Projecting the Future Diabetes Population Size and Related Costs for the U.S. *

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**Health Affairs (Millwood)*. 2009; 28(5): w978-w990.
Diabetes Care. 2009; 32(12): 2225-2229.

Funding

- National Changing Diabetes Program
- Novo Nordisk A/S

Outline

- Why do we need forecasts of chronic diseases?
- New natural history and treatment effect data relevant to type 2 diabetes
- A brief history of diabetes modeling
- Prior attempts to forecast of diabetes population

Outline

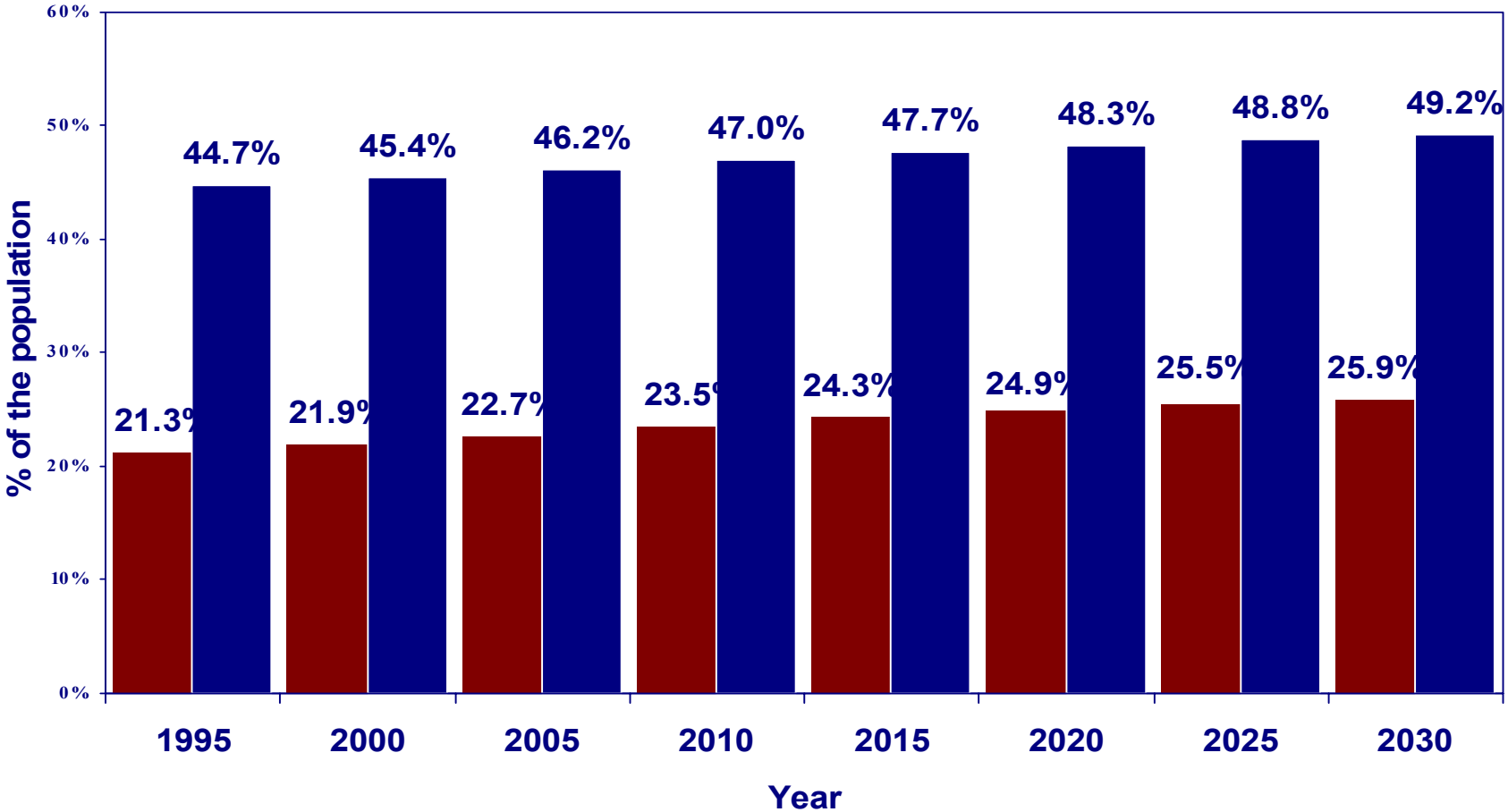
- New type 2 diabetes population cost model
- Baseline population and cost estimates for diabetes in U.S. for 25 years
- Sample policy simulation that examines impact of a 10-year and 25-year budget scoring window
- Other implications

Why do we need forecasts of chronic diseases?

Why do we need forecasts of chronic diseases?

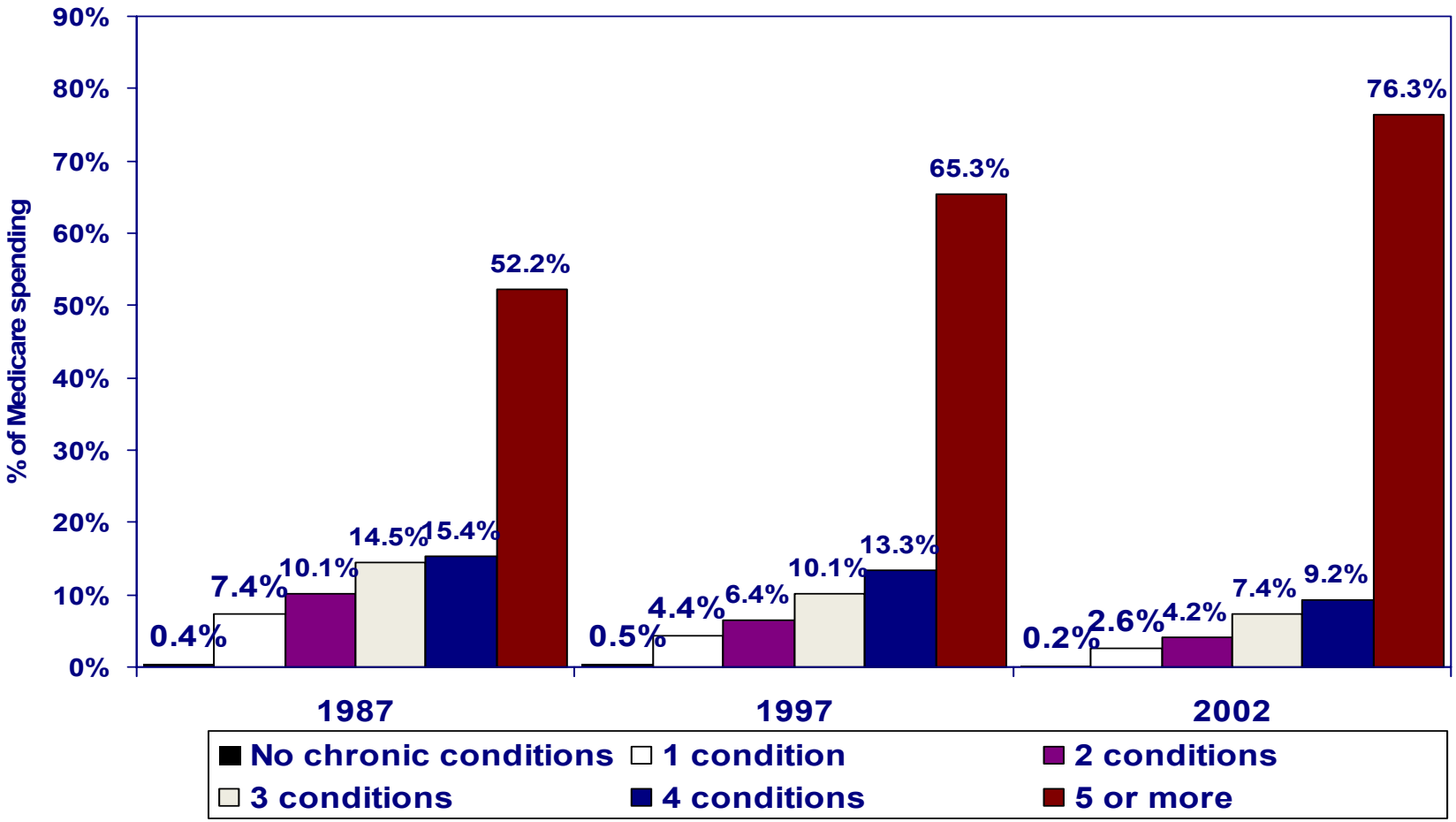
- Broad U.S. Healthcare Challenges
- Incomplete access to care
  - Uninsured – 45.7 million (2008, Kaiser Family)
  - Passage of Health Care and Education Affordability Reconciliation Act of 2010
- Rising health care costs

