

Diabetes outcomes
Keystone
17 July 2014

How diabetes outcomes have changed over the past 30 years



**Professor Philip Home
Newcastle University**

How diabetes outcomes have changed over the past 30 years

Duality of interest:

The speaker for himself or institutions with which he is associated receives funding for his research, advisory, and speaker activities from most manufacturers of diabetes medications, and some diagnostics companies

Professor Philip Home
Newcastle University

How diabetes outcomes have changed over the past 30 years

An ambiguous title . . .

- 'How . . . something has changed'
 1. By what means? [How did I get to Keystone?]
 2. To what extent? [How did the USA do in the World Cup?]

Loss of vision in people with diabetes

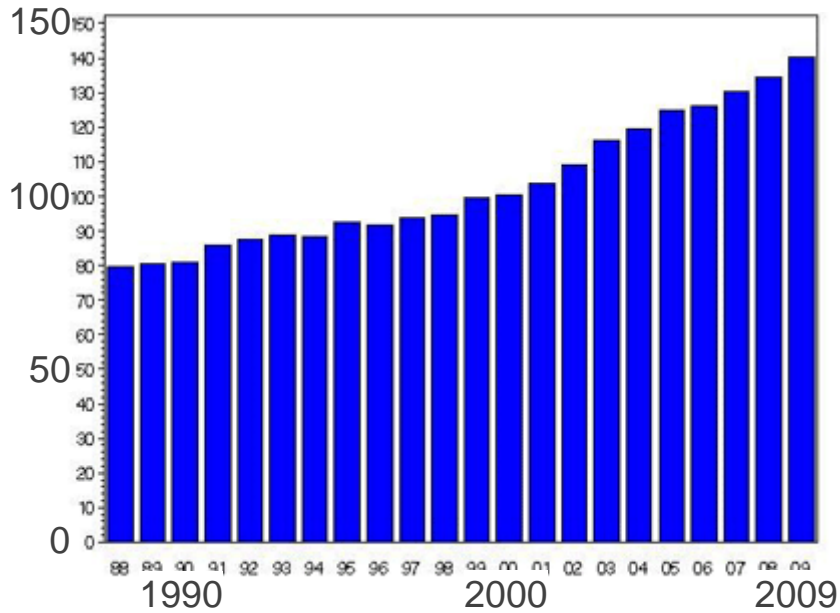
1998-2000 (3 years), Newcastle upon Tyne

- 7 people registered blind, 11 partially sighted
- Incidence rates (due to diabetes)
 - blindness per year
0.87/100 000 population
0.35/1000 people with diabetes
- Screening
 - 84 %/yr (5588 of 6650)

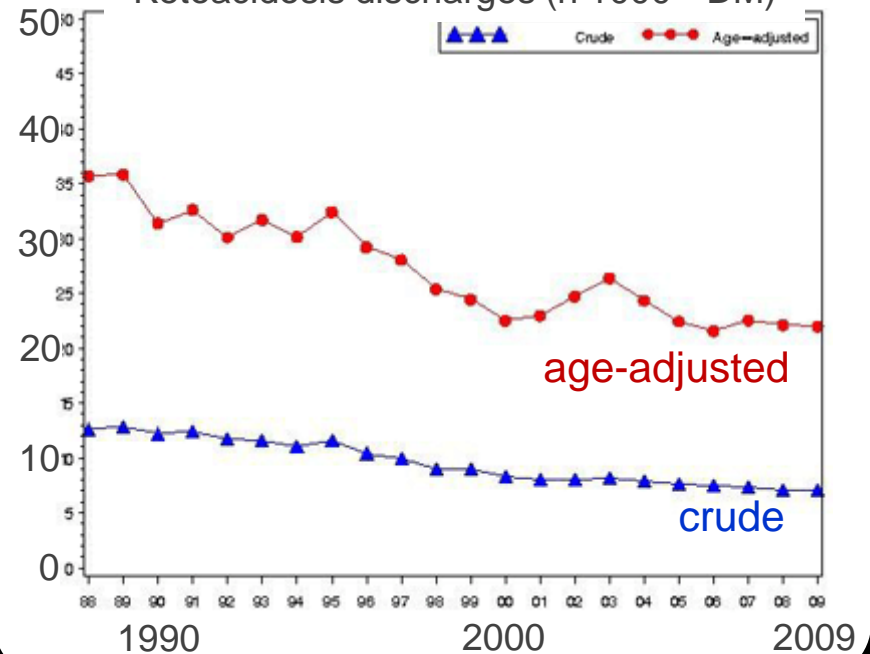
Arun et al, Diabet Med, 2003

Changes in ketoacidosis hospitalizations over 21 years in the USA

Ketoacidosis discharges (n 1000⁻¹)

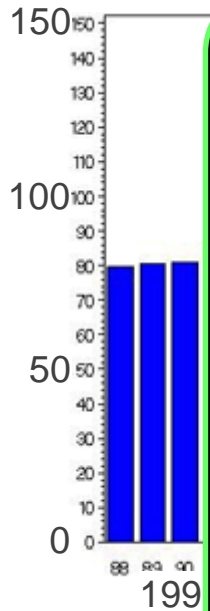


Ketoacidosis discharges (n 1000⁻¹-DM)

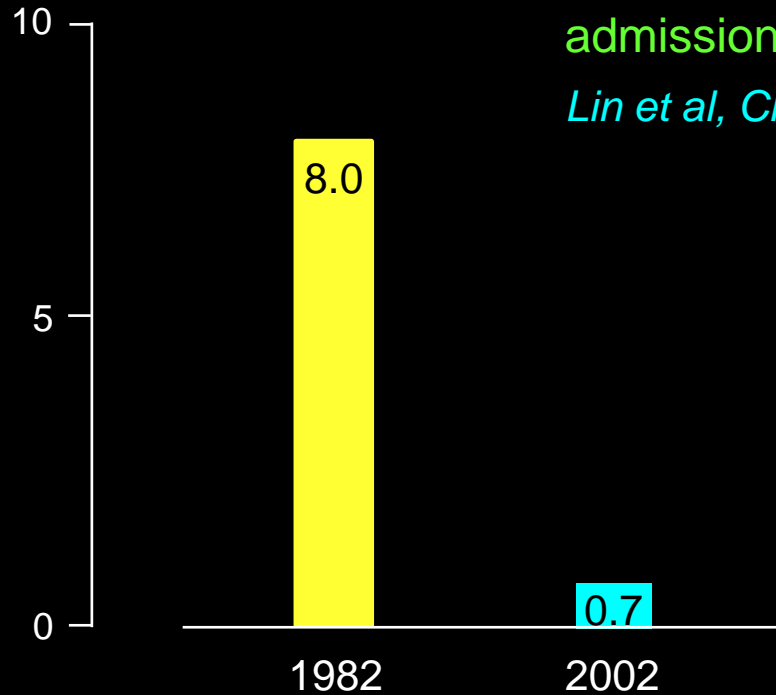


Changes in ketoacidosis hospitalizations over 21 years in the USA

Ketoacidosis discharges (n 1000⁻¹)



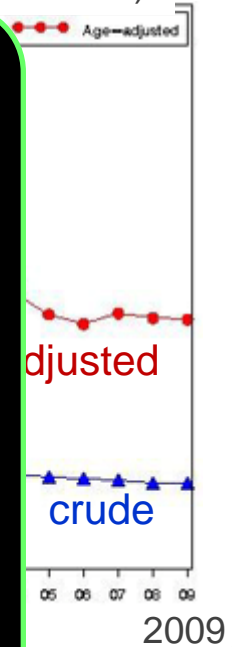
Deaths (% of admissions)



Deaths during ketoacidosis admission in Taipei

Lin et al, Chang Gung Med J, 2005

Ketoacidosis discharges (n 1000⁻¹-DM)



