Epidemiologic notes on type 2 diabetes

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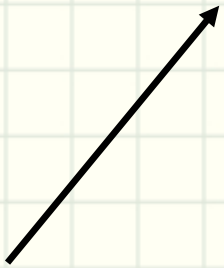
The type 2 diabetes epidemic

Prevalence = Incidence * Duration



Risk factors

The type 2 diabetes epidemic

Prevalence

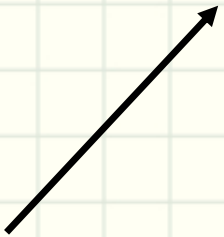
The number of people with diabetes is increasing due to population growth, aging, urbanization, and increasing prevalence of obesity and physical inactivity. Quantifying the prevalence of diabetes and the number of people affected by diabetes, now and in the future, is important to allow rational planning and allocation of resources.

Wild S, Roglic G, Green A, Sicree R, King H. Global prevalence of diabetes: estimates for the year 2000 and projections for 2030. Diabetes Care. 2004;27:1047-53.

Increasing population life expectancy

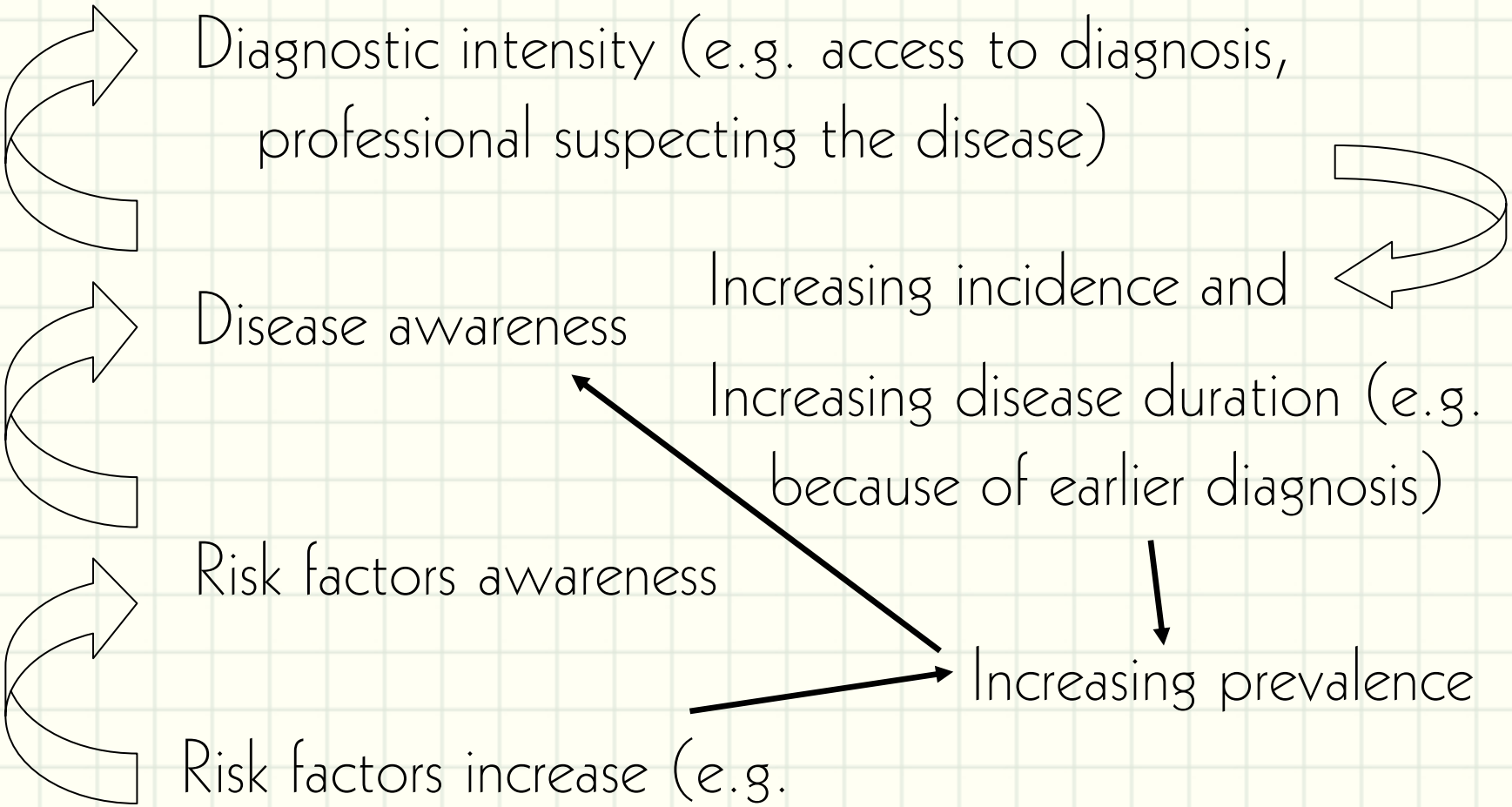


Prevalence = Incidence * Duration



Improved care of the disease and its complications

Feedback


Diagnostic intensity (e.g. access to diagnosis, professional suspecting the disease)
Disease awareness
Risk factors awareness
Risk factors increase (e.g. obesity epidemic)
Increasing prevalence
Increasing incidence and
Increasing disease duration (e.g. because of earlier diagnosis)

Earlier diagnosis of diabetes

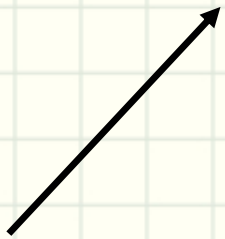
- Is type 2 diabetes diagnosed earlier in its natural history?
- If type 2 diabetes was often diagnosed by symptoms due to its complications after years of silent disease, there is room for a large increase in incidence and prevalence
- Is mean age at diagnosis decreasing?
- Is younger age at diagnosis due to risk factor exposure, to increasing diagnosis or both?

