

# Incidence and prevalence of drug use – A brief overview

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## Topics

- Definitions of epidemiological measures of drug use
- How can they be estimated from dispensing data
- The relation between incidence, prevalence and duration
- The waiting time distribution
- Dynamic pharmacoepidemiologic model of drug use

## Period prevalence

- The proportion of a population that uses a drug within a period, e.g. within year
- E.g., what proportion of the Danish population used insulin in 2010?
- 68.904 out of 5.5 million redeemed a prescription on insulin in 2010 (1,25%)

[www.medstat.dk](http://www.medstat.dk)

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## Period prevalence, caveats

- A mish-mash of prevalent and incident use
- Underestimated by just counting prescriptions within a year

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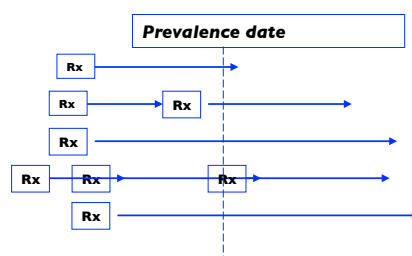
## Point prevalence proportion

- The proportion of a population that on a given point in time uses a particular drug
- What proportion of the Danish population used ADHD drugs on Jan 1st 2011?

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## Methods of estimating point prevalence proportion



1. Fixed period, e.g. 30 days
2. Assuming fixed daily intake, e.g. 1 DDD/day
3. Legend duration/Quantity and prescribed daily dose
4. +/- allowance for non-compliance

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## Point prevalence proportion, caveats

- May depend heavily on the assumed period of usage assigned to a prescription → sensitivity analyses !

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## Incidence rate, definition

$$\text{Incidence rate} = \frac{\text{New disease occurrences}}{\text{The person-time at risk that gave rise to the new cases}}$$

Unit : persontime<sup>-1</sup>, Range: 0 - ∞

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## Incidence rate, estimate

- Numerator: new users after a run-in period
- Denominator: follow-up among non-users

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## Incidence rate, caveats

- Run-in period may be too short → overestimate

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## Estimate of the duration of treatment

$$d = \frac{p}{(1-p) \times i}$$

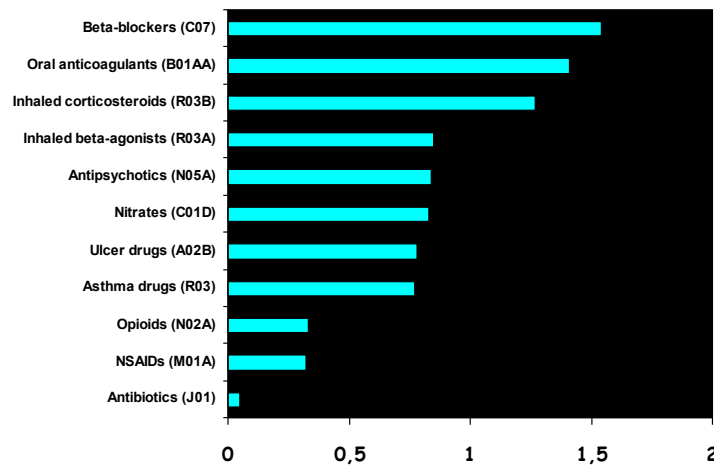
where

- d = average duration of treatment
- p = point prevalence of treatment
- i = incidence of treatment

## Caveats for duration estimate

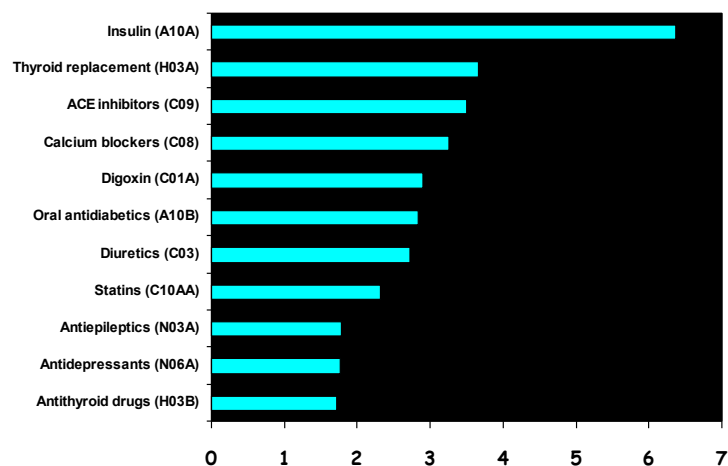
- Inherited problems from point prevalence estimate
- Non-equilibrium states
- Interpretation (life table technique)

