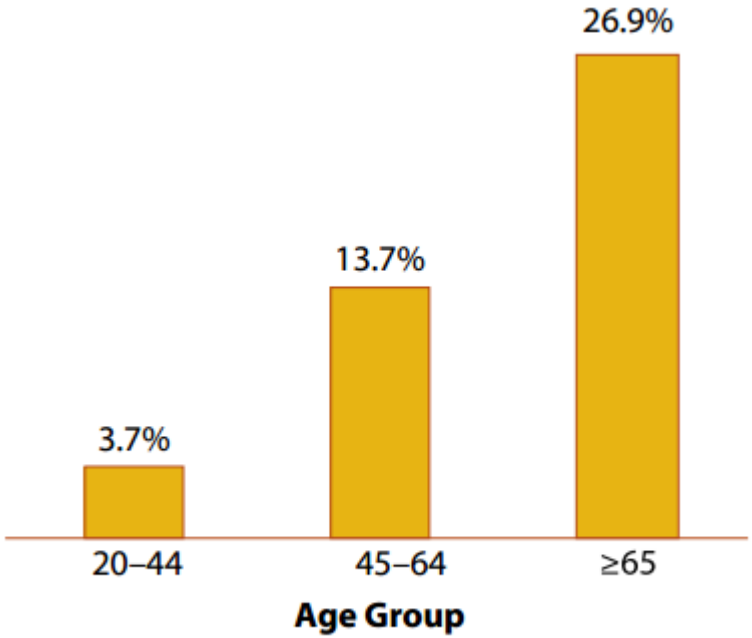
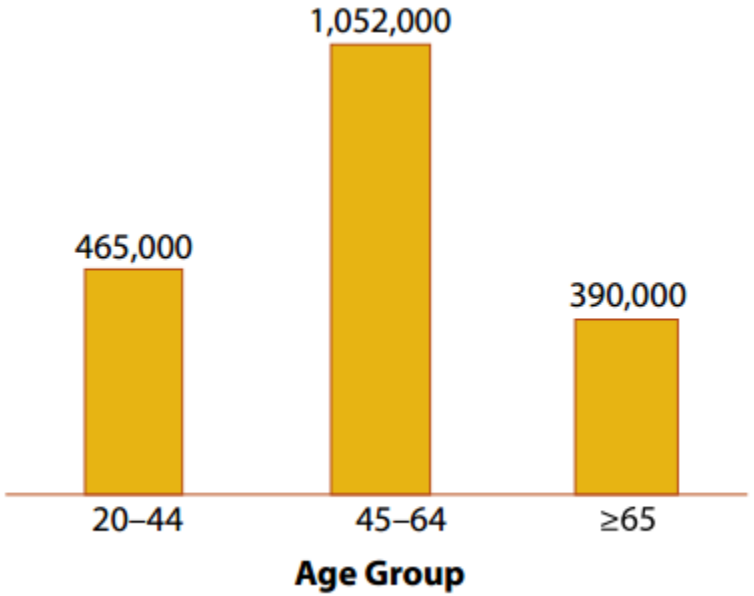
CDC Diabetes Statistics