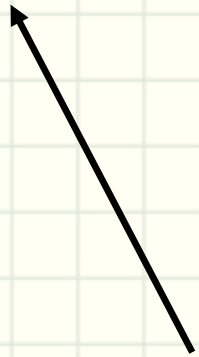
Reporting and defining

Improvement of health archives (administrative data)



Prevalence = Incidence * Duration





Increased reporting (surveys)

Changing diagnostic criteria or test

Opportunistic screening

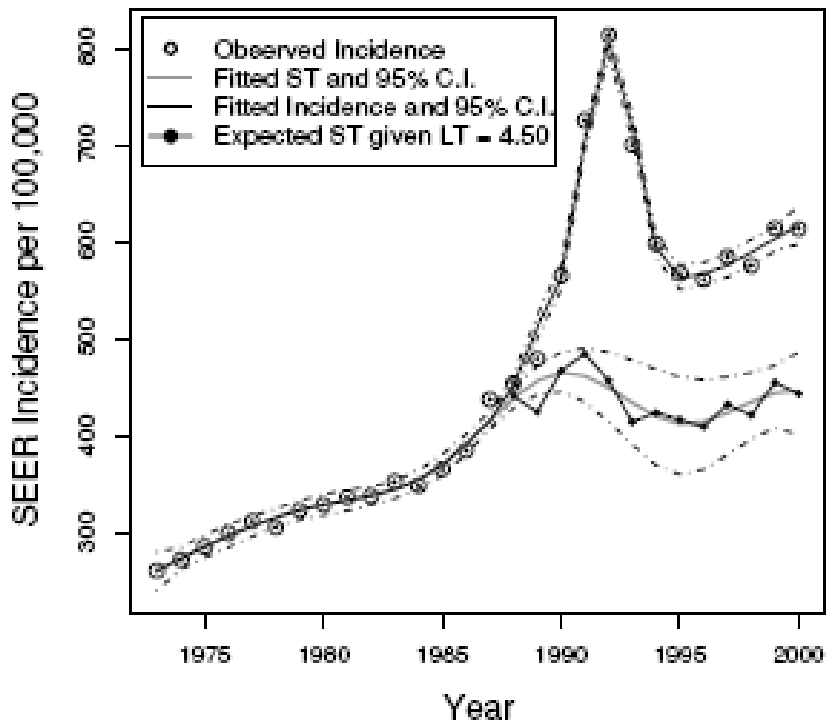
The USPSTF recommends screening for type 2 diabetes in adults with hypertension or hyperlipidemia.

B recommendation.

The USPSTF found good evidence that, in adults who have hypertension and clinically detected diabetes, lowering blood pressure below conventional target blood pressure values reduces the incidence of cardiovascular events and cardiovascular mortality; this evidence is considered fair when extrapolated to cases of diabetes detected by screening. Among patients with hyperlipidemia, there is good evidence that detecting diabetes substantially improves estimates of individual risk for coronary heart disease, which is an integral part of decisions about lipid-lowering therapy.

Screening for type 2 Diabetes Mellitus in Adults, Topic Page. February 2003. U.S. Preventive Services Task Force. Agency for Healthcare Research and Quality, Rockville, MD.
http://www.ahrq.gov/clinic/uspstf/uspsdiab.htm

Cancer incidence and screening



Telesca D, Etzioni R, Gulati R. Estimating Lead Time and Overdiagnosis Associated with PSA Screening from Prostate Cancer Incidence Trends.Biometrics. 2007 May 14;

- Cancer screening was responsible for a steep increase in incidence of many cancers (e.g. prostate cancer, melanoma, breast cancer)

Prevalence measure

- A population based study using defined accepted criteria for the diagnosis of type 2 diabetes would provide prevalence measures (diagnosed + not diagnosed diabetes) in a given population, if participation in the study would be high

- Repeated testing over time in a cohort would provide clues on incidence and influence of risk factors

- Prevalence of diabetes has no direct and simple interpretation. How much of the reported increase in prevalence of type 2 diabetes is due to improved diagnosis and care?

Hauner H, Hanisch J, Bramlage P, Steinhagen-Thiessen E, Schunkert H, Jöckel KH, Wasem J, Moebus S.

Prevalence of Undiagnosed Type-2-Diabetes Mellitus and Impaired Fasting Glucose in German Primary Care: Data from the German Metabolic and Cardiovascular Risk Project (GEMCAS).

Exp Clin Endocrinol Diabetes. 2007 Oct 9;

...prevalence of known type 1 and type 2 diabetes mellitus was found to be 0.6 and 12.2%, respectively. Another 2.9% (23% of the diagnosed) had either undiagnosed diabetes (0.9%) or impaired fasting glucose (2.0%)...