### Durations for selected drugs, low end Funen County, 2003



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### Durations for selected drugs, high end Funen County, 2003



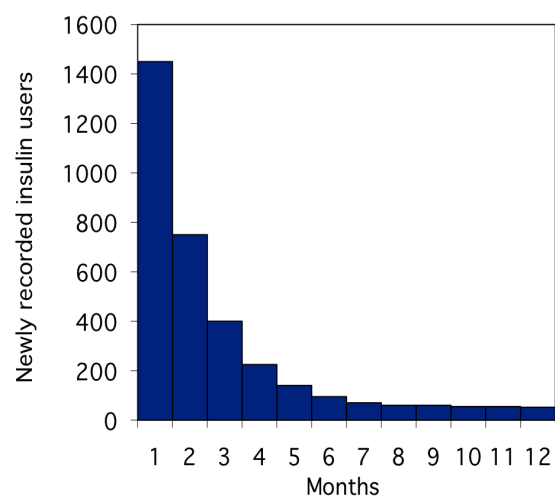
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## Waiting time distribution Description

- The distribution of time until the first prescription for users of specific drugs within a chosen time window
- Example:  
When did the insulin users redeem their first prescription in 2010?

## The waiting time distribution

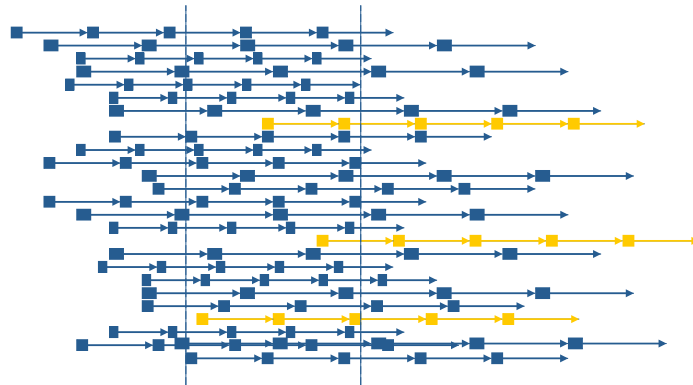
Hallas et al, Epidemiology 1997





## Model for waiting-time distribution, insulin example

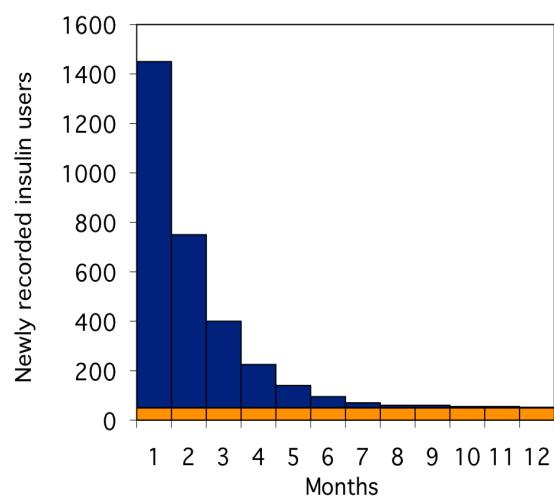
2010



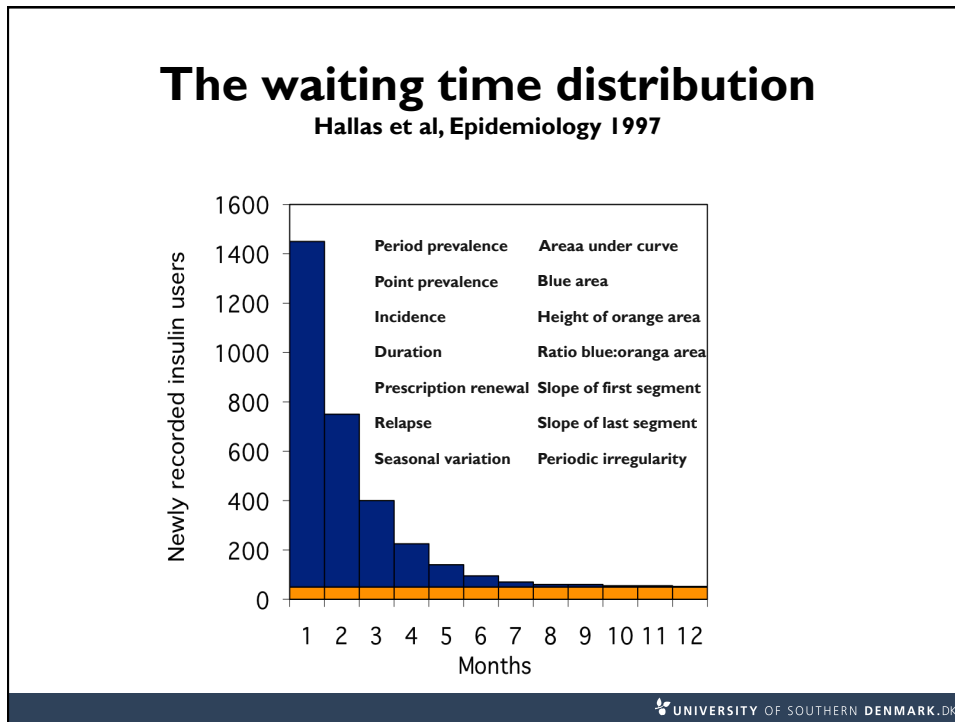
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## The waiting time distribution

Hallas et al, Epidemiology 1997



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## Dynamic pharmacoepidemiological model of drug use

