

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

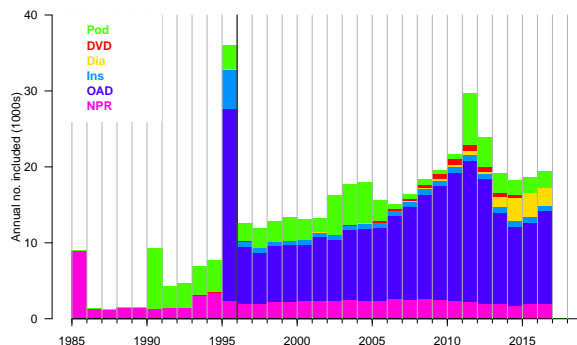
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NNFoundation, 21 January 2019

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Inclusion criteria in DMreg



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Background

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

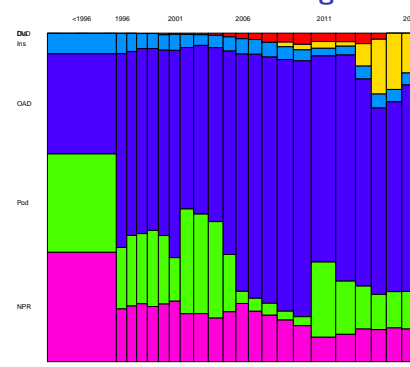
Key questions:

- ▶ 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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Inclusion criteria in DMreg



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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 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...

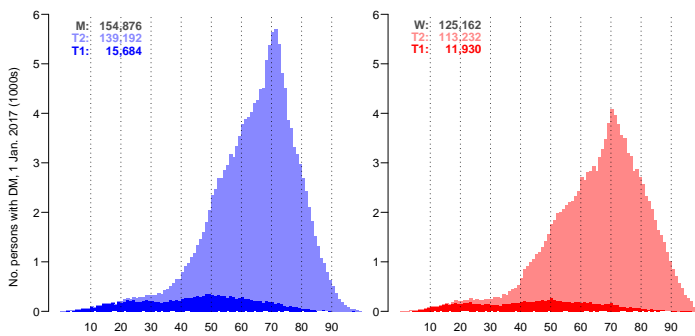
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Sources for the DMreg