Smith SM, Holohan J, McAuliffe A, Firth RG. Irish diabetes detection programme in general practice.

Diabet Med. 2003;20:717-22.

> Forty-one practices returned 3821 questionnaires. The prevalence of Type 2 diabetes mellitus in the study population was 9.2% (353), of whom 23.5% (83) were previously undiagnosed (i.e. 83/3821=2.2% ?)...

Leiter LA, Barr A, Bélanger A, Lubin S, Ross SA, Tildesley HD, Fontaine N; Diabetes Screening in Canada (DIASCAN) Study. Diabetes Screening in Canada (DIASCAN) Study: prevalence of undiagnosed diabetes and glucose intolerance in family physician offices.

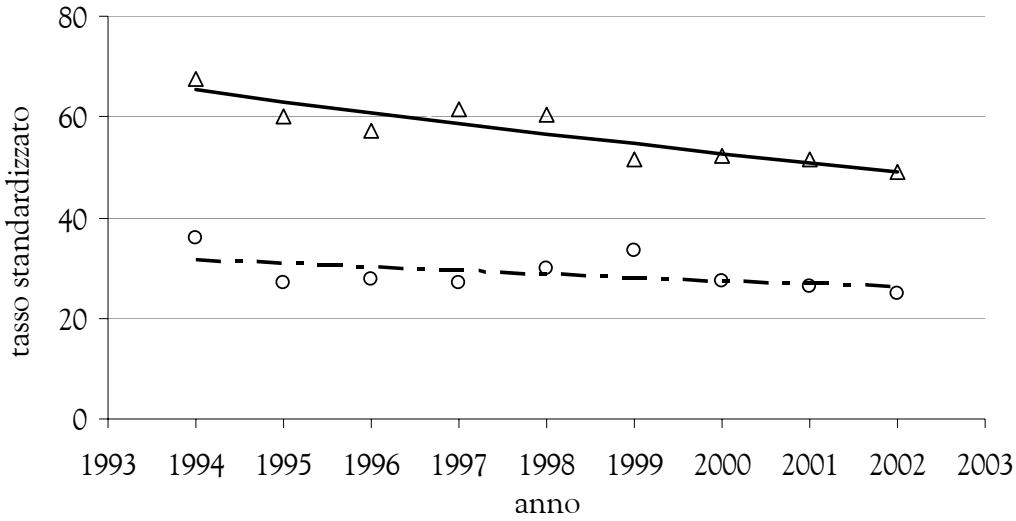
Diabetes Care. 2001;24:1038-43.

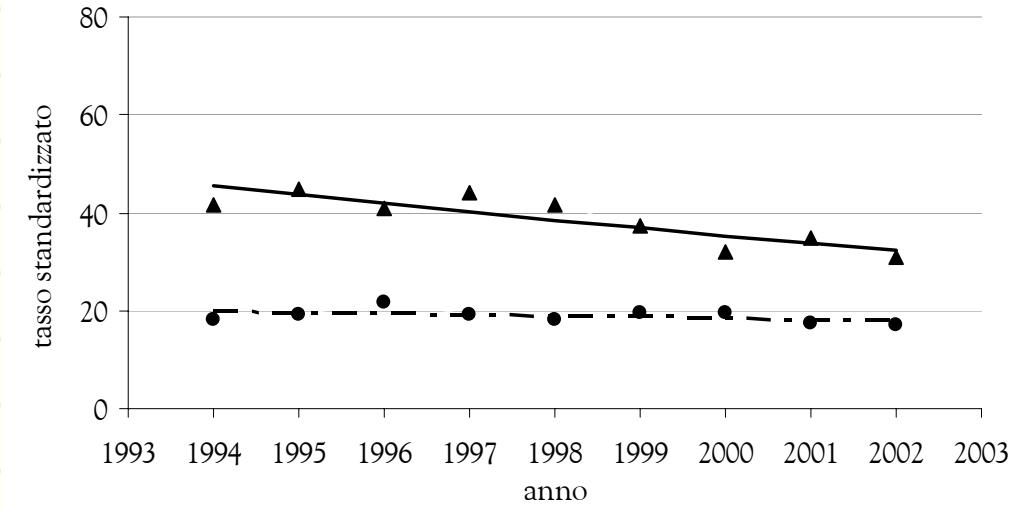
> . . . Previously undiagnosed diabetes was discovered in 2.2% of the patients, and new glucose intolerance was found in an additional 3.5% of patients. Overall, 16.4% of patients had previously known diabetes. . .

Diabetes and mortality

- Mortality offers a hard surveillance indicator for many lethal diseases

Incidence and mortality trends for gastric cancer in Umbria, Italy (1994-2002)





Incidence.