- Prevalence of drug use determined by
  - Incidence of use
  - Discontinuation of use (~ duration)
  - Mortality among users
- How can we look at this at the population level?

Kildemoes HW et al, Br J Clin Pharmacol 2008

Kildemoes HW et al, Pharmacoepidemiol Drug Saf 2010

## Dynamic pharmacoepidemiological model of drug use

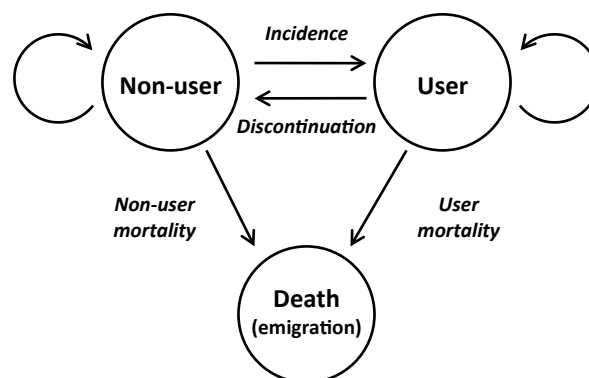
- Analyse prescription data in repeated one-year periods
- Cross-section at the beginning of the year:
  - Point prevalence of drug use defined as  $\geq 1$  prescription during the past year (1st year run-in period)
- Cohort during the next year:
  - Incidence rate\* of use among non-users
  - Discontinuation rate\* among users
  - Mortality rates\* of users and non-users

\* or proportions

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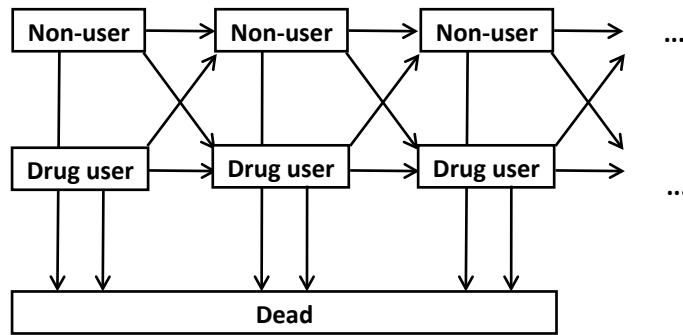
## Semi-markov model of drug use