Source: 2005–2008 National Health and Nutrition Examination Survey

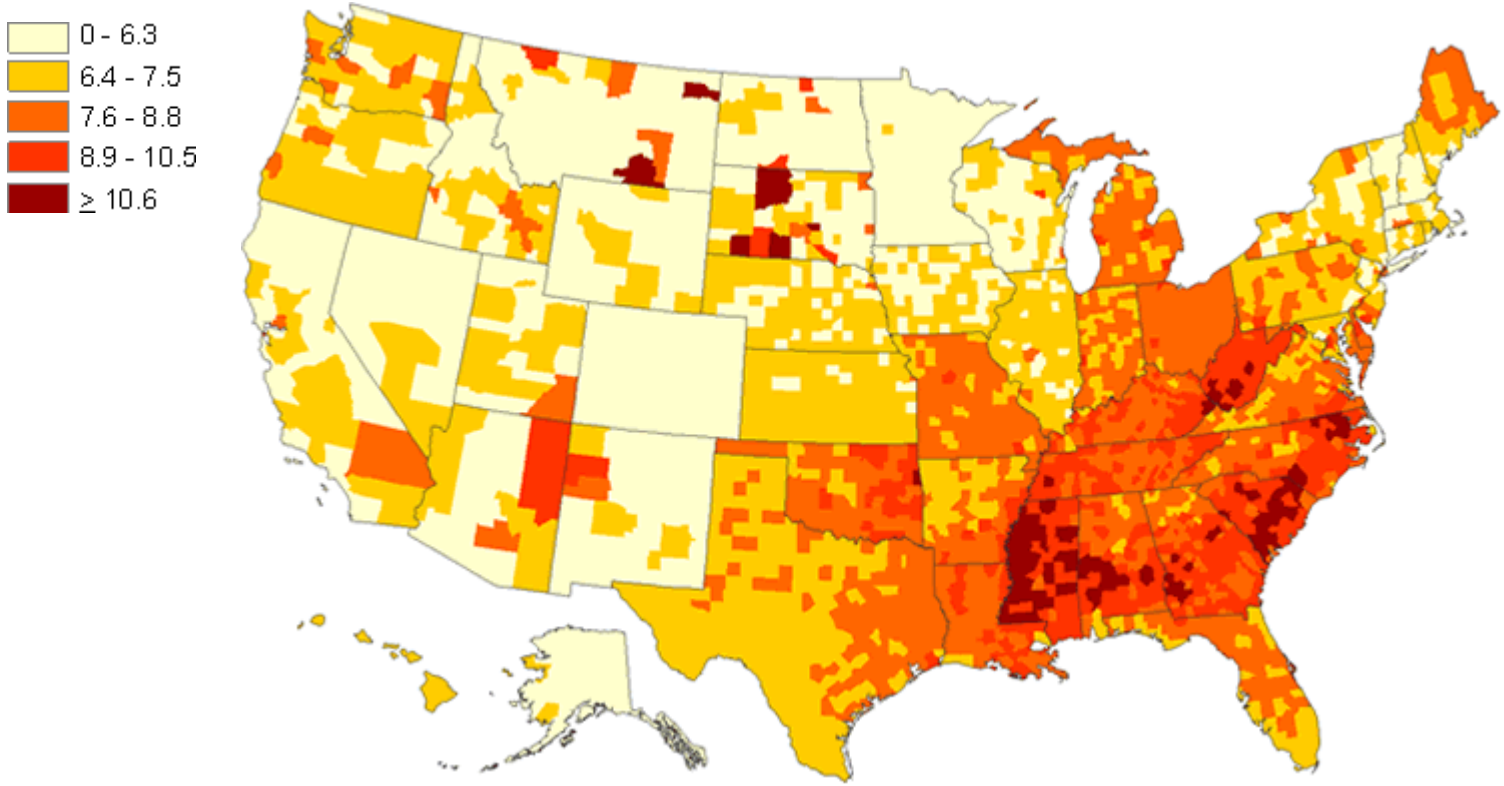


Source: 2007–2009 National Health Interview Survey estimates projected to the year 2010

Diagnosed and undiagnosed diabetes among people aged 20 years or older, United States, 2010	
Group	**Number or percentage who have diabetes**
Age ≥20 years	**25.6 million or 11.3% of all people in this age group**
Age ≥65 years	**10.9 million or 26.9% of all people in this age group**
Men	**13.0 million or 11.8% of all men aged 20 years or older**
Women	**12.6 million or 10.8% of all women aged 20 years or older**
Non-Hispanic whites	**15.7 million or 10.2% of all non-Hispanic whites aged 20 years or older**
Non-Hispanic blacks	**4.9 million or 18.7% of all non-Hispanic blacks aged 20 years or older**