/us/, 2014

Changes in ketoacidosis hospitalizations over 21 years in the USA

Ketoacidosis discharges (n 1000⁻¹)

150
140
130
120
110
100
90
80
70
60
50
40
30
20
10
0

Ketoacidosis discharges (n 1000⁻¹-DM)

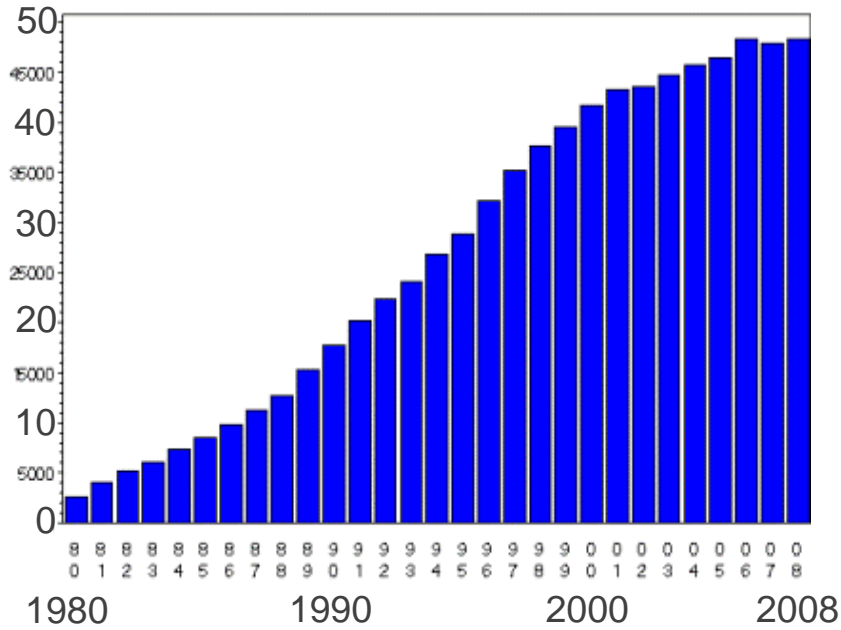
50⁰⁰ Crude Age-adjusted

Understanding the numbers ('how' the numbers change)

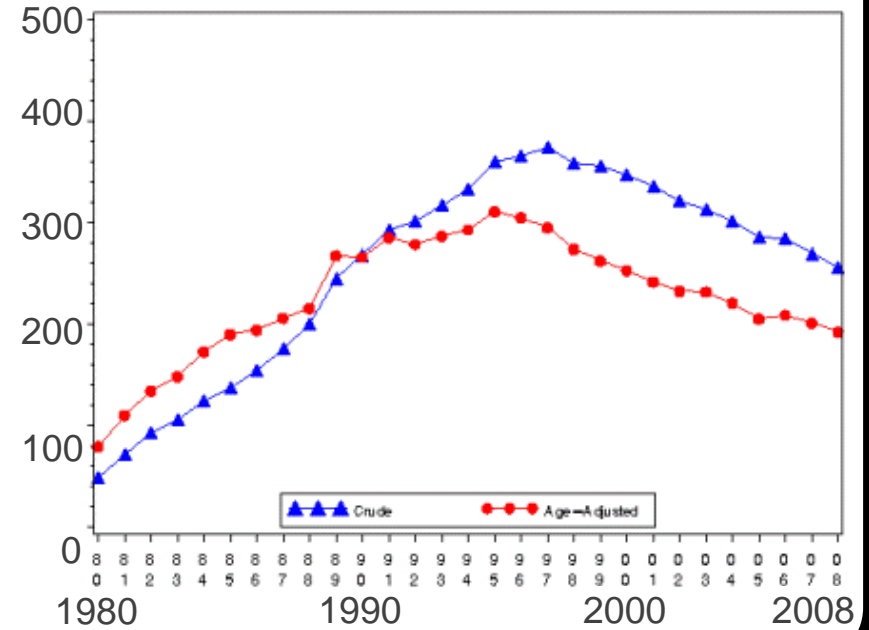
- If the population with a condition increases, the numbers with a related condition (diabetes complication) should increase
- But if the age-profile of the population of interest changes (eg becomes younger), and the related condition is age-related in the general population, then the rate with the related condition should decrease
 - one would expect MI per person with DM to be falling
- If the condition is diagnosed earlier the same effect will apply
- If a complication kills people, and is prevented, then the incidence of a later condition will rise
 - as CV disease is ameliorated, the rate of visual impairment due to macular damage should increase

Changes in renal failure therapy provision over 28 years in the USA

People entering end state renal therapy (n 1000⁻¹)

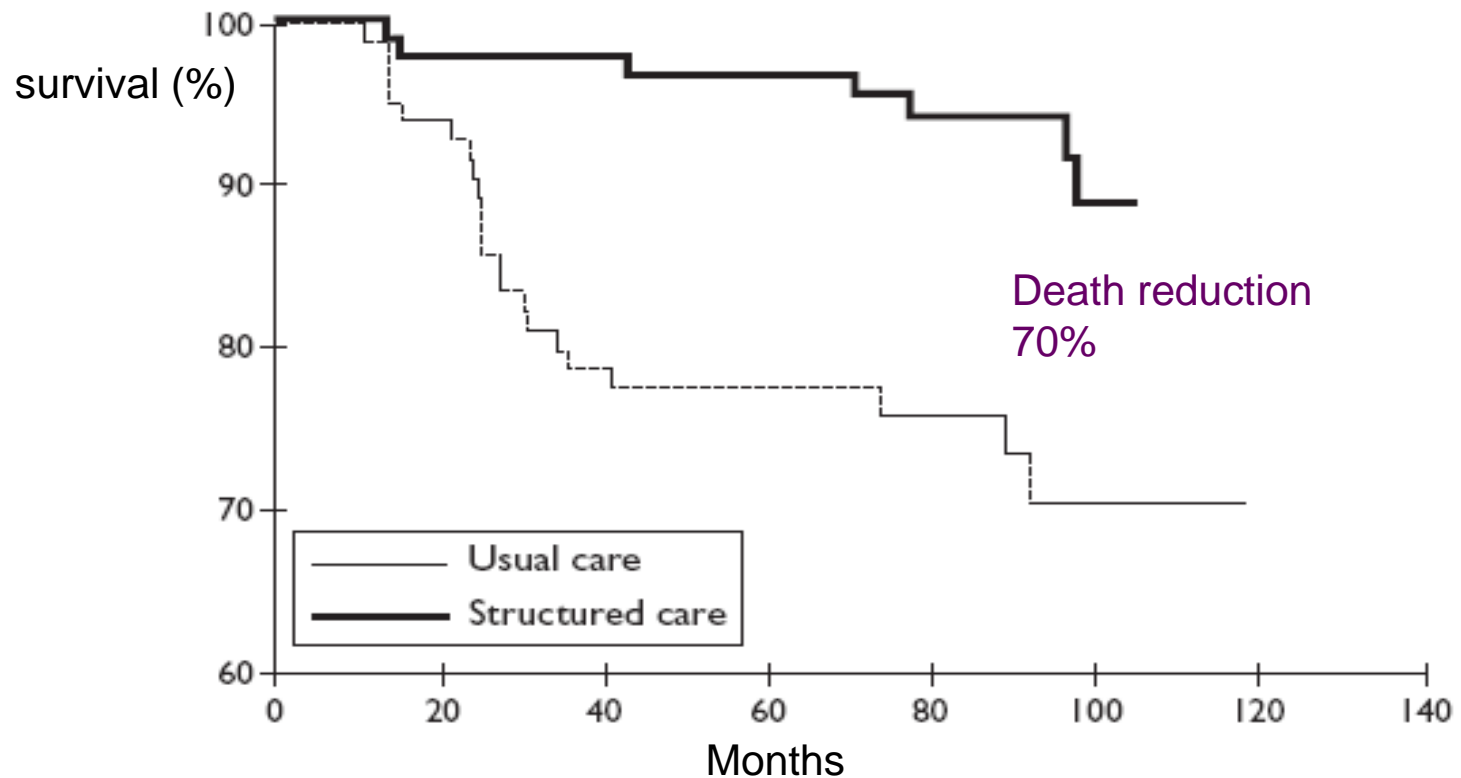


ESRF therapy (n 100,000⁻¹-people)