Percentage of the U.S. Population With Chronic Diseases, 1995-2030



Source: Projections of Chronic Illness Prevalence and Cost Inflation, Wu, Shin-Yi and Anthony Green, RAND, October 2000.

Percentage of Medicare $ Spent on Chronic Illness, 1987, 1997 and 2002



Source: K. Thorpe and D. Howard, "The Rise In Spending Among Medicare Beneficiaries: The Rise Of Chronic Disease Prevalence and Changes in Treatment Intensity," *Health Affairs* (web exclusive August 22, 2006): p. 378.

The Crucial Role of the Estimators in the Legislative Budget Process

- The U.S. federal budget process depends heavily on objective assessments of both federal spending and tax receipts under alternative scenarios.
- Typically, policymakers want to know two things: what will happen under current law or baseline, and what will happen if there were a change in the law.
- Cost estimating can be a straightforward exercise, or an extremely complex one.

Developing Federal Cost Estimates

- Two primary agencies project future spending
  - Office of the Actuary (OACT) at the Centers for Medicare and Medicaid Services
    - OACT responsible for projecting future spending for Medicare
  - Congressional Budget Office (CBO)
    - Nonpartisan body that “scores” new legislation
- CBO only includes data that meets their professional standards for scientific rigor.
  - By their nature short-term costs are almost always more predictable than long-term saving.

Developing Federal Cost Estimates

- CBO also works in a required “scoring” window
  - Currently 10 years
  - Used to be 5 years
- Modeling to Predict Effects of Legislation.
  - Traditionally provider and payer focused modeling, not disease-based.
  - Clinical information is typically not included
- **CBO played crucial role in Health Care Reform providing estimates showing deficit reduction**

Why do we need forecasts of chronic diseases?

- Beyond health care spending
- Patient treatment planning
- Workforce planning
- Design of public health interventions

Diabetes as a Model Chronic Condition

Diabetes as a Model Chronic Condition

- Diabetes is an excellent chronic condition for demonstrating potential contribution clinical information can make to forecasting
- Natural history of diabetes has been assessed and modeled extensively over a decade.
  - The baseline progression of major complications are well documented.
  - The effect of treatment interventions are generally well understood (but evolving).
  - Multiple scientific organizations have created diabetes models (NIH, CDC, UK, and European).

Diabetes Trials and Models

- Publication of groundbreaking trials has been followed by model building
  - Diabetes Control and Complication Trial (Type 1 Diabetes) 1993
  - DCCT first trial demonstrating microvascular benefits of intensive glucose control in diabetes
  - United Kingdom Prospective Diabetes Study (Type 2 Diabetes) 1998
  - UKPDS demonstrated benefits of intensive glucose and blood pressure control in type 2 diabetes

Diabetes Trials and Models

- Trials also provide us with information regarding
  - Natural history of disease
  - When treatments will have effects
  - How large treatment effects are
  - What complications are prevented
- UKPDS example
  - Microvascular benefits observed after 9 years of intensive glucose control
  - Mortality and cardiovascular benefits during 10 years of post-trial follow-up (metabolic memory)

Recent trials

- ACCORD (NEJM 2008; 358: 2545)
  - HbA1C 7.5 vs. 6.5
  - North America
- ADVANCE (NEJM 2008; 358: 2560)
  - HbA1C 7.5 vs. 6.5
  - Europe, Australasia, China
- VADT (NEJM 2008; 10.1056/NEJMoa0808431)
  - HbA1C 8.5 vs. 6.5
  - North America

Recent Trial Findings

- 2/6/08, NIH announces discontinuation of ACCORD trial glucose control arm
- Excessive mortality in very, intensive glucose control arm
  - 3 deaths/1000 treated
  - 257 deaths vs. 203 deaths
- Unclear etiology
- In order to achieve lower target used multi-dose insulin, TZDs, exanatide in combination
- Dramatic result for diabetes world