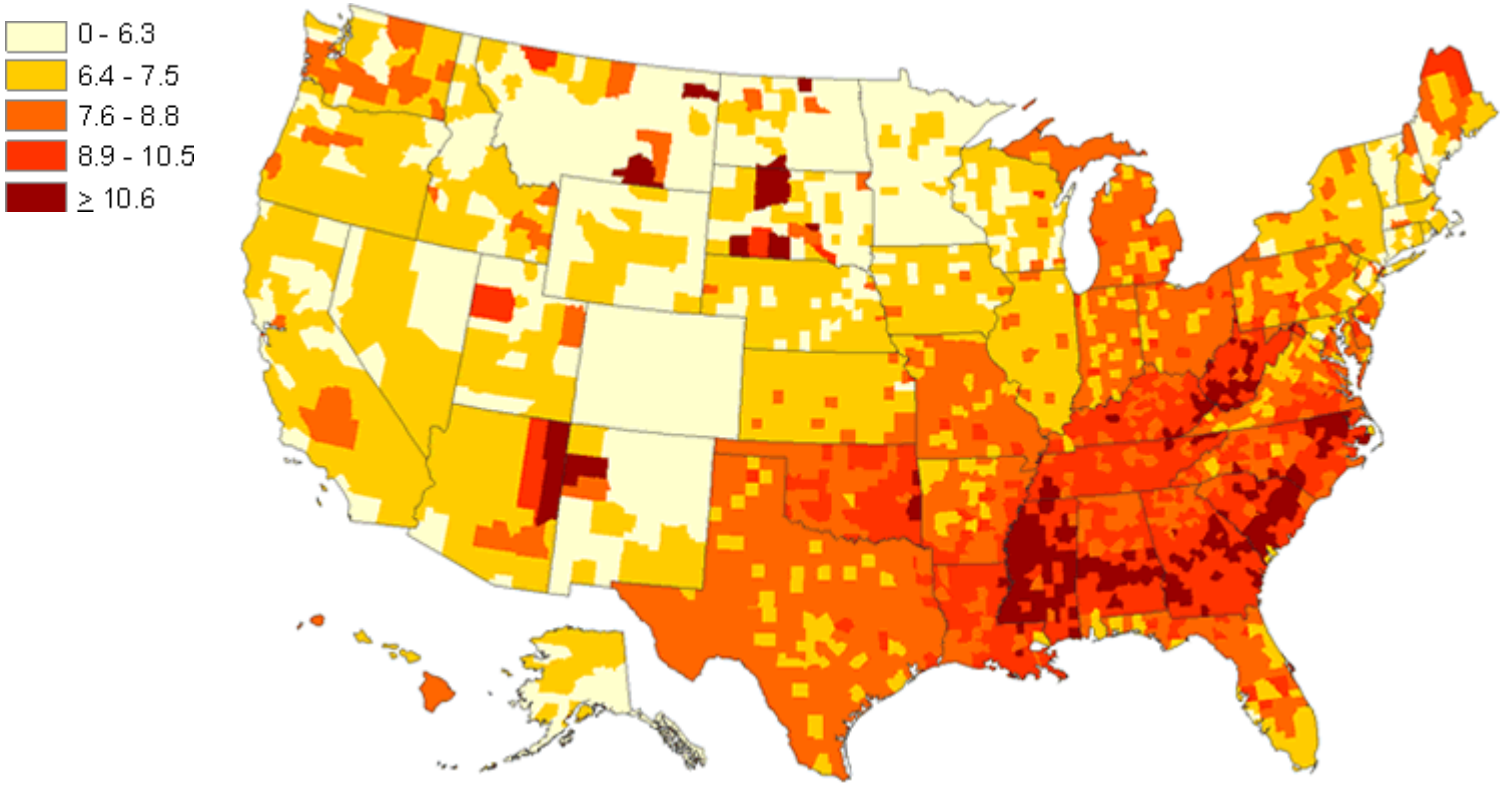
Diabetes Mellitus

- 2004 - CDC Statistics