Hong Kong diabetes care

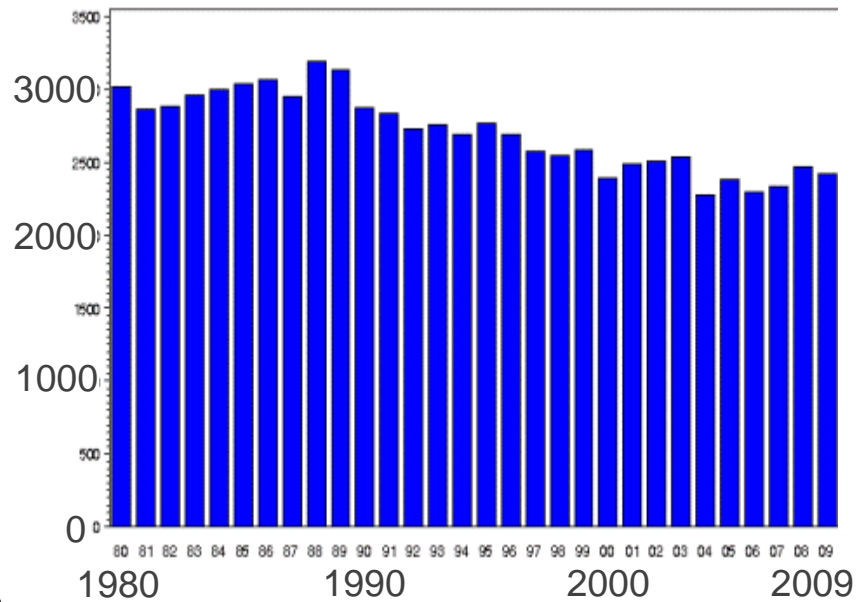
Implementation of protocol + team driven care



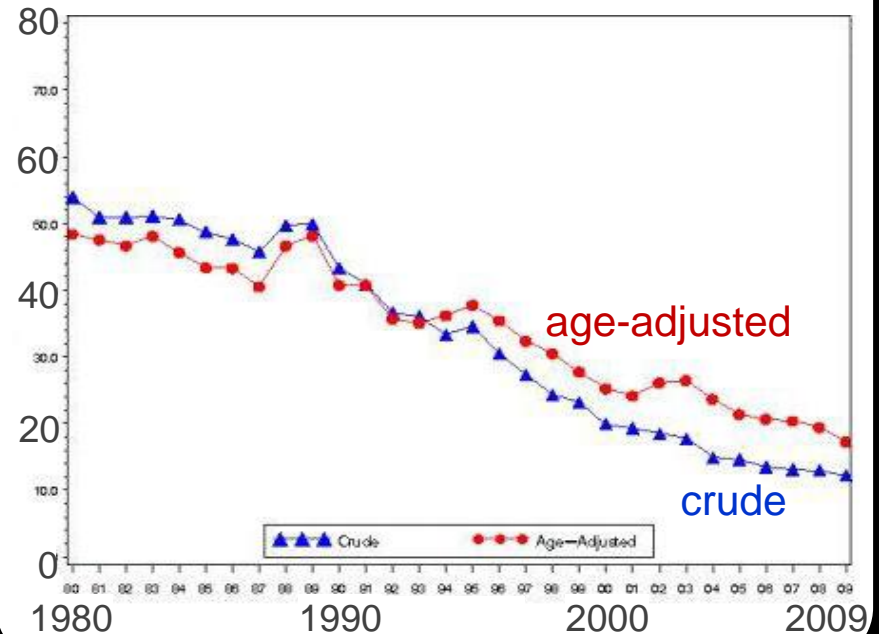
So et al, Am J Managed Care, 2003

Changes in hyperglycaemic events and death over 29 years in the USA

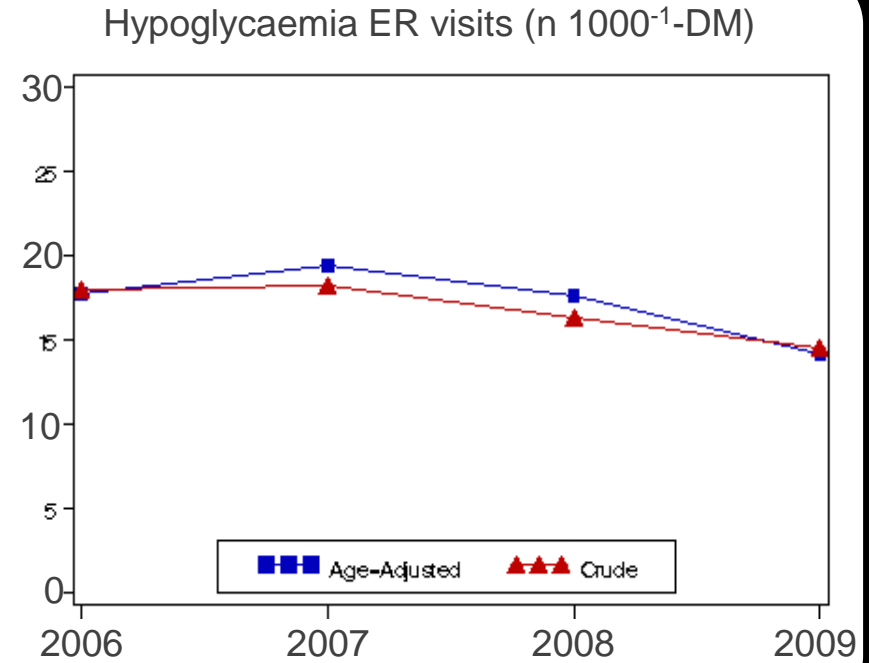
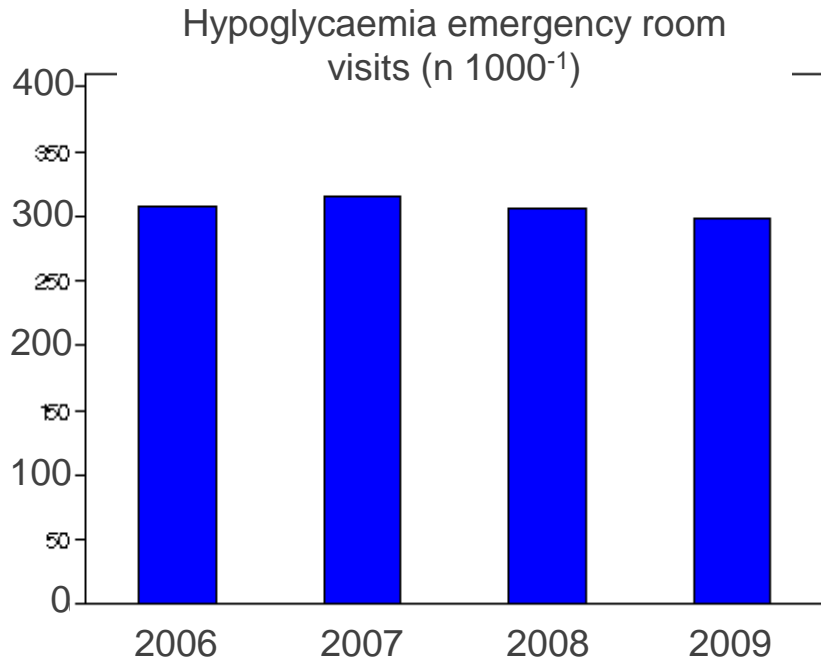
Hyperglycaemic deaths (n)