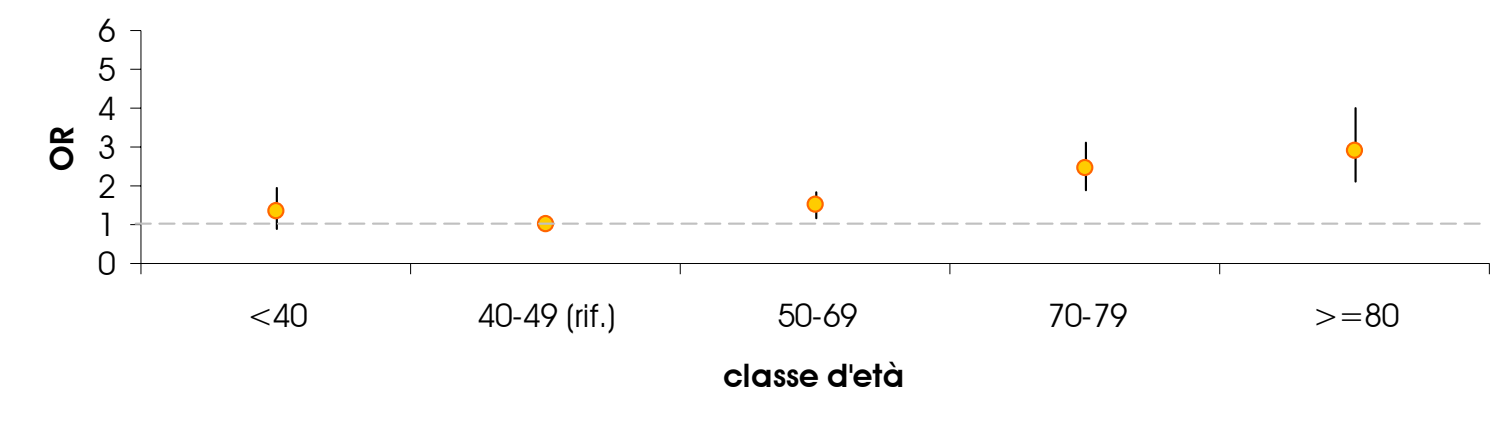
Male + observed rate
line: joinpoint (jp=0), EAPC –3.5 (95%IC da –4.9 a –2.0).
Female,) observed rate;
dashed line joinpoint (jp=0), EAPC –2.3 (95%IC da –5.7 a 1.1)

Mortality

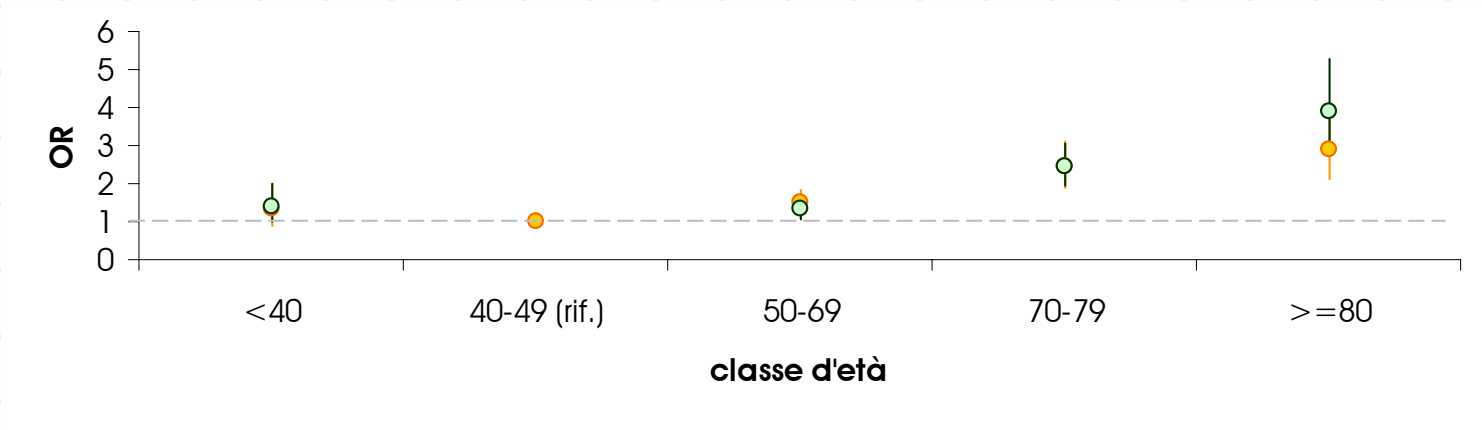
Male % observed rate;
line joinpoint
EAPC –4.2
(95%IC da –6.3 a –1.9).
Female, # observed rate;
dashed line: joinpoint
EAPC –1.2
(95%IC da –3.5 a 1.1)

Diabetes and mortality

- Mortality offers a hard surveillance indicator for many lethal diseases
- Official mortality data were often unreliable with respect to the burden of diabetes
  - Because diabetes was underreported in causes of death certifications
  - Because type 2 diabetes progresses over many years and thus actual mortality does not reflect recent trends
- However mortality within the cohort of registered cases allows for risk and survival analyses even if cause of death certifications are inadequate and may be useful particularly if large datasets become available