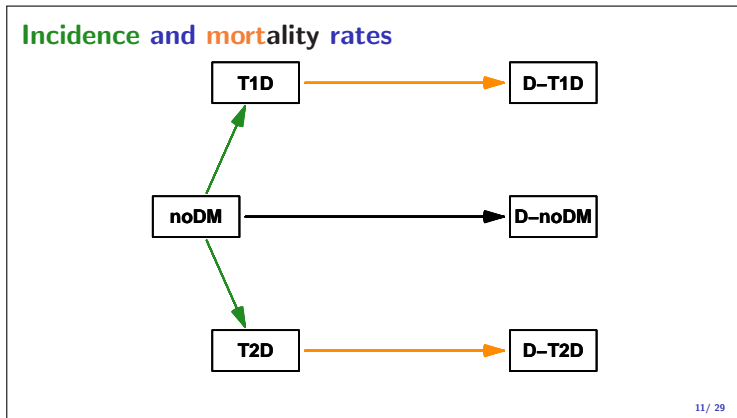
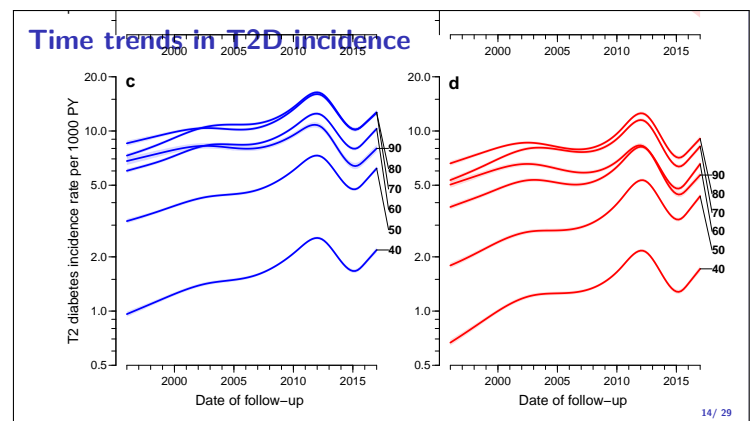
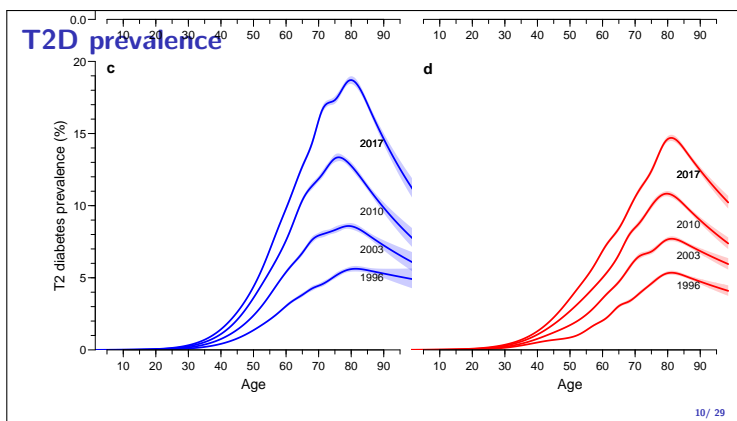
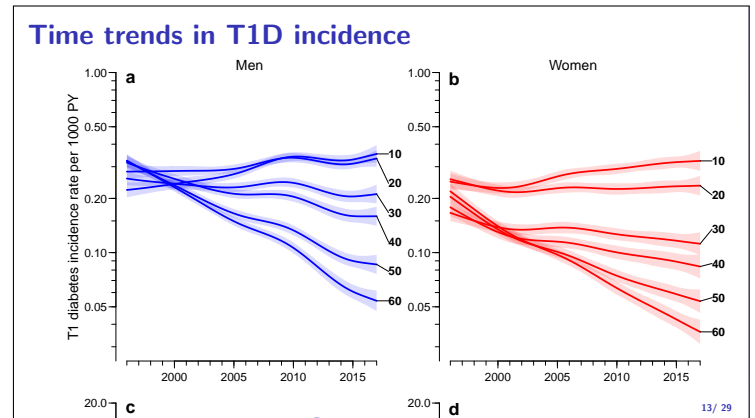
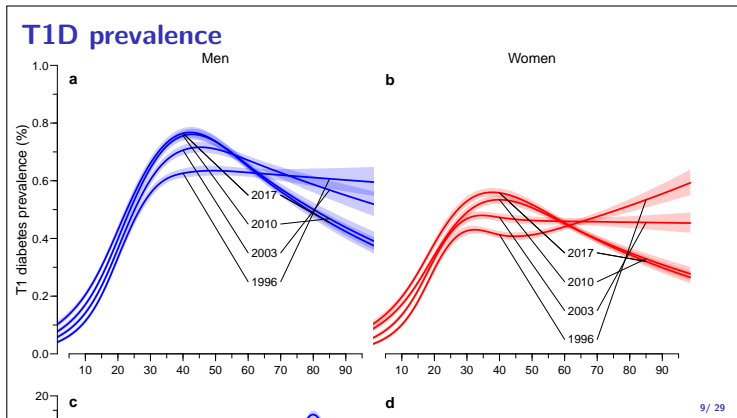
- ▶ NPR, National Patient Register
- ▶ RMPS, Register of Medicinal Product Statistics
- ▶ NHSR, National Health Services Register
- ▶ DADD, Danish Adult Diabetes Database
— annual clinical status since 2005
— complete for T1D, not for T2D
— date only used if no other criteria met
- ▶ DiaBase, Eyescreening 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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Prevalence of diabetes 2017-01-01

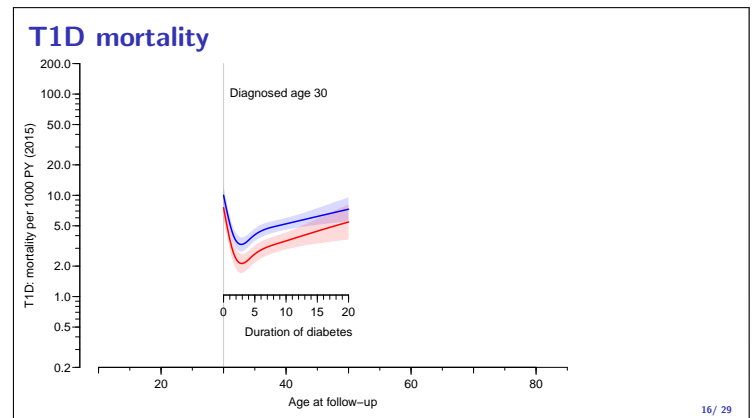


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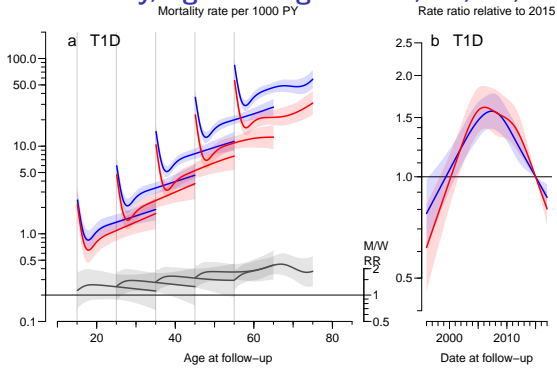