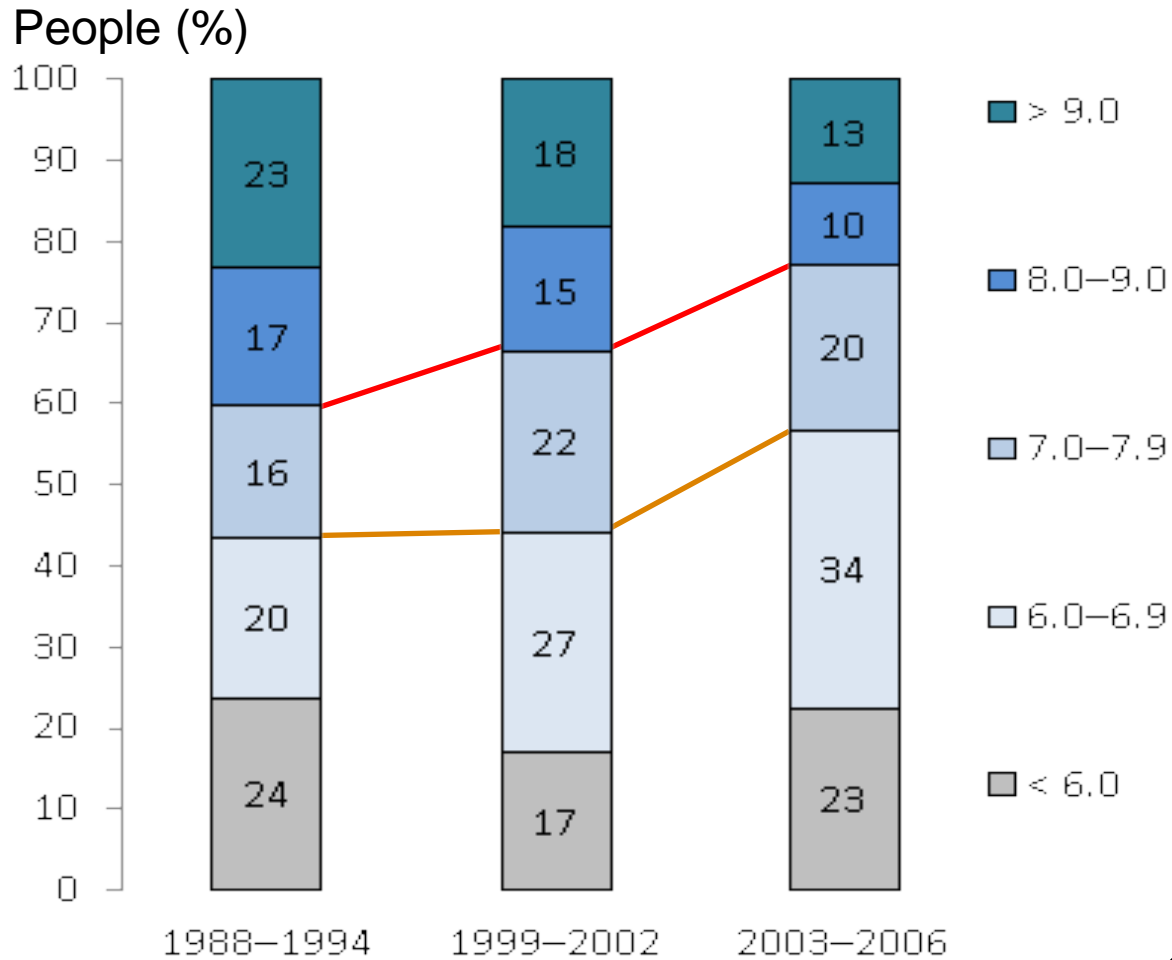
Hyperglycaemic deaths (n 100,000⁻¹-DM)



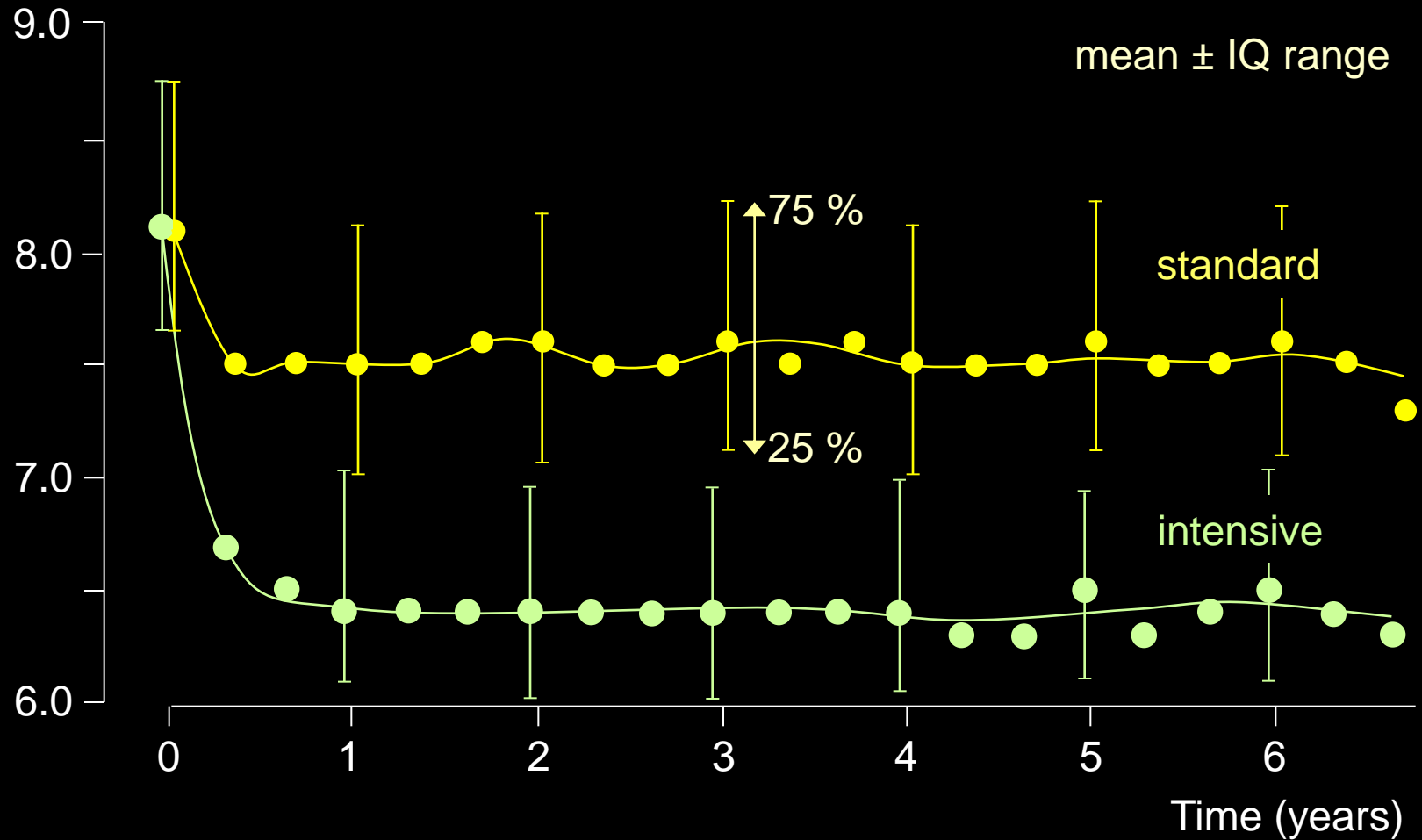
Changes in hypoglycaemia emergency room visits 2006-2009 in the USA