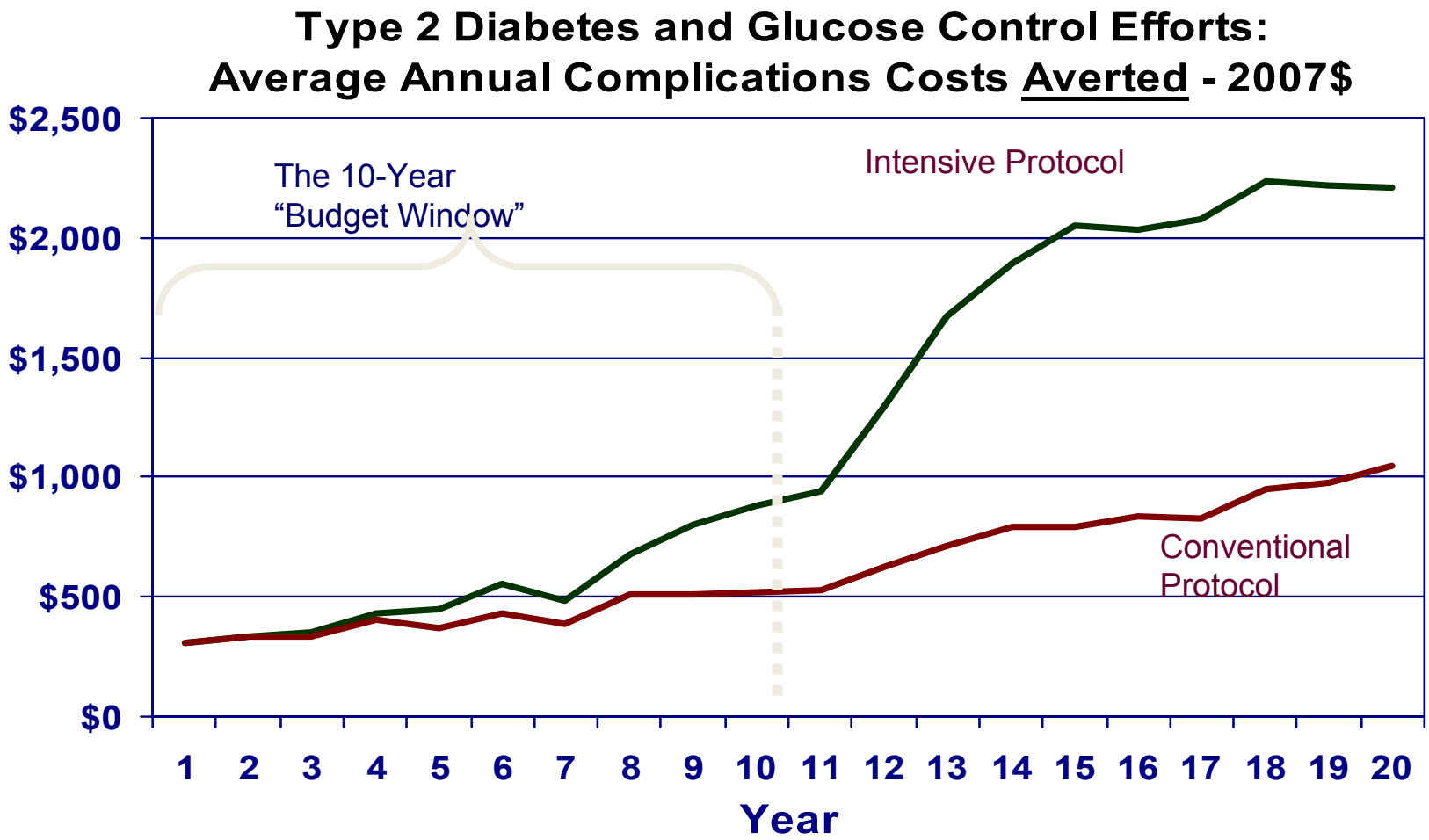
Other Trial Findings

- ADVANCE
  - No cardiovascular benefit
  - Reduces nephropathy progression
  - No excess deaths
- VADT
  - No cardiovascular benefit
  - Non-significant increase in sudden cardiac death

Diabetes Trials and Models

- Diabetes Models
  - DCCT Research Group Type 1 diabetes model 1996
  - NIDDK type 2 diabetes model 1997
  - CDC/RTI model of diabetes complications 2002
  - UKPDS type 2 diabetes model 2004
  - Sheffield model
  - CORE diabetes model 2004
  - Eagle model
  - Archimedes model 2003
- Models designed to simulate the natural history of major diabetes complications
- Models regularly compared during the Mount Hood Challenge

The Budget Window, Disease Progression, and Effect of Treatment



O'Grady Health Policy LLC

Source: National Changing Diabetes Programs: Federal Health Care Cost Estimating: A Look at Current Practice and the Implications for Assessing Chronic Disease Prevention Proposals.

Prior Attempts to Forecast the Diabetes Population

A Humbling History of Diabetes Forecasting

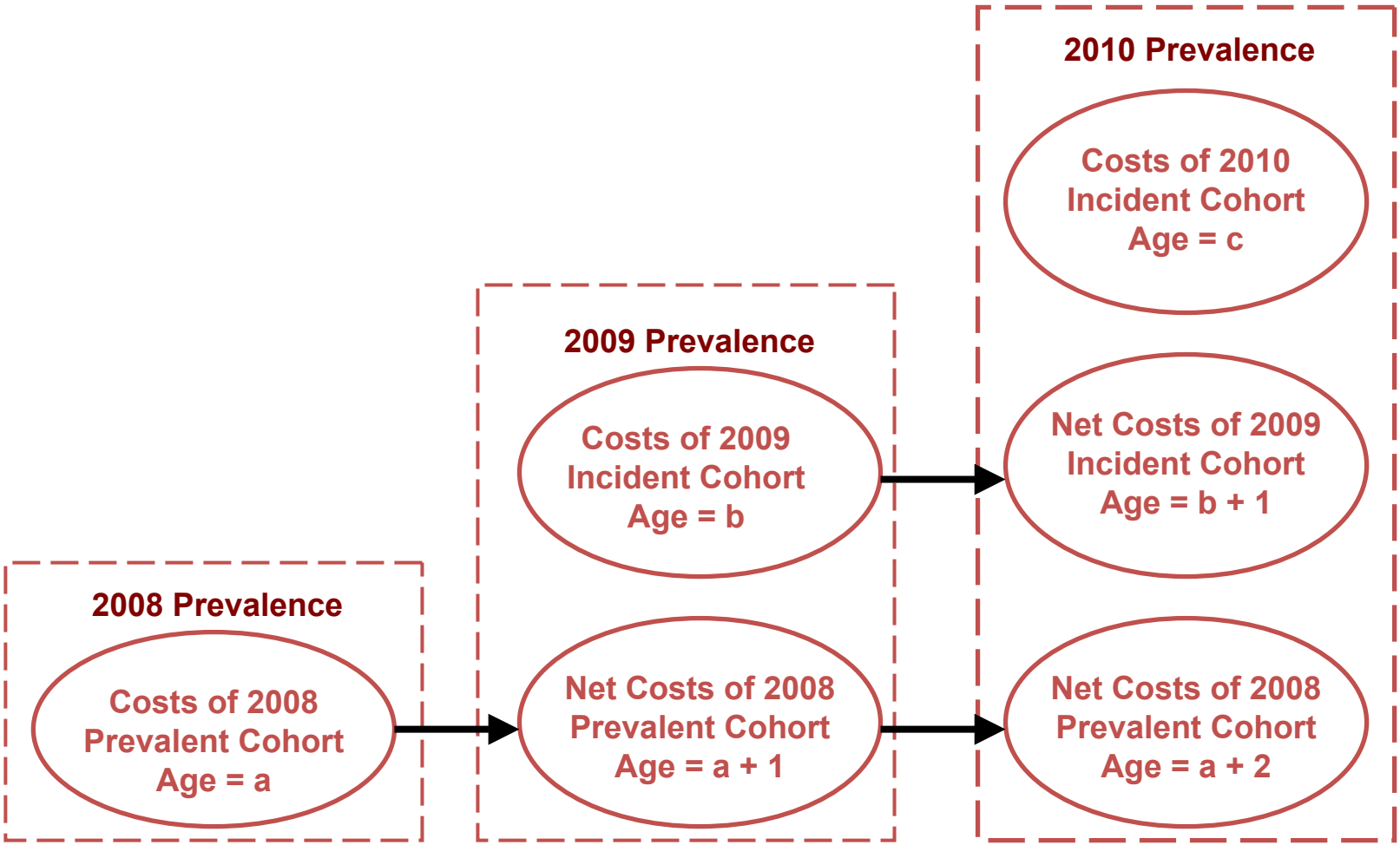
- 1992 (Helms, Diabetes Care)
  - 6.5 million in 1987 to 11.6 million in 2030
- 1998 (King, Diabetes Care)
  - 21.7 million by 2025
- 2001 (Boyle, Diabetes Care)
  - 29 million by 2050
- 23.7 million with diabetes today