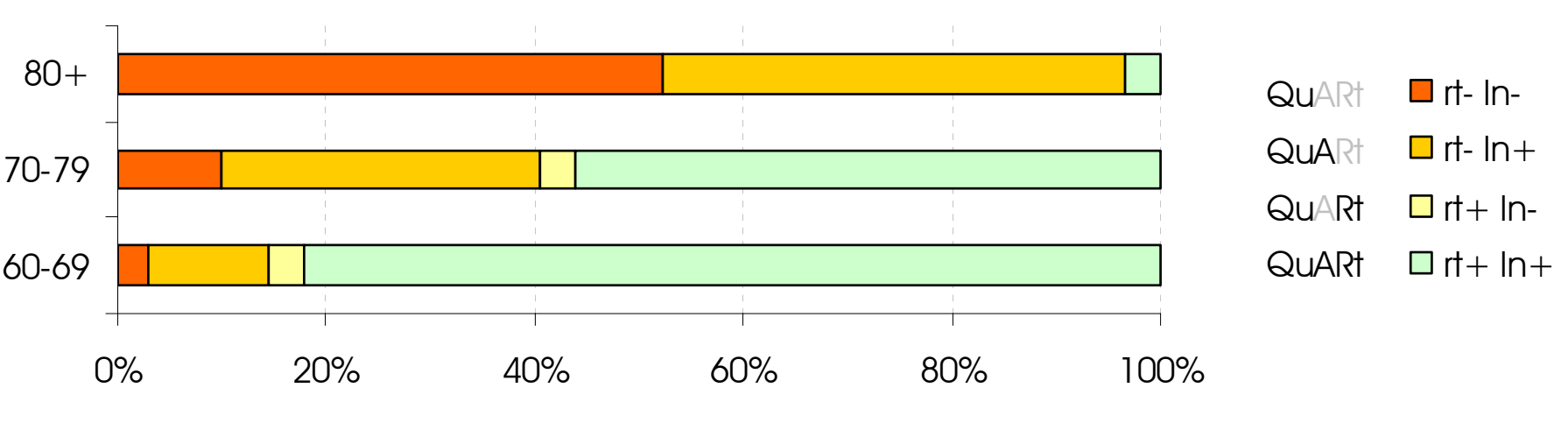
Odds ratios of receiving mastectomy by age class for cases in stage I to III (adjusted for multifocality, diameter, hospital volume, year of surgical treatment)



Same as above but also odds ratios unadjusted for diameter are shown (green circles)

- Oldest old women have a odds ratio of 2.9 and 3.9 respectively adjusted and unadjusted for main diameter of receiving mastectomy instead of BCS

Treatment associated with BCS by age class
(period 1998-2001)

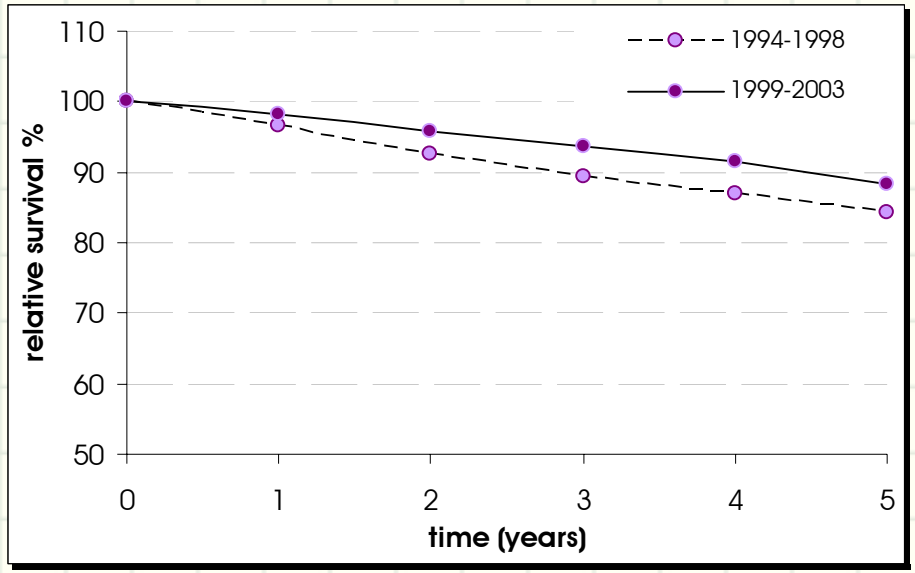


- Axillary dissection after breast conserving surgery was frequently omitted in women >=80 years old; about 30% of women in this age class were treated with BCS

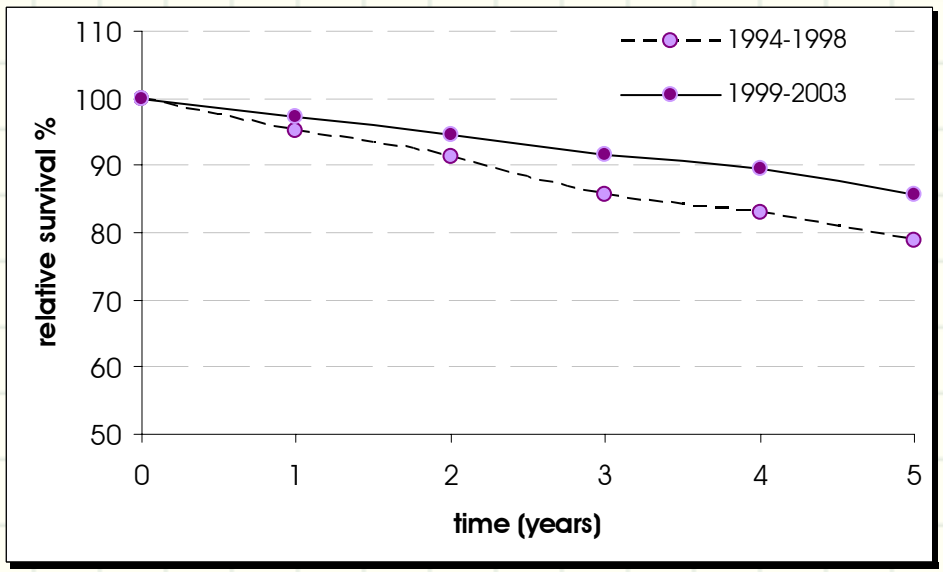
- Radiotherapy use decreased with increasing age and was almost not used among the oldest old