Transitions between defined states

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## Transitions from one year to the next



(here migration is ignored)

## Group Work

## **A. Epidemiological measures**

1. What is the point prevalence of statin and ARB use in 2005?
2. What are the epidemiologic "driving forces" of the increase in prevalence?
3. Could epidemiological measures of drug use contribute to the understanding of the drug utilisation patterns?
4. Which epidemiological measure of drug use would you prefer for evaluating changes in prescriber behaviour?

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## **B. Interpretation of data**

1. What do these statistics tell us about prescribing quality?
2. What is the public health relevance of the utilisation data?
3. Are there additional data that would add to the interpretation?

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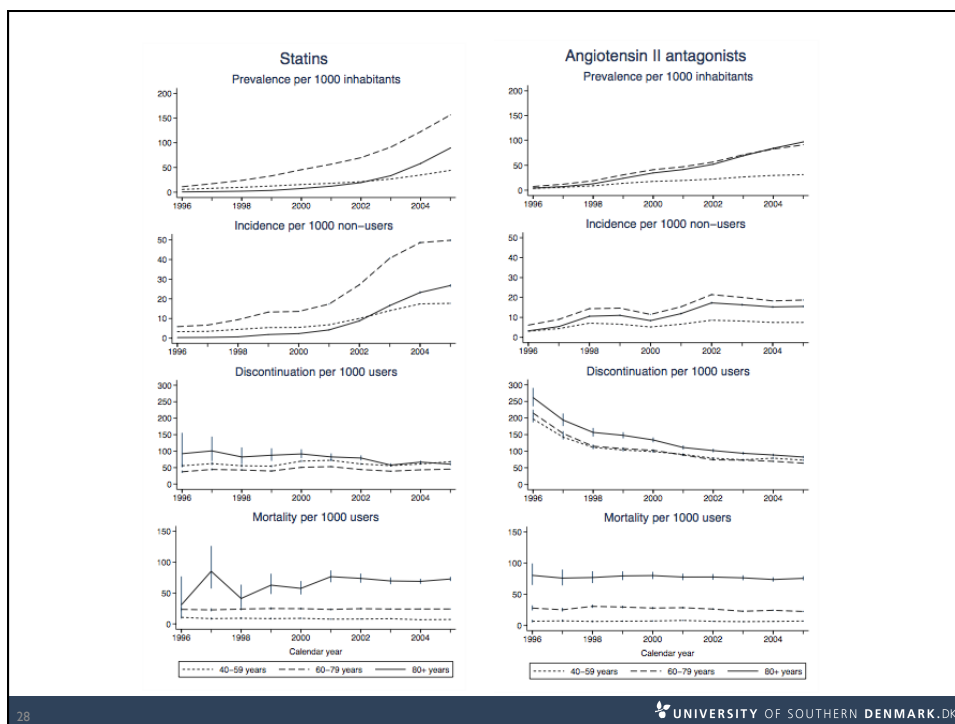
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## Data from Danish national population-based statistics

| <b>C10AA Statins</b>            | <b>2001</b> | <b>2002</b> | <b>2003</b> | <b>2004</b> | <b>2005</b> |
|---------------------------------|-------------|-------------|-------------|-------------|-------------|
| Expenditures (Mill EUR)         | 47          | 63          | 59          | 42          | 35          |
| Therapeutic intensity (DDD/TID) | 20          | 29          | 44          | 66          | 89          |
| Total annual use (Mill DDD)     | 40          | 56          | 87          | 130         | 175         |
| <b>C09CA ARBs</b>               | <b>2001</b> | <b>2002</b> | <b>2003</b> | <b>2004</b> | <b>2005</b> |
| Expenditures (Mill EUR)         | 23          | 28          | 32          | 35          | 38          |
| Therapeutic intensity (DDD/TID) | 12          | 15          | 18          | 20          | 22          |
| Total annual use (Mill DDD)     | 24          | 29          | 35          | 39          | 43          |

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