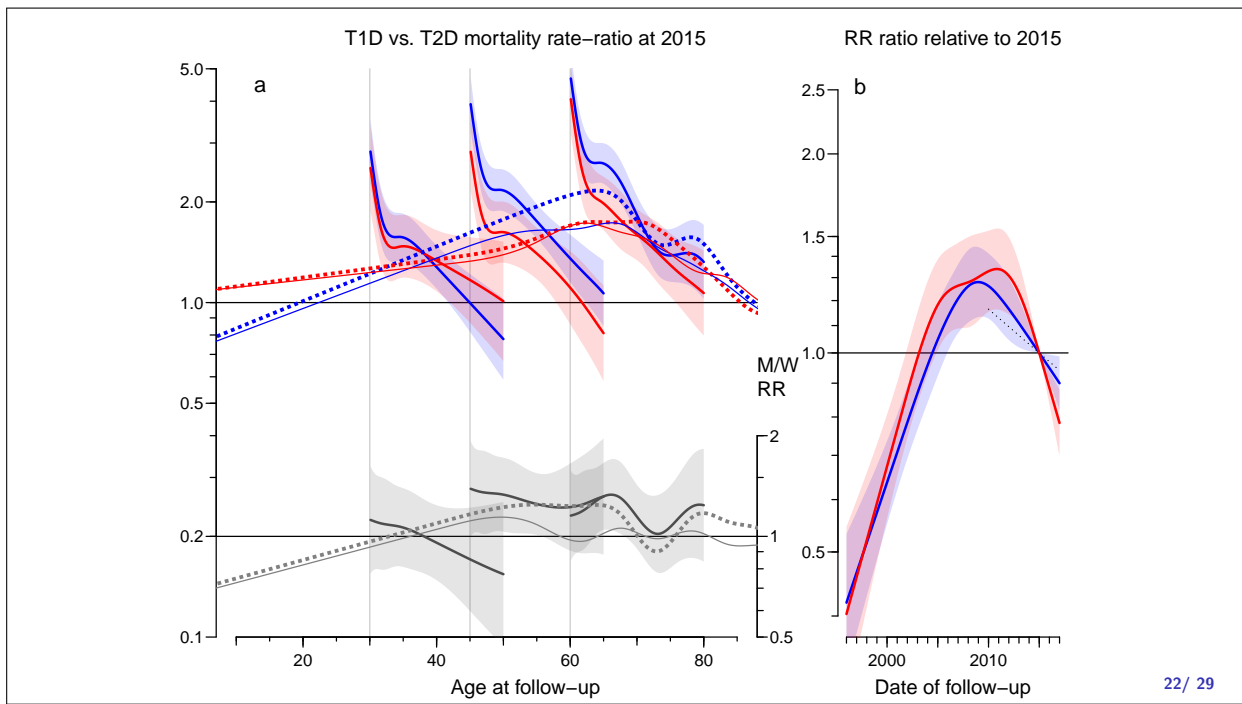
Relative mortality T2D vs. T1D: **0.58**

— T2D patients have a 42% **lower** mortality than T1D

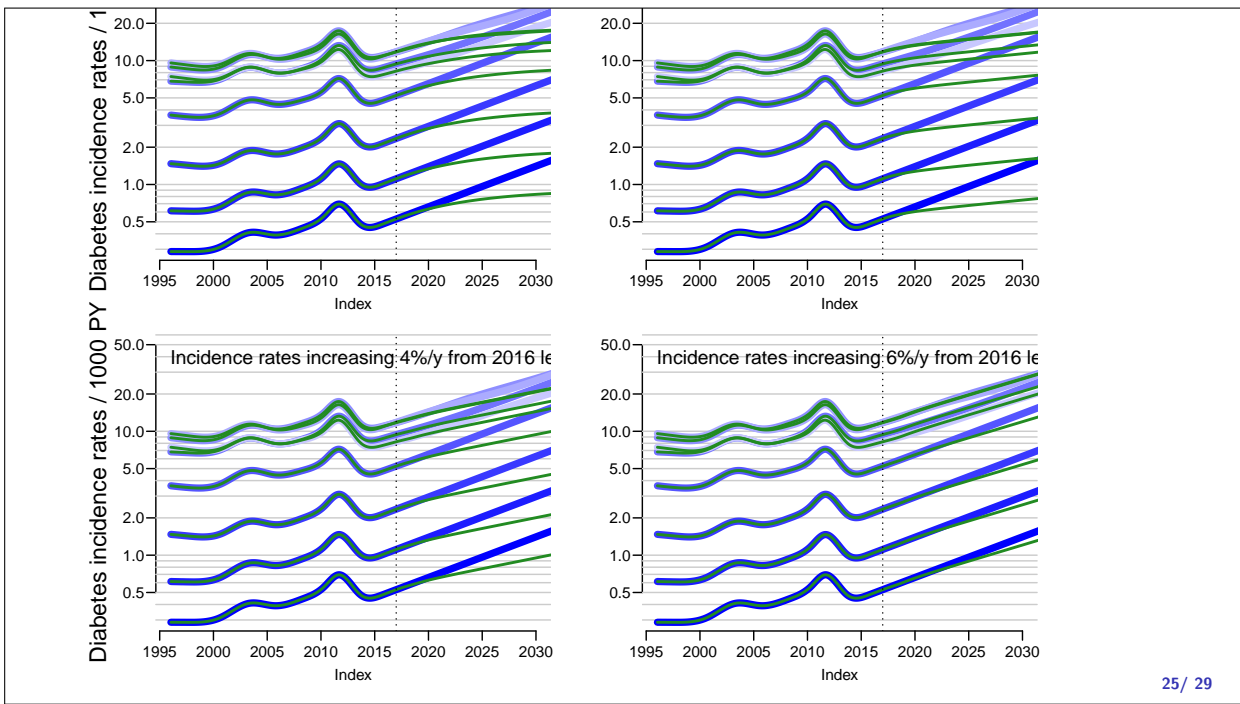
Relative mortality Men vs. Women: **1.6**