Relative survival among elderly women by age class and period

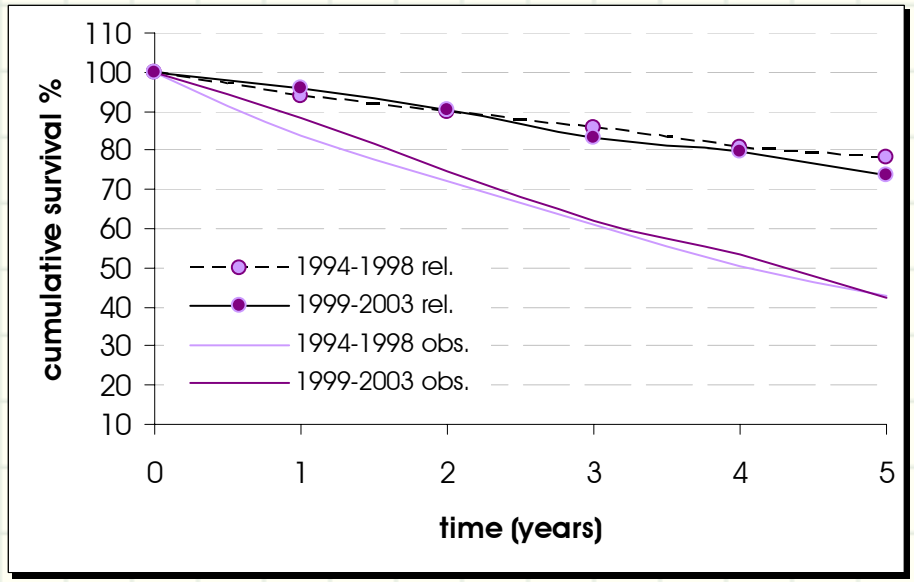
60-69



70-79

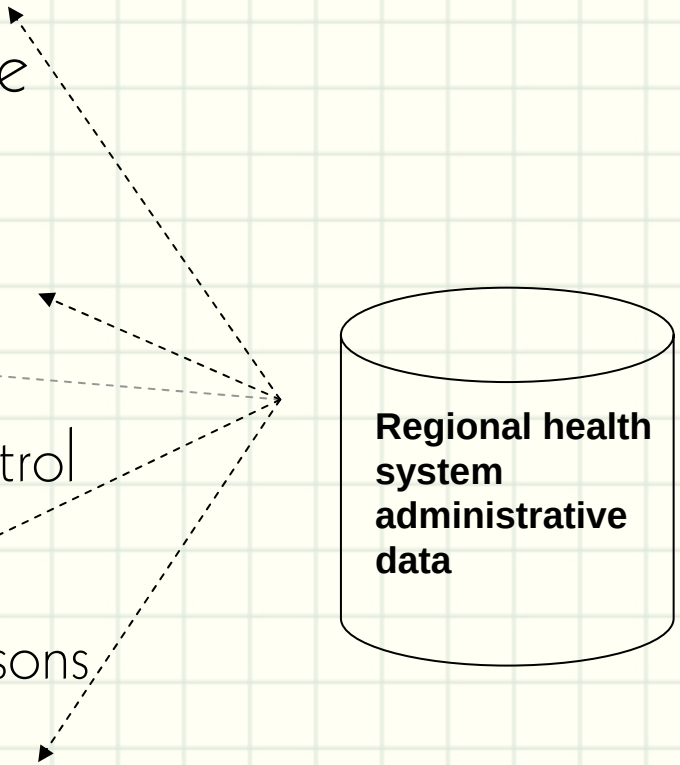


80+



The Umbria Diabetes Register

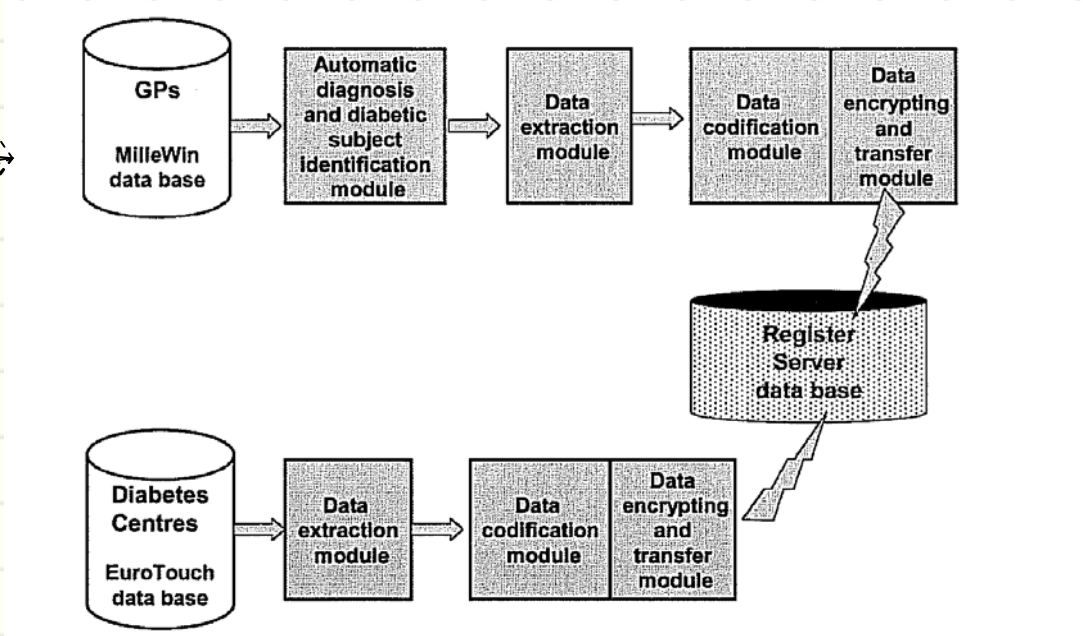
- Surveillance
- Quality of care evaluation
  - health system
  - process
  - diabetes control
  - outcomes
  - diseased persons