Prior Model Characteristics

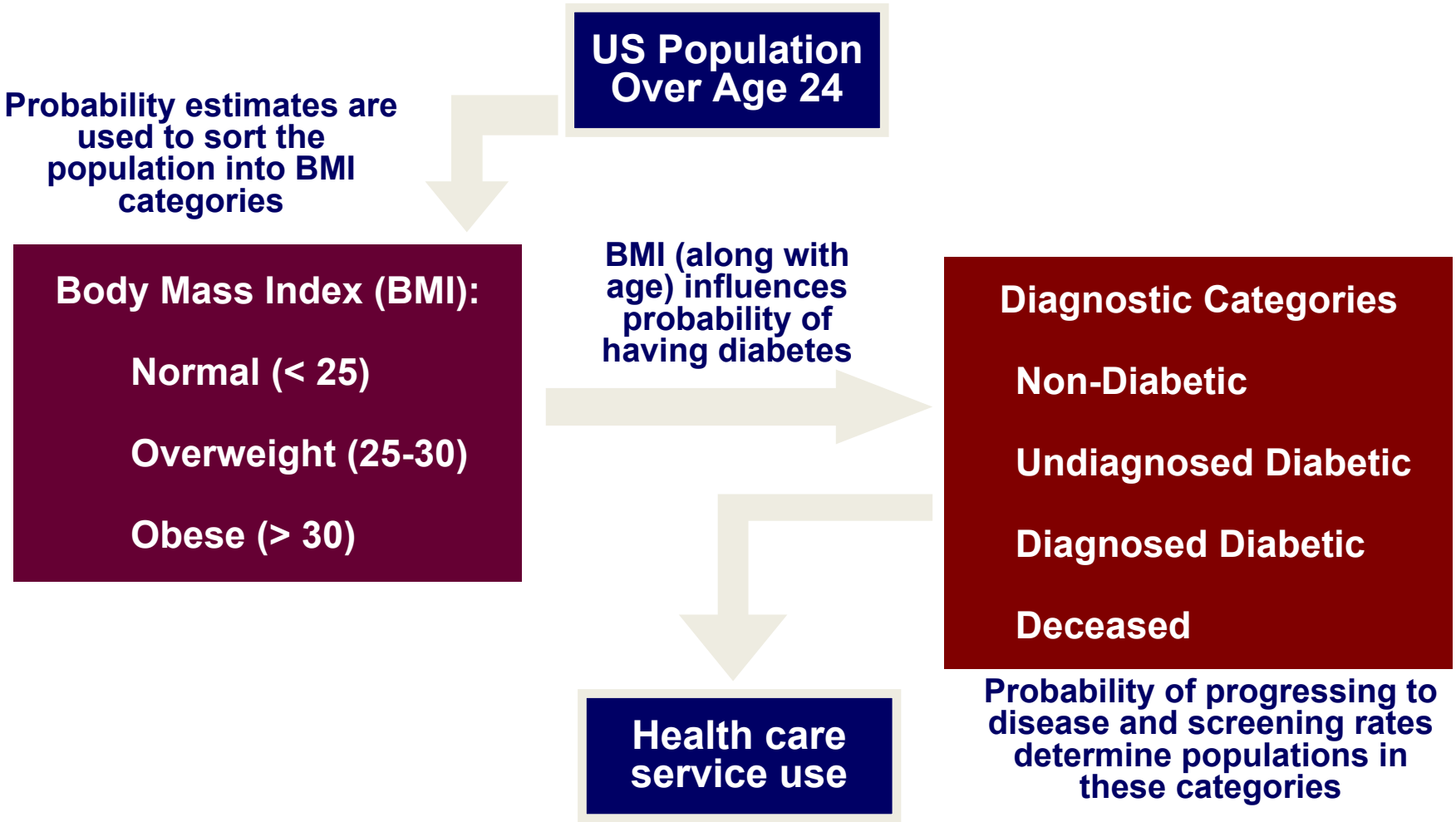
- General population growth underestimated
- Used fixed age-specific and sex-specific prevalence rates for diabetes
- No formal accounting for obesity
- No formal accounting for costs

New type 2 diabetes population cost model

Figure 1:
Conceptual Model Of Costs Of Diabetes With Prevalent And Future Cohorts Over Time