— averaged over type and age

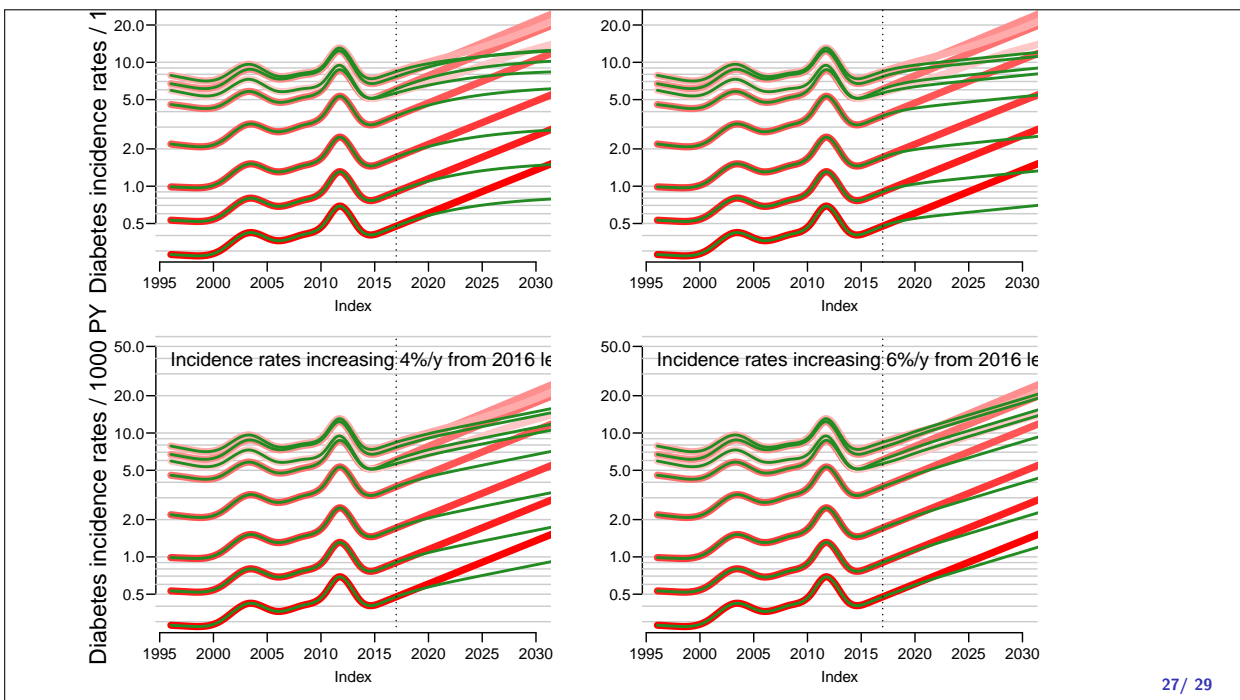
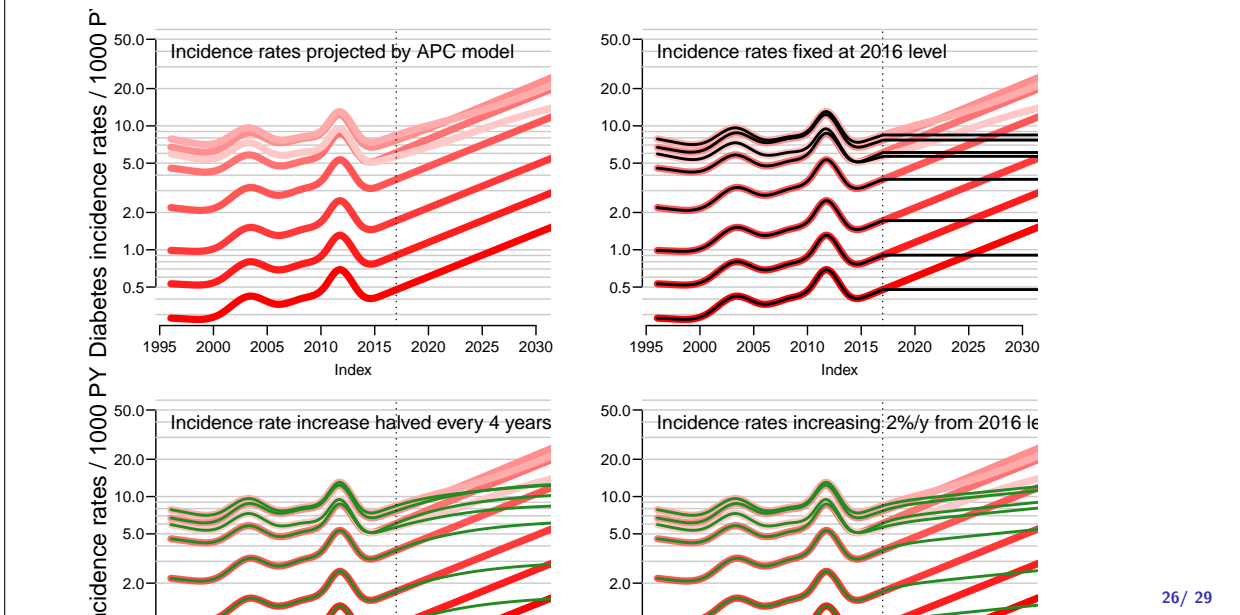
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## Incidence rates in the future



# Number of future prevalent cases of DM

... using attenuation:  
halving of slope every 5 years