- Costs



Uses of data and available data sources

- Surveillance
- Quality of care evaluation
  - health system
  - Process
  - diabetes control
  - outcomes
  - diseased persons
- Costs

[Usually coverage is incomplete]



Uses of data

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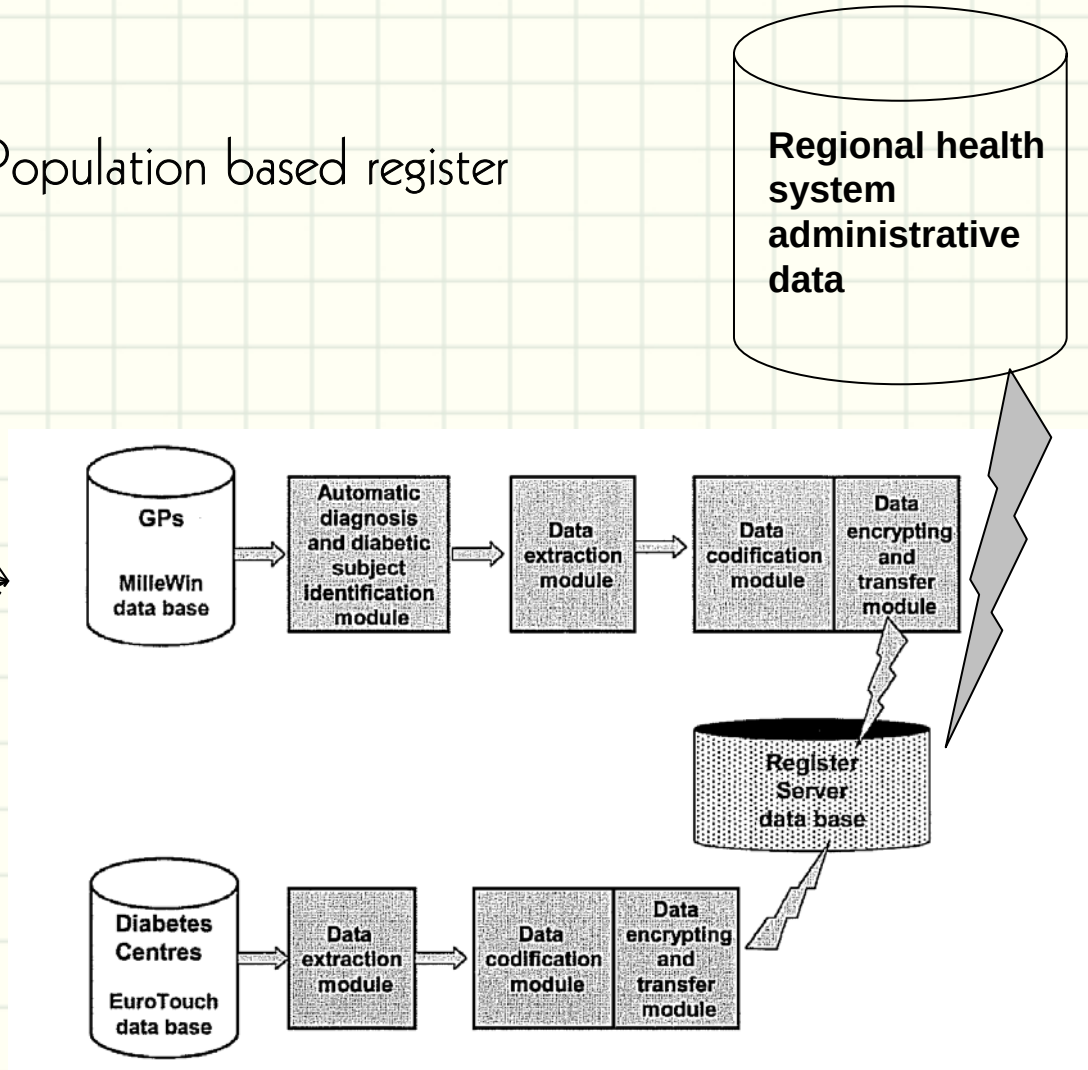
Population based register