Changes in overall blood glucose control over ~15 years in the USA

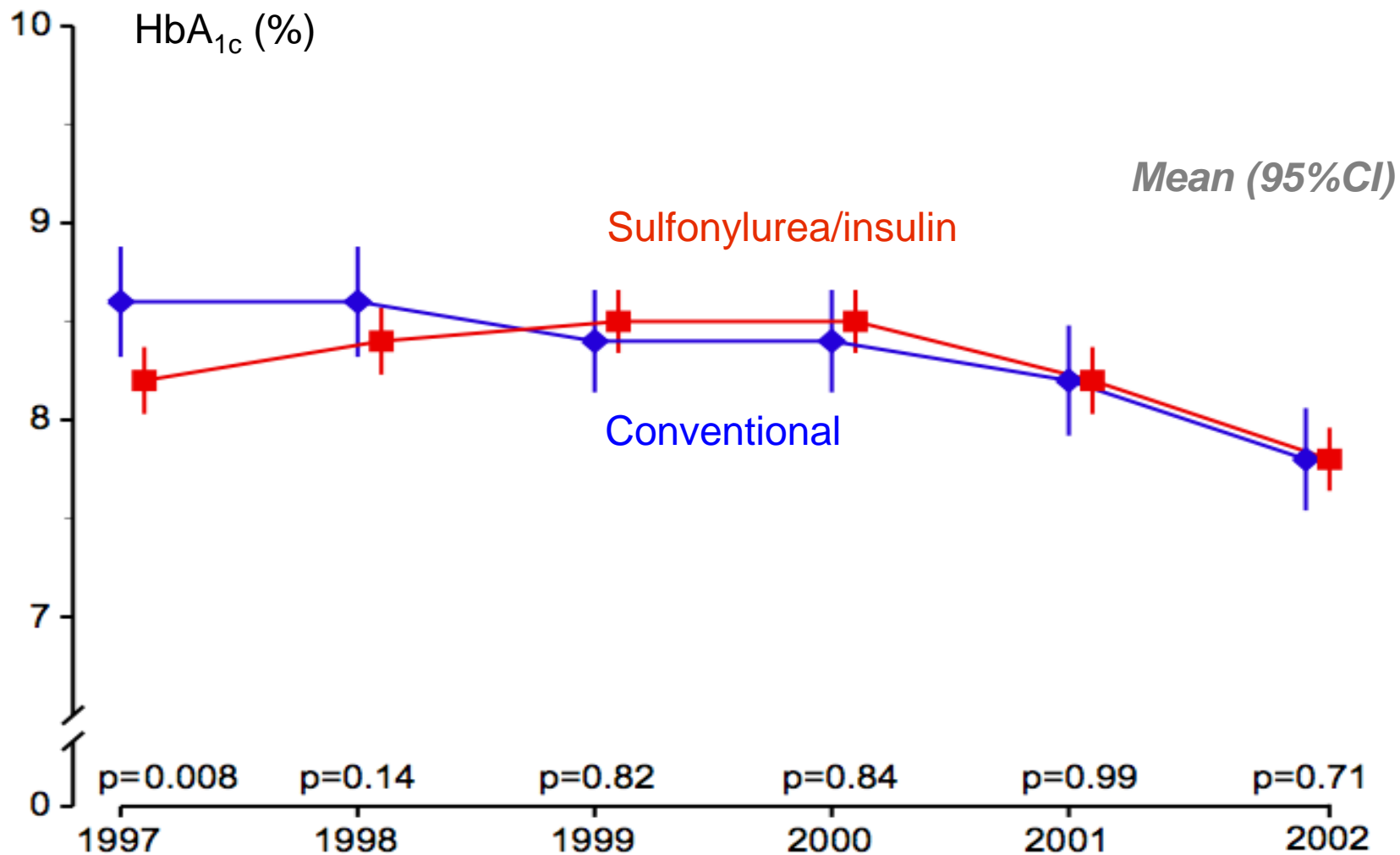


Durability of glucose control in the ACCORD study

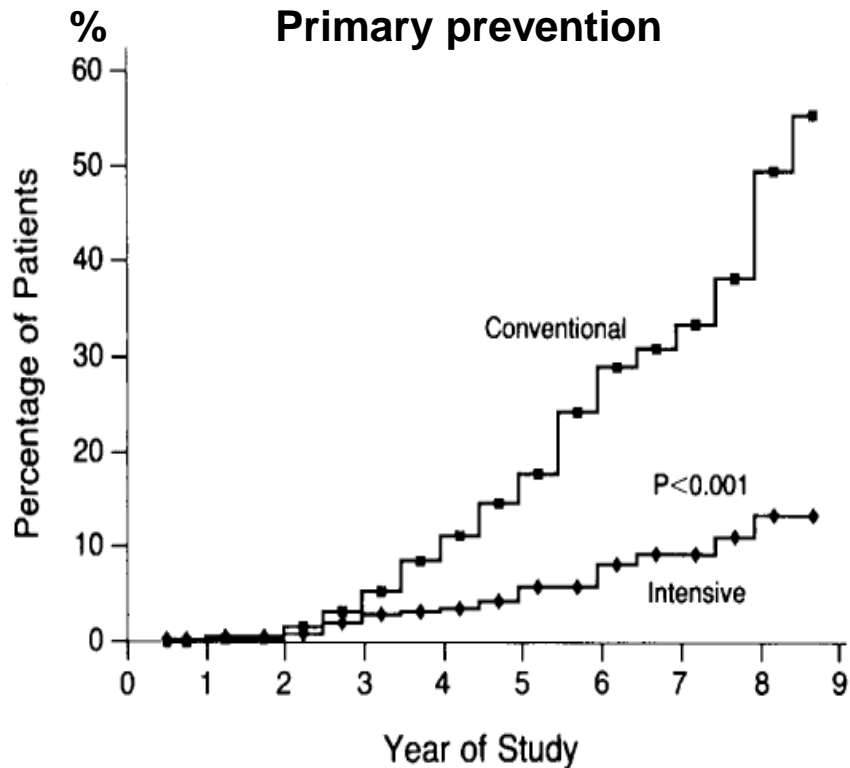


ACCORD Study Group, *N Engl J Med*, 2008

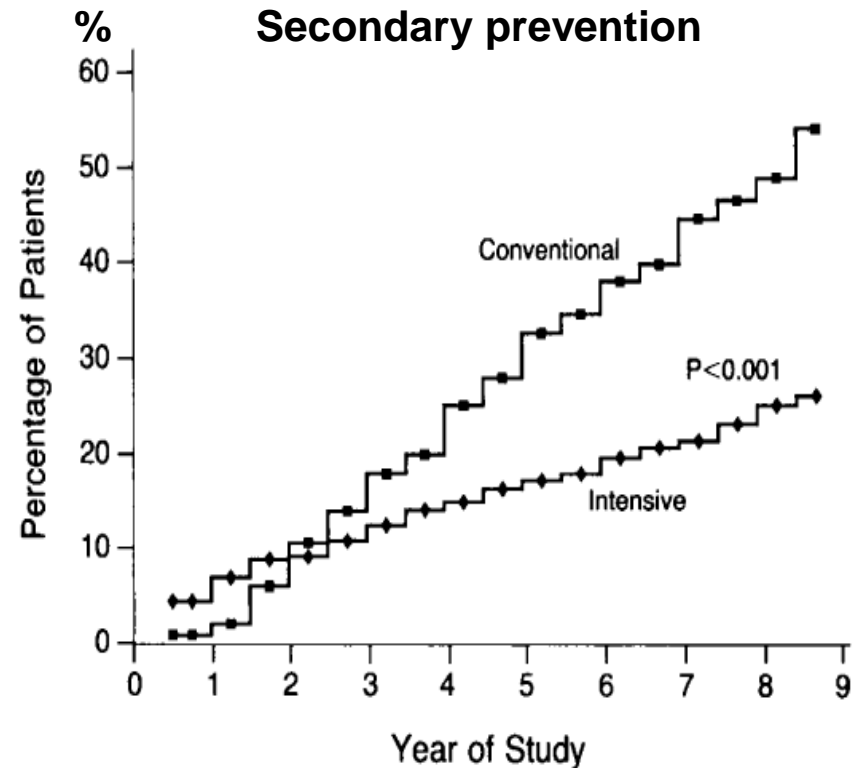
Post-trial changes in HbA_{1c} in the UKPDS