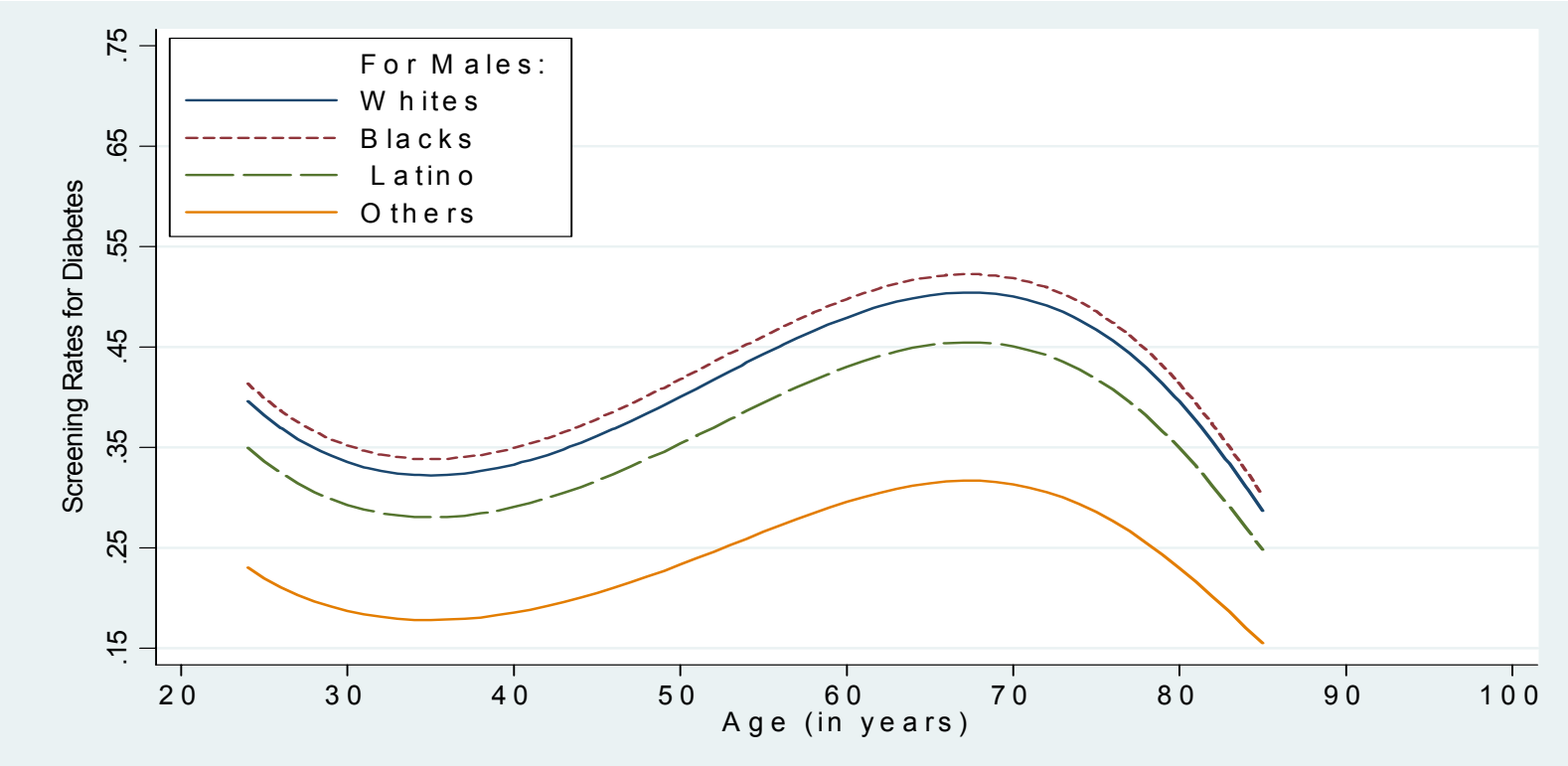


Prevalence and Incidence Modeling



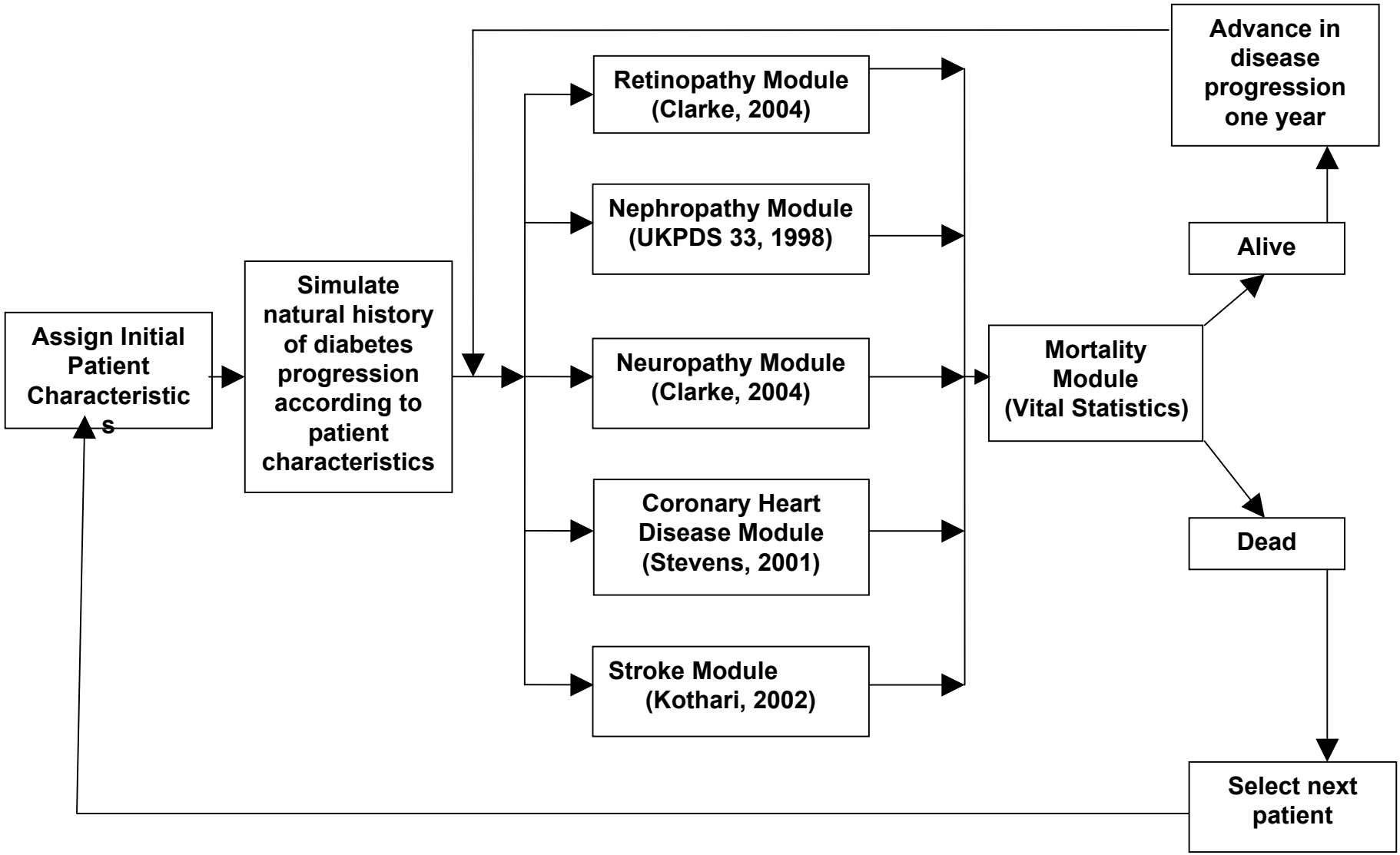
Screening Rate Assumptions for Men

Males' Screening Rates by Age and Race/Ethnicity



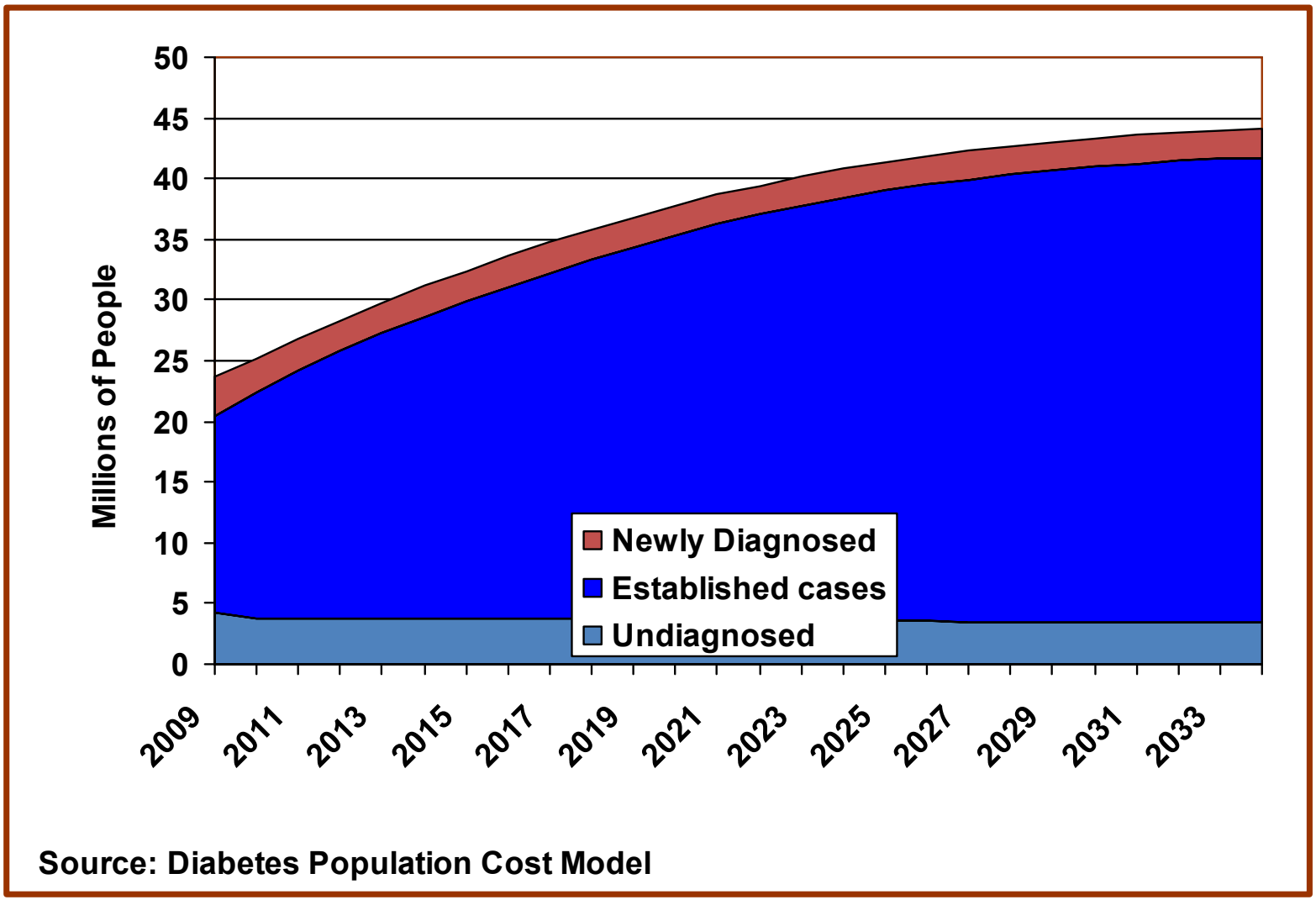
Source: National Health and Nutrition Examination Surveys (NHANES) (2005-2006).
http://www.cdc.gov/nchs/nhanes.htm