Administrative + clinical datasets

A system based on both administrative and clinical datasets present many advantages:

- evaluation of data quality (completeness and validity)
- availability of data for non participating GP/centres and production of population-based indicators
- simplified access to relevant information (e.g. hospitalization, specialist care, follow-up)

A diabetes register may produce:

- Prevalent cases (history)
- First diagnosis of new cases of diabetes
- Fixed variables (e.g. gender, presence of complications at diagnosis)
- Longitudinal data:
  - Quality of care process indicators; typically measured repeatedly (e.g. foot exam),
  - Parameters linked to disease control (e.g. blood pressure) typically measured repeatedly
- Progressive complications (e.g. rethinopathy, microalbuminuria)
- Events (e.g. myocardial infraction, stroke, acute complication)

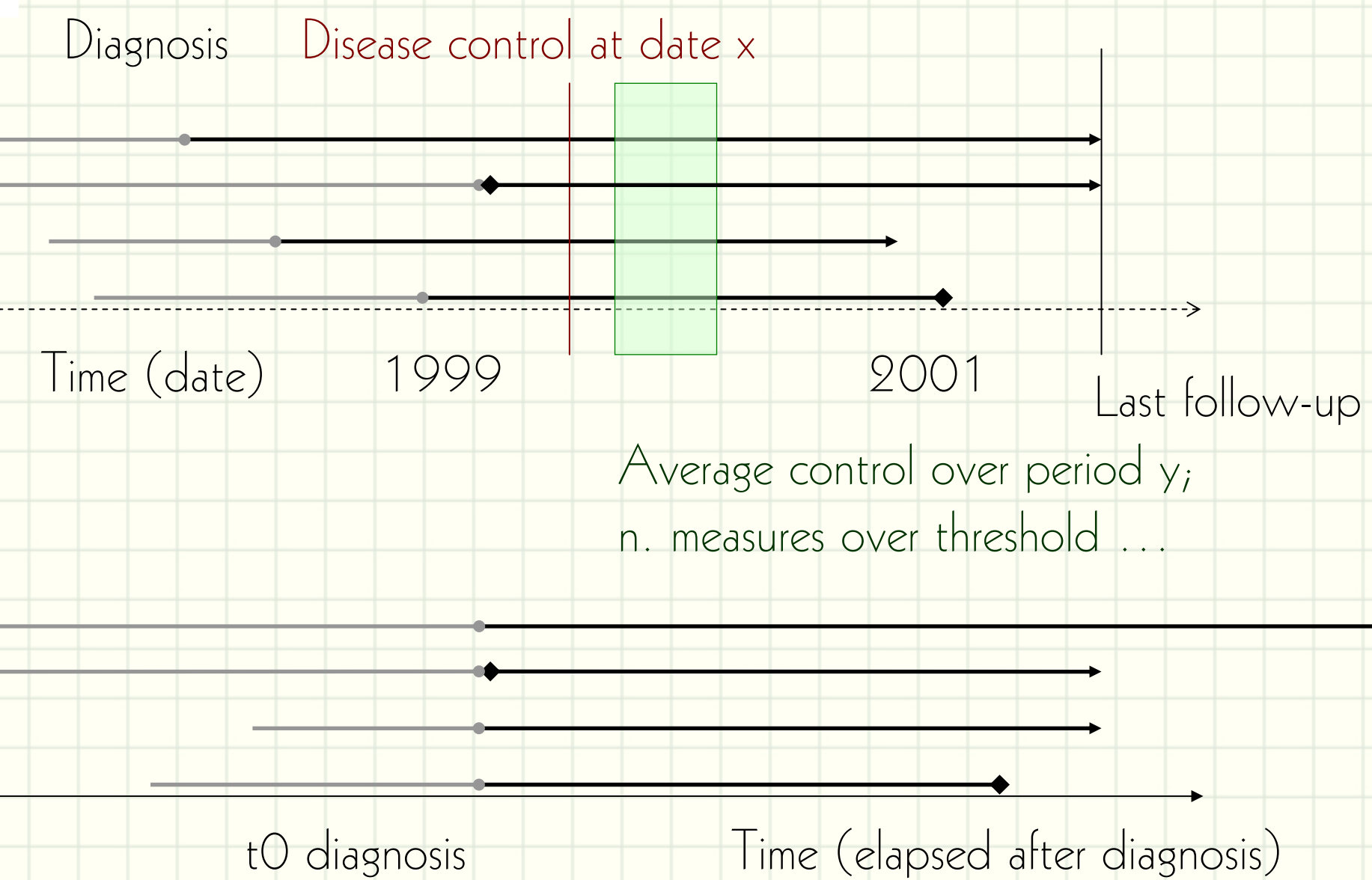
BIRO Report

Interpretation of statistical results:

How to make best use of
available information

Complex datasets are produced

- Age is an important timescale
- Disease duration is another fundamental timescale
- Simplified indicators should be produced to assess overall quality of care and disease control over a defined period
- More complex analyses should be produced to assess the different contributions of interventions to disease control and prevention of complications/death



Average control over period y;
n. measures over threshold . . .

Control achieved after diagnosis;
Risk of complications/death