3-Step sustained retinopathy progression in the DCCT by randomised treatment group



| | | | | |
|--------------|-----|-----|----|----|
| Conventional | 375 | 220 | 79 | 52 |
| Intensive | 342 | 202 | 78 | 49 |

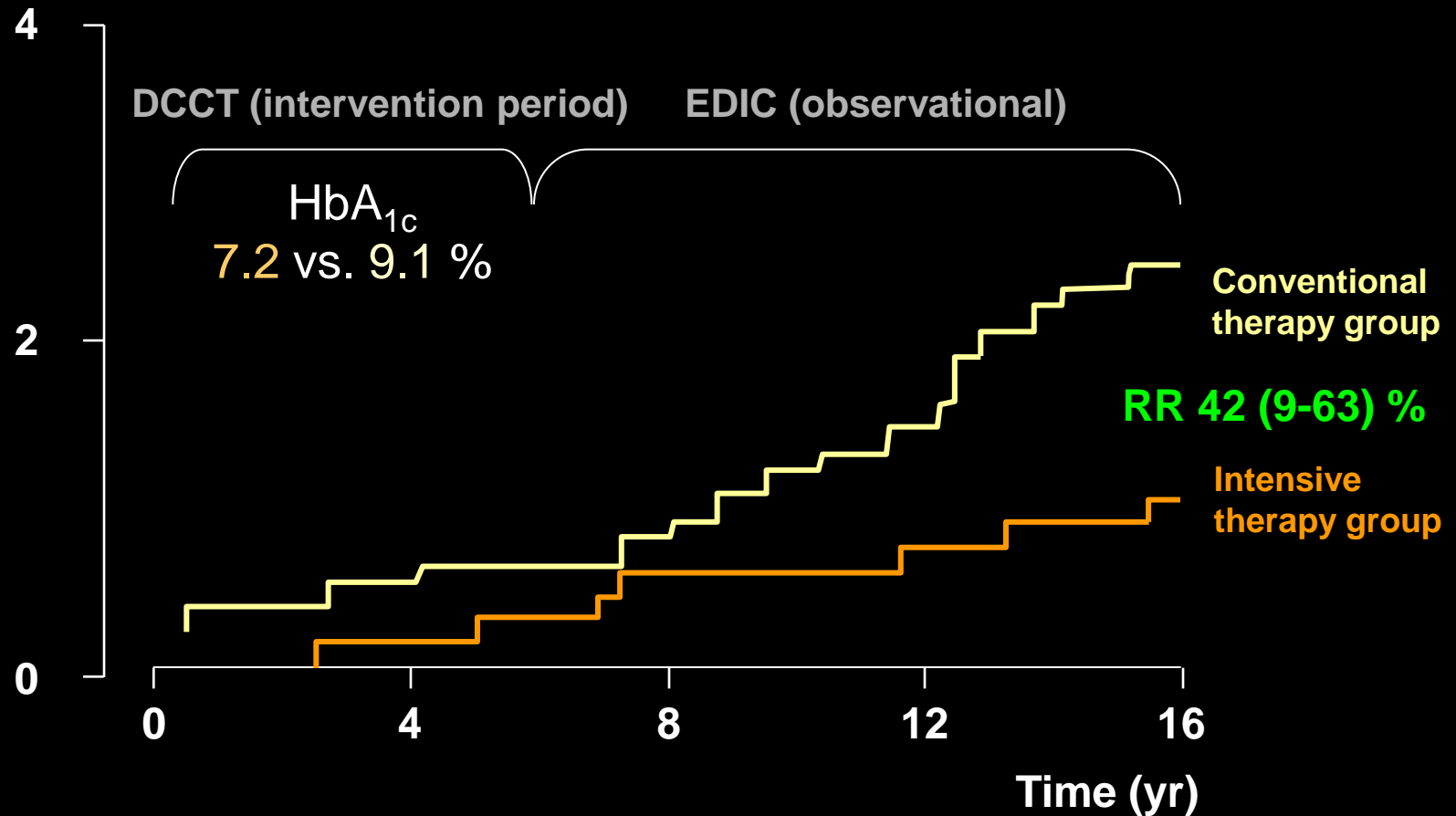


| | | | | |
|--------------|-----|-----|-----|----|
| Conventional | 348 | 324 | 128 | 79 |
| Intensive | 354 | 335 | 136 | 93 |

The Diabetes Control and Complications Research Group, N Engl J Med, 1993

Relation of CVD events to HbA_{1c} in the follow-up period of the DCCT

Cumulative incidence of major CVD (%)



DCCT-EDIC study group, *N Engl J Med*, 2005

The intensity of the DCCT

- Multiple insulin injections or CSII
- Self-monitoring x4 day⁻¹ with dose adjustment
- Glucose and glycated haemoglobin targeting
- Further education of people with diabetes
- Physician/clinic visits monthly
- Telephone advice / use of nurse educators
- Study participant 'ownership' incentive

The Diabetes Control and Complications Research Group, N Engl J Med, 1993

The Diabetes Control and Complications Trial

or

The Diabetes Professional and Patient Motivation, Patient and Professional Education, Intensive Self-monitoring, Effective Insulin Regimen, Audit and Target by Glycated Haemoglobin, Effect on Complications Trial

[DCCT or DPPMPPEISMEIRATGHECT]

What are the lessons of the DCCT?

In people with Type 1 diabetes

- ? Better blood glucose control prevents microvascular complications
- ? Intensive insulin treatment prevents microvascular complications
- ? Improved patient education prevents microvascular complications
- ? Some other aspect of improved metabolic control prevent microvascular complications
- ? Aspects of intensive diabetes management, combined in unknown proportions, prevent microvascular complications

How diabetes outcomes have been changed over the past 30 years

1970s

- artificial pancreas (concept)
- CSII
- blood glucose meters
- glycated haemoglobin
- radioimmunoassay
- effective blood pressure management
- laser photocoagulation

1980s

- glucose clamps for PK/PD
- ACE-inhibitors
- non-mydratic retinal photography
- wearable artificial pancreas concept
- glucose sensors
- statins

1990 and since

- outcome studies
- metformin (USA)
- thiazolidinediones
- insulin analogues
- CGM
- incretin therapies
- SGLT2 blockers
- sensor pump control

Guidelines

- from 1989 (European NIDDM)

Outcome of Podiatry-led Foot Care

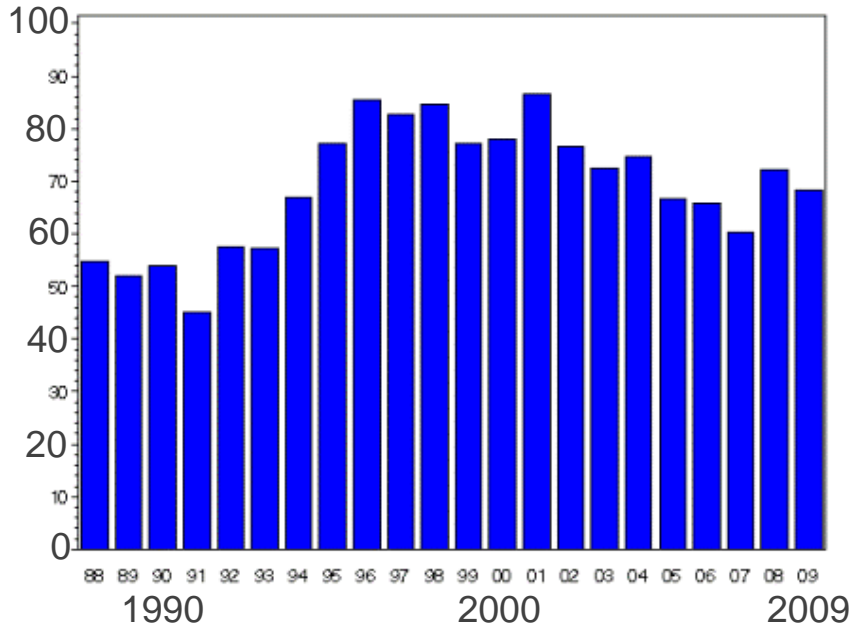
Freeman Diabetes Service – 1995/1996

| | | |
|----------------------------------|------------------|--------|
| Background population | (n) | 75 000 |
| Managed population with diabetes | (n) | 1 500 |
| Incidence of foot ulceration | (per 1000 pt-yr) | 14.3 |
| Incidence of toe amputation | (per 1000 pt-yr) | 0.3 |
| Incidence of limb amputation | (per 1000 pt-yr) | 0.6 |