Modeling Diabetes Complications



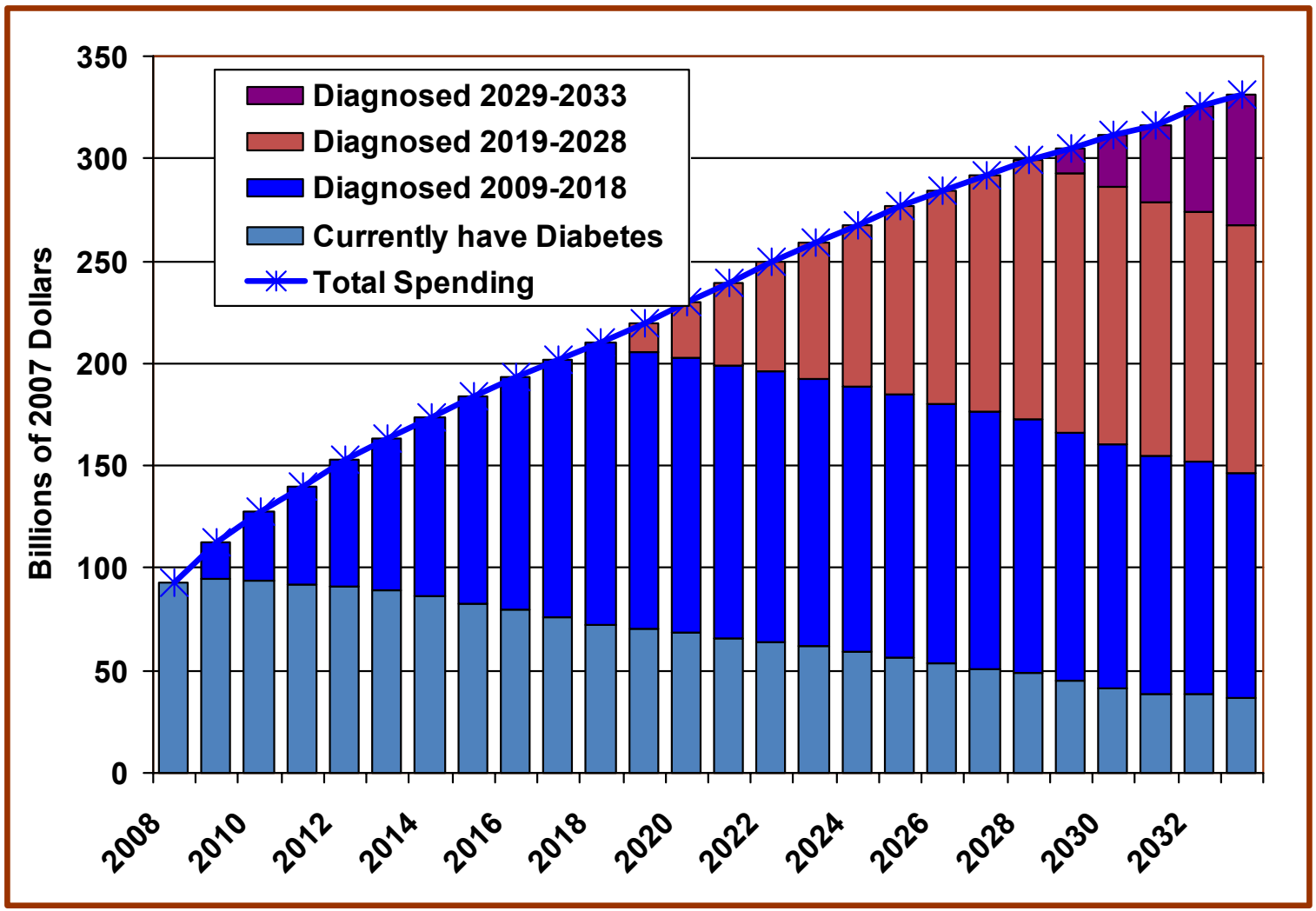
Baseline Diabetes Population and Cost Projections

Figure 2:
Projected Distribution of Newly Diagnosed, Undiagnosed and Established Cases of Diabetes, 2009-2034



Source: Diabetes Population Cost Model

Figure 3:
Projected Direct Spending on Diabetes and Its Complications for Different Cohorts, 2008-2033



Baseline Population and Cost Projections

- U.S. adult population (24-85)
  - 2009- 23.7 million people with diabetes
  - 2034- 44.1 million people with diabetes
- Direct medical costs of population
  - 2009- 113 billion (2007 US)
  - 2034- 336 billion
- Trends reflect
  - Expected demographic shift that currently is occurring with the aging of the baby boom generation
  - Current high rates of obesity.

Figure 4:
Projected Distribution of Newly Diagnosed, Undiagnosed and Established Medicare Cases of Diabetes, 2009-2034

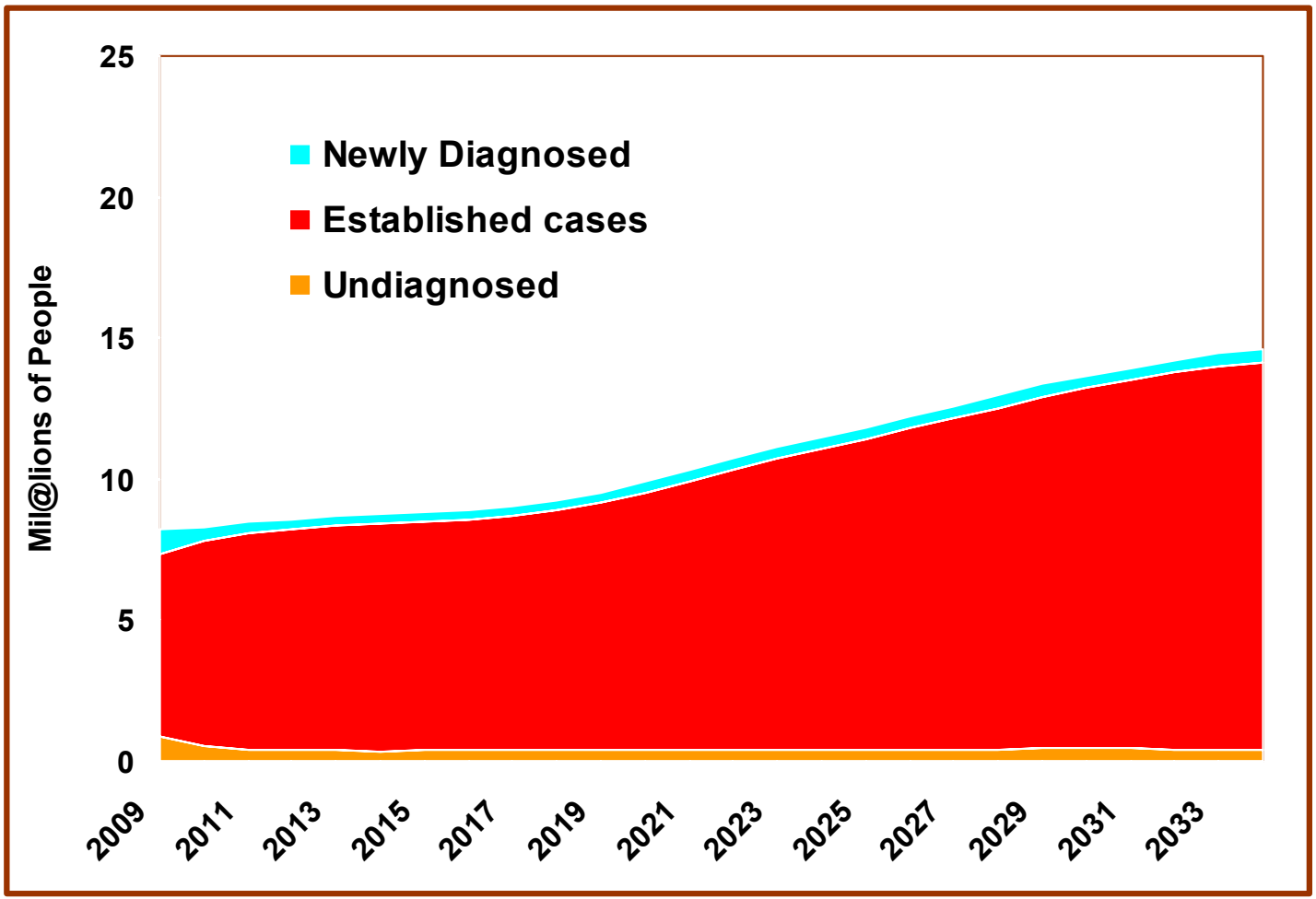
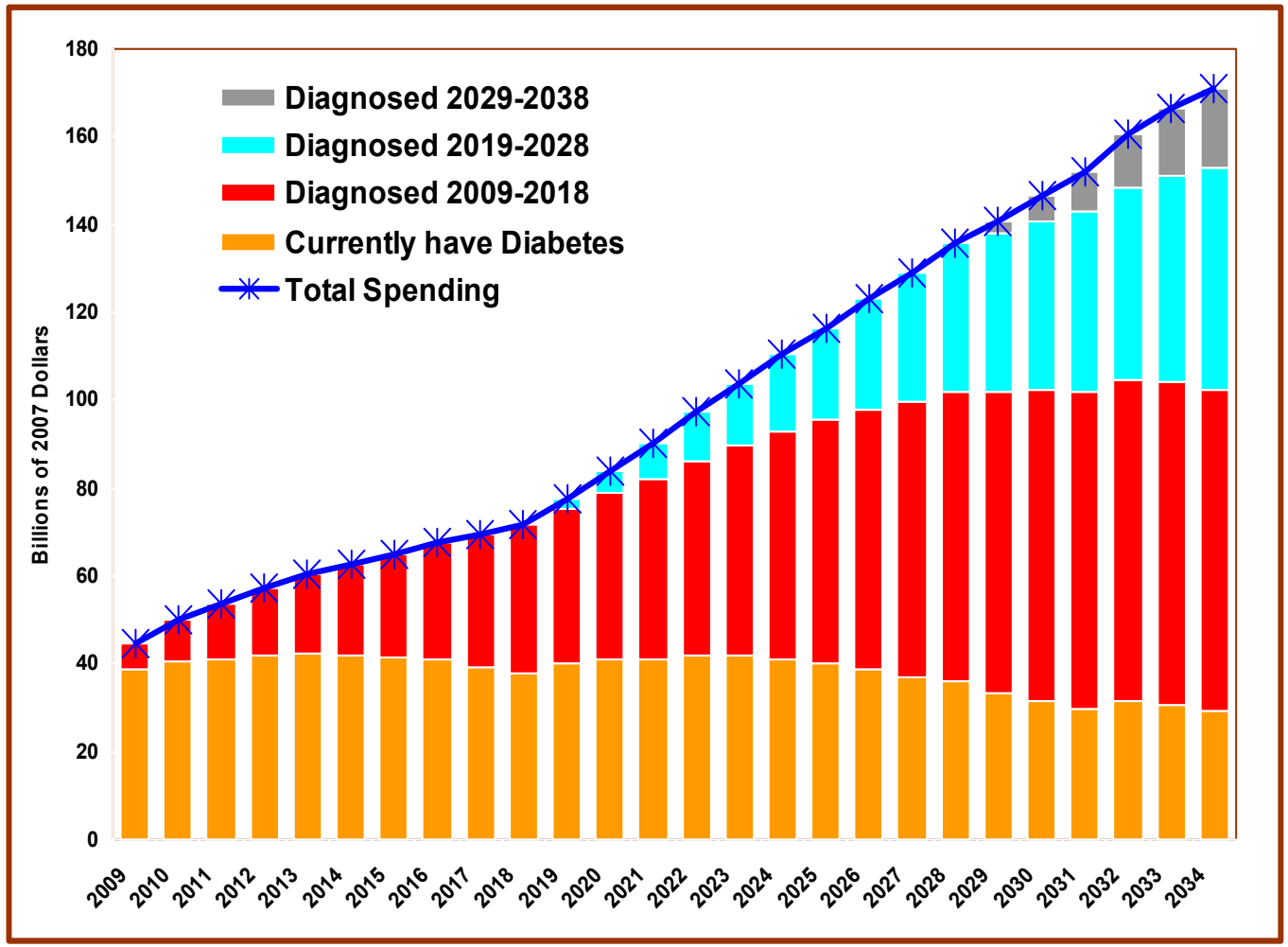