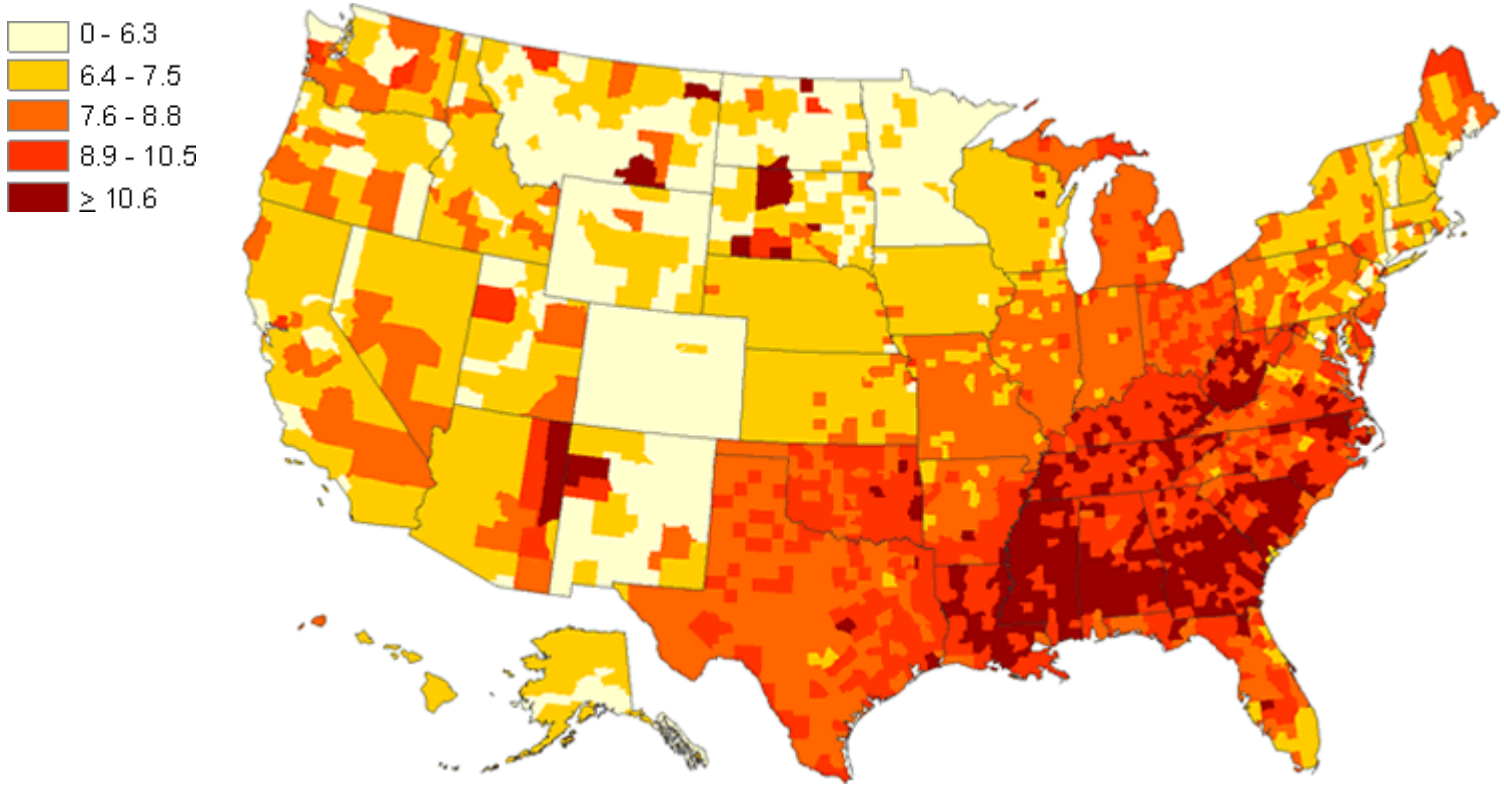
Diabetes Mellitus

- 2005 - CDC Statistics