- ### Incidence conclusion
- T1:**
- ▶ slight increase in younger ages
 - ▶ decrease in older ages
 - ▶ registration artefact?
- T2:**
- ▶ increase till 2011, dip till 2014, increase again
 - ▶ same pattern in all ages
 - ▶ influence of HbA_{1c} criteria — no data (yet)
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- ### 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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T1D mortality, age at diagnosis 15, 25, 35, 45 and 55



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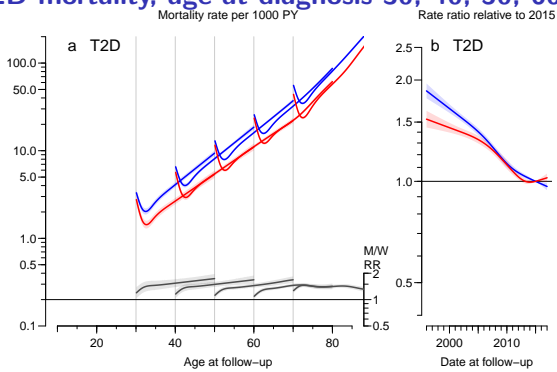
Summary of time trends in DK — % per year

% 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

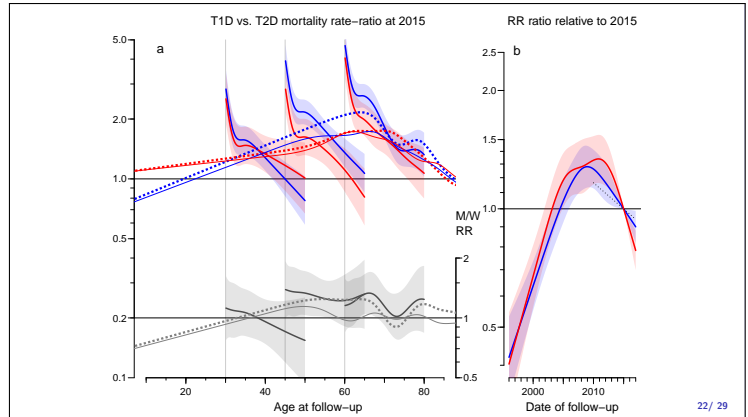
Relative mortality T2D vs. T1D: **0.58**
 — T2D patients have a 42% **lower** mortality than T1D
 Relative mortality Men vs. Women: **1.6**
 — averaged over type and age

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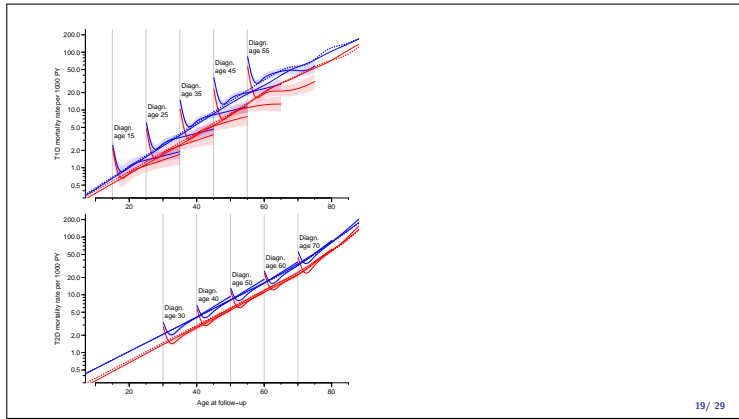
T2D mortality, age at diagnosis 30, 40, 50, 60 and 70



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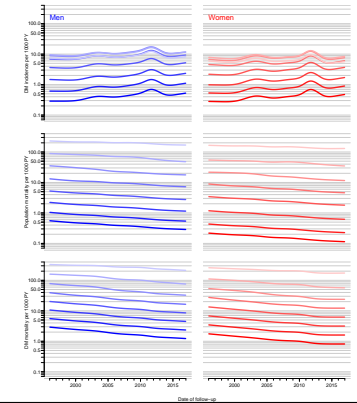


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Incidence and mortality rates
 ages 20, 30, ..., 90



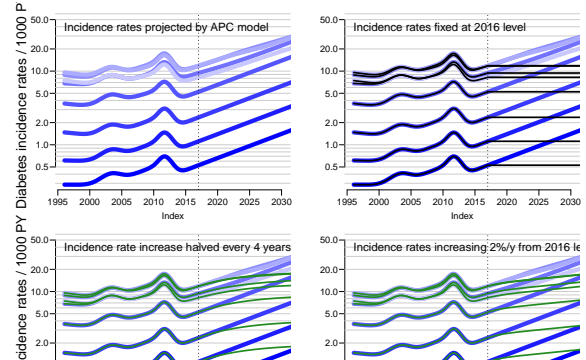
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Mortality conclusion

- ▶ 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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Incidence rates in the future



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