Figure 6(a):
Projected Direct Medicare Spending on Diabetes and Its Complications for Different Cohorts, 2009-2034

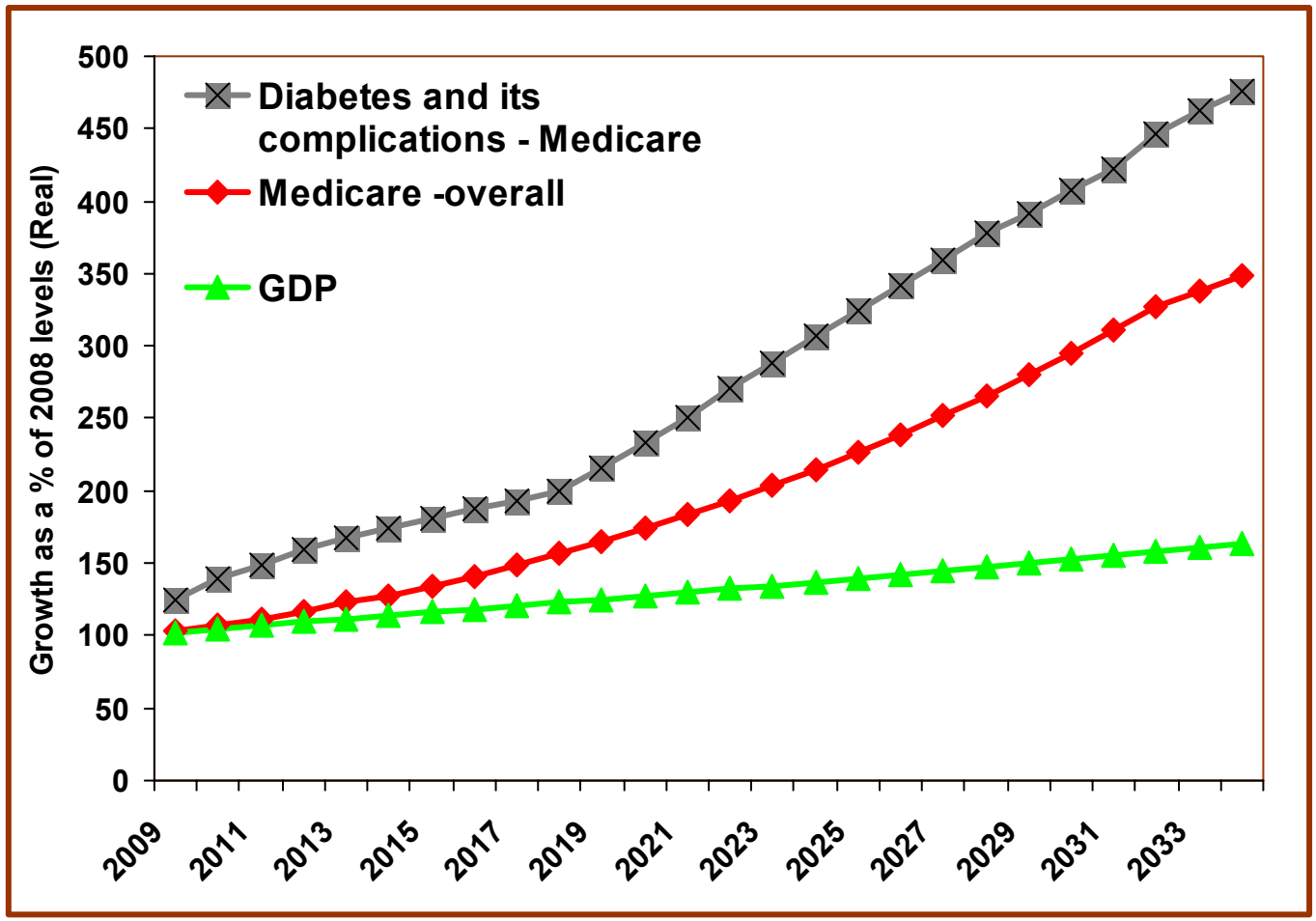


Medicare Baseline Population and Cost Projections

- Medicare population
  - 2009- 23.7 million people with diabetes
  - 2034- 44.1 million people with diabetes
- Direct medical costs of population
  - 2009- 113 billion (2007 US)
  - 2034- 336 billion