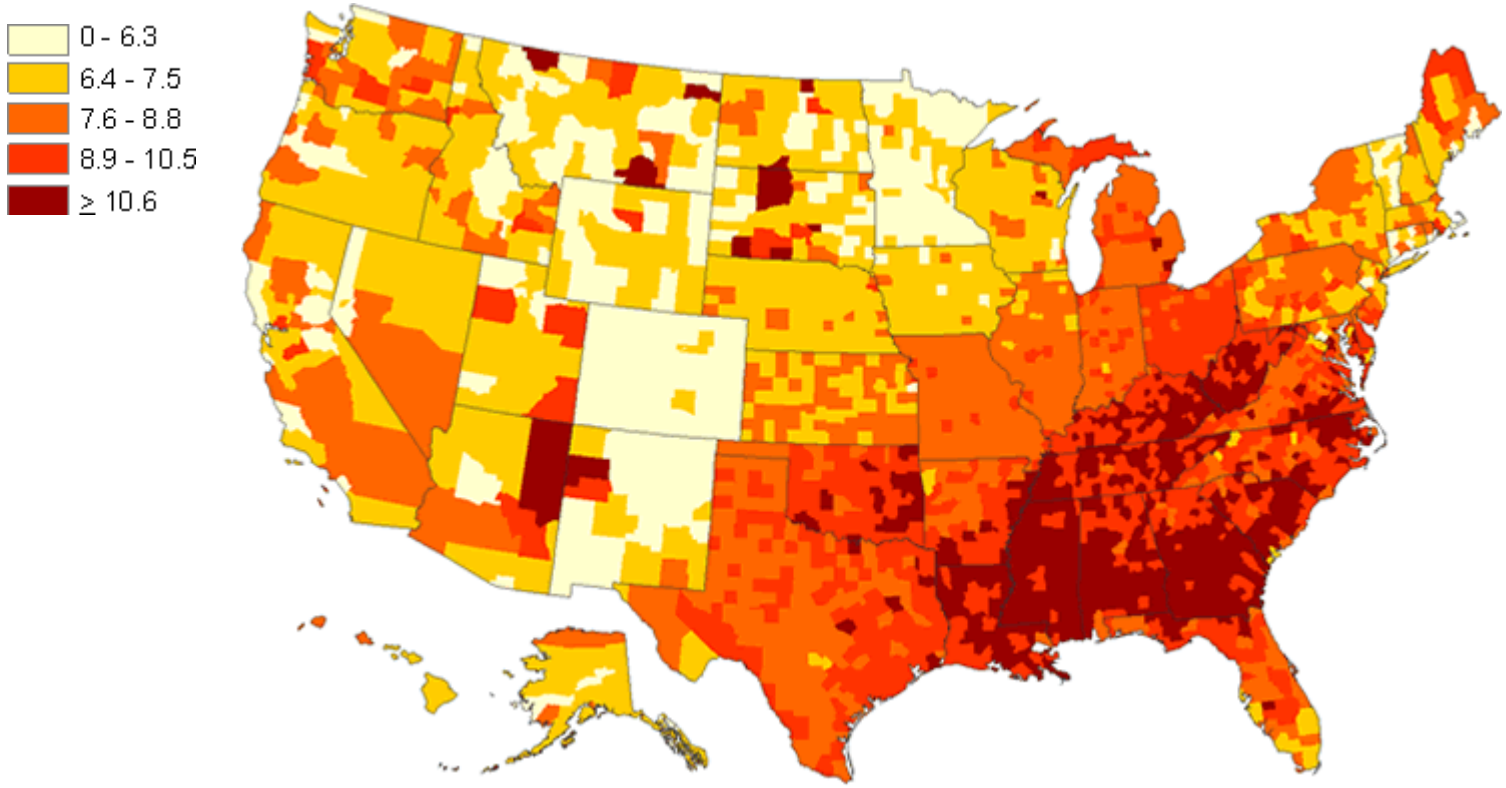
Diabetes Mellitus

- 2006 - CDC Statistics