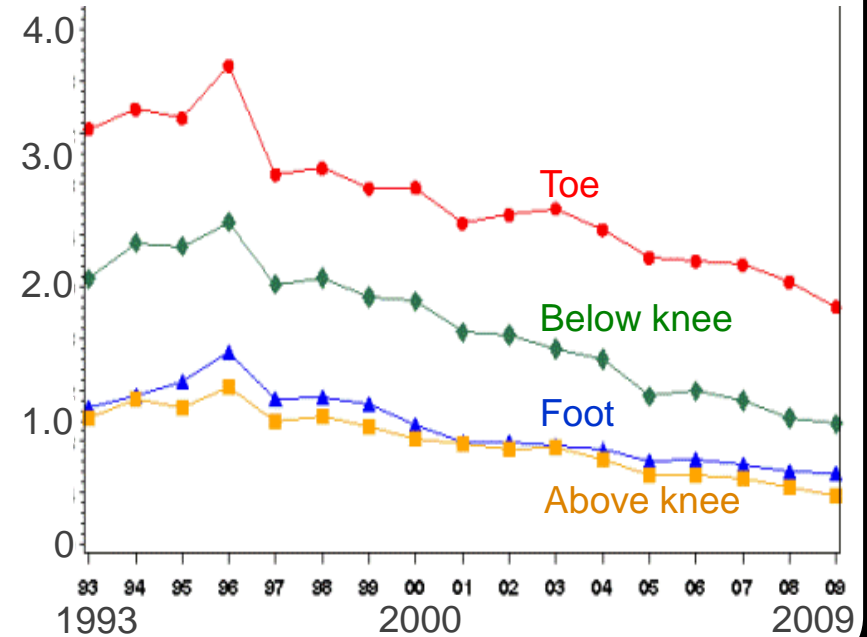
Robertshaw and Robertshaw, Newcastle Diabetes, 1998

Changes in limb amputations over 21 years in the USA

Amputation discharge numbers (n 1000⁻¹)

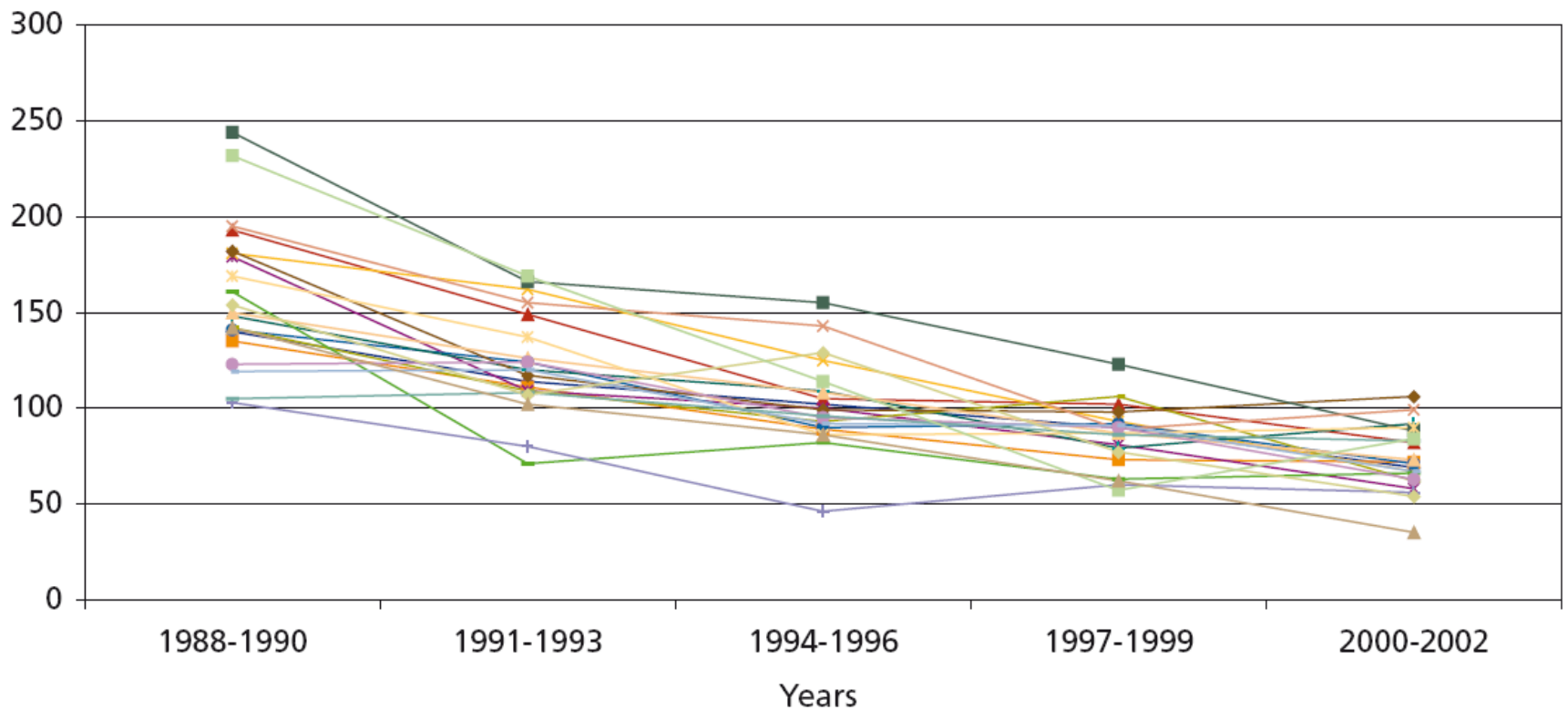


Amputation discharge rate (n 1000⁻¹-DM)



Regional variation in first amputation rates in Finland 1988-2002

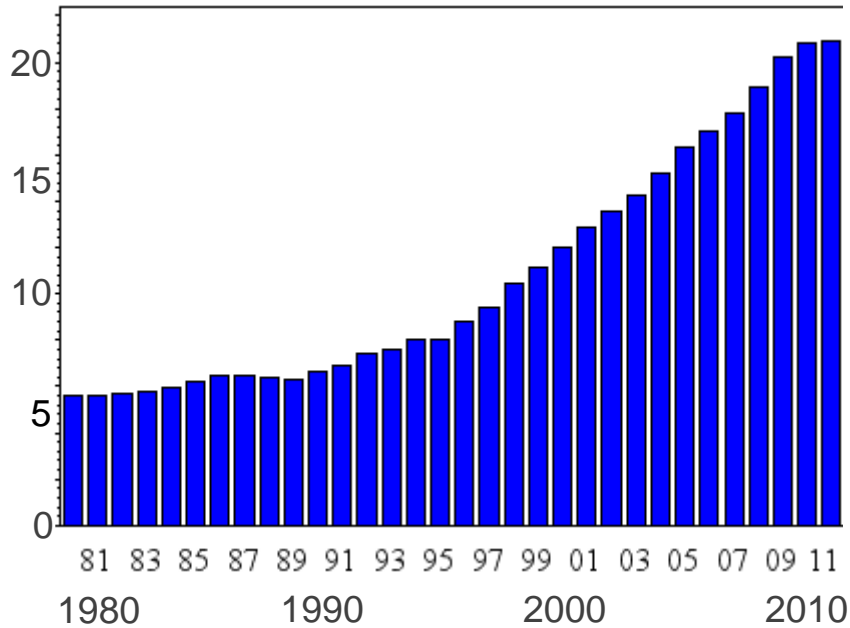
www.diabetes.fi



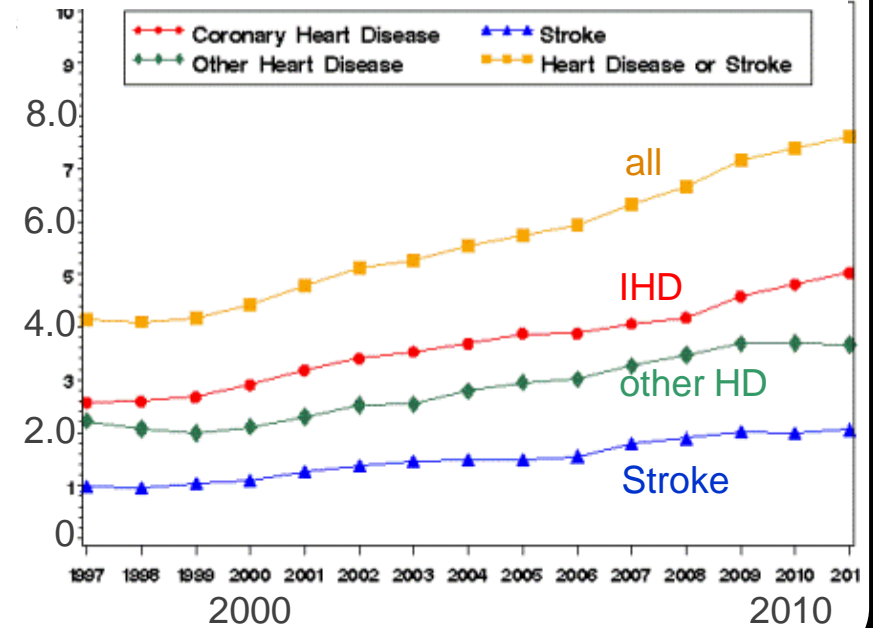
- ◆ Uusimaa
- ◆ Kanta-Häme
- ◆ Southern Karelia
- ◆ Northern Savo
- ◆ Central Ostrobothnia
- ◆ Lapland
- ◆ Helsinki
- ◆ Pirkanmaa
- ◆ Southern Savo
- ◆ Central Finland
- ◆ Northern Ostrobothnia
- ◆ Varsinais-Suomi
- ◆ Päijät-Häme
- ◆ Eastern Savo
- ◆ Southern Ostrobothnia
- ◆ Satakunta
- ◆ Kymenlaakso
- ◆ Northern Karelia
- ◆ Vaasa
- ◆ Kainuu
- ◆ Länsi-Pohja

Changes in numbers of people with diabetes and cardiovascular disease in the USA

People with cardiovascular disease (n 1000,000⁻¹)

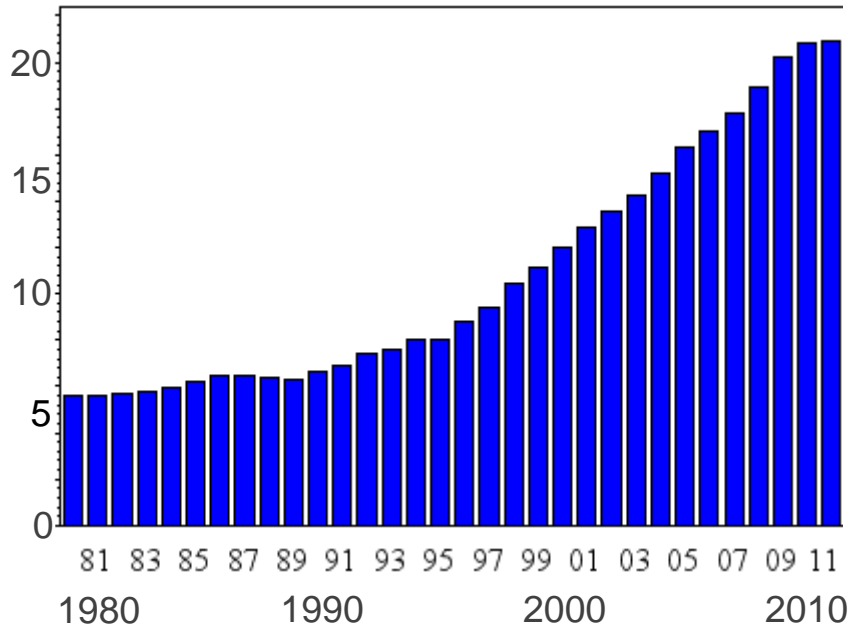


People with cardiovascular disease (n 1000,000⁻¹)

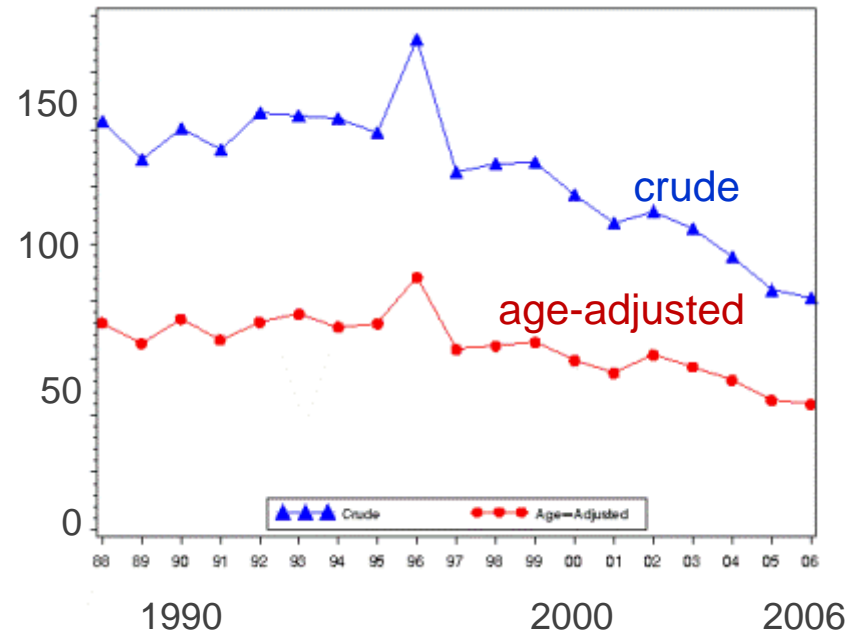


Changes in numbers of people with diabetes and cardiovascular disease in the USA

People with cardiovascular disease (n 1000,000⁻¹)



People with cardiovascular events (n 1000⁻¹-DM)



www.cdc.gov/diabetes/statistics/us/, 2014

How diabetes outcomes have been changed over the past 30 years

- there is evidence of improvement in diabetes surrogate and actual outcomes over the last 30 years
- however, the increase in diabetes incidence/prevalence has overwhelmed the improvements to give increase in absolute numbers of adverse outcome
- the technology of diabetes care improved massively either side of 1980, but has taken decades to be implemented more widely
- more lately the number of therapeutic tools has increased remarkably – but it is too soon to see evidence of outcome from that, in particular in the face of the 'obesity' epidemic
- monitoring tools and educational approaches have probably paid a major part in allowing the implementation of management changes
- the guidelines 'epidemic' largely flowed from the technological introductions, and the need and ability to improve care

Thank you for listening