Figure 6(b):

Projected Real Growth – Medicare Direct Spending on Diabetes and Its Complications, Medicare Overall and GDP, 2009-2034



Policy Projections

Policy Projections

- Modeled a prototypical diabetes treatment improvement intervention that is similar to current well-designed disease management programs.
- Intensify the treatment of individuals with prevalent and incident diabetes aiming to improve
  - Glucose control
  - Blood pressure control
  - Cholesterol control
  - Use of beneficial preventive therapies (aspirin, ACEI)

Policy Projections

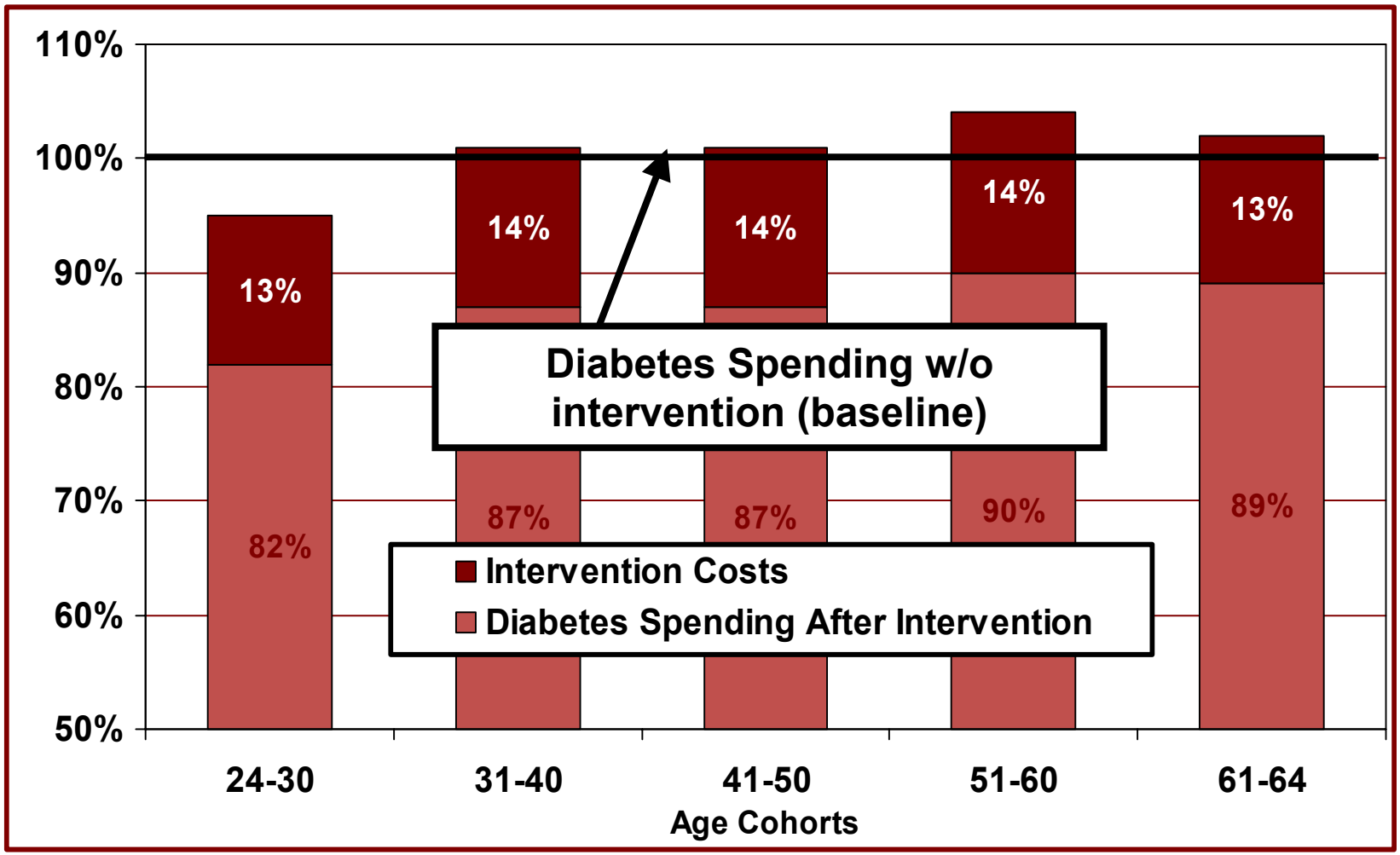
- $20 billion gross program spending over 25 years
- Enroll 41-64 year olds with existing diabetes
- 60,000-100,000 per year
- Assume lifelong adherence

Diabetes Quality Improvement Intervention

Entry Age Cohort	Number of patients entering treatment program each year	Baseline spending (no improvement intervention)	▪Improvement intervention spending	New spending plus cost of intervention	Net new spending
25-year effects (2009–2033)					
24-30 year old	60,000	$167 billion	$21 billion	$161 billion	-$6 billion
31-40 year old	60,000	$145 billion	$20 billion	$145 billion	$0 billion
41-50 year old	60,000	$134 billion	$19 billion	$136 billion	$2 billion
51-60 year old	80,000	$153 billion	$21 billion	$159 billion	$6 billion
61-64 year old	100,000	$160 billion	$21 billion	$165 billion	$5 billion
10-year effects (2009–2018)					
24-30 year old	60,000	$21.0 billion	$3.7 billion	$22.1 billion	$1.2 billion
31-40 year old	60,000	$20.2 billion	$3.7 billion	$22.0 billion	$1.9 billion
41-50 year old	60,000	$20.7 billion	$3.6 billion	$22.1 billion	$1.5 billion
51-60 year old	80,000	$28.0 billion	$4.5 billion	$29.4 billion	$1.4 billion
61-64 year old	100,000	$34.9 billion	$5.1 billion	$36.5 billion	$1.6 billion
Dollar amounts in 2007 $.					

Source: Derived from the authors' own analyses/computations.

Diabetes Quality Improvement Intervention (25-year spending)



Source: Derived from the authors' own analyses/computations.

Policy Projections

- Younger subpopulations experience greater clinical benefits and larger cost offsets
- For most age groups, program does not reduce overall spending but does generate a cost offset
- Savings from younger cohorts could partially subsidize costs of older cohorts
- Size of the offset is correlated with the budgetary window (10 years vs. 25 years) most clearly for the youngest cohorts

U.S. Budget Process Implications

- Paper highlights recent progress in the world of chronic disease modeling
- Work has been largely supported by public $
  - Cancer (NCI-Cancer Intervention and Surveillance Modeling Network)
  - HIV (NIMH, NIAID, CDC-Cost-Effectiveness of Preventing AIDS Complications Team)
  - Obesity (CDC)
  - Neurological diseases (NINDS-Immediate Practice-Altering Clinical Trials)
- Discoveries regarding natural history of diseases and their treatments could be leveraged by cost estimators

U.S. Budget Process Implications

- Current congressional budget procedures are already moving toward a longer-term focus:
  - CBO is issuing more long-term estimates for health care entitlements
  - The Senate adopted a new rule which will require CBO to produce long-term cost estimates under certain circumstances

U.S. Budget Process Implications

- Our focus:
  - Introducing epidemiological modeling as a viable supplement to current cost estimating approaches
  - Extension of the budget window as appropriate, especially in the context of policymaking for chronic illnesses with long time horizons
  - Where there is clear and convincing data, allowing improved chronic illness cost estimating to influence budget enforcement within the current ten-year window

Other Implications

- The forecast is not set in stone
- Diabetes prevention has more trial data behind it than ever before
- Obesity rates are starting to level off – can this be reversed?
- Early intensive diabetes care may have long-lasting cost implications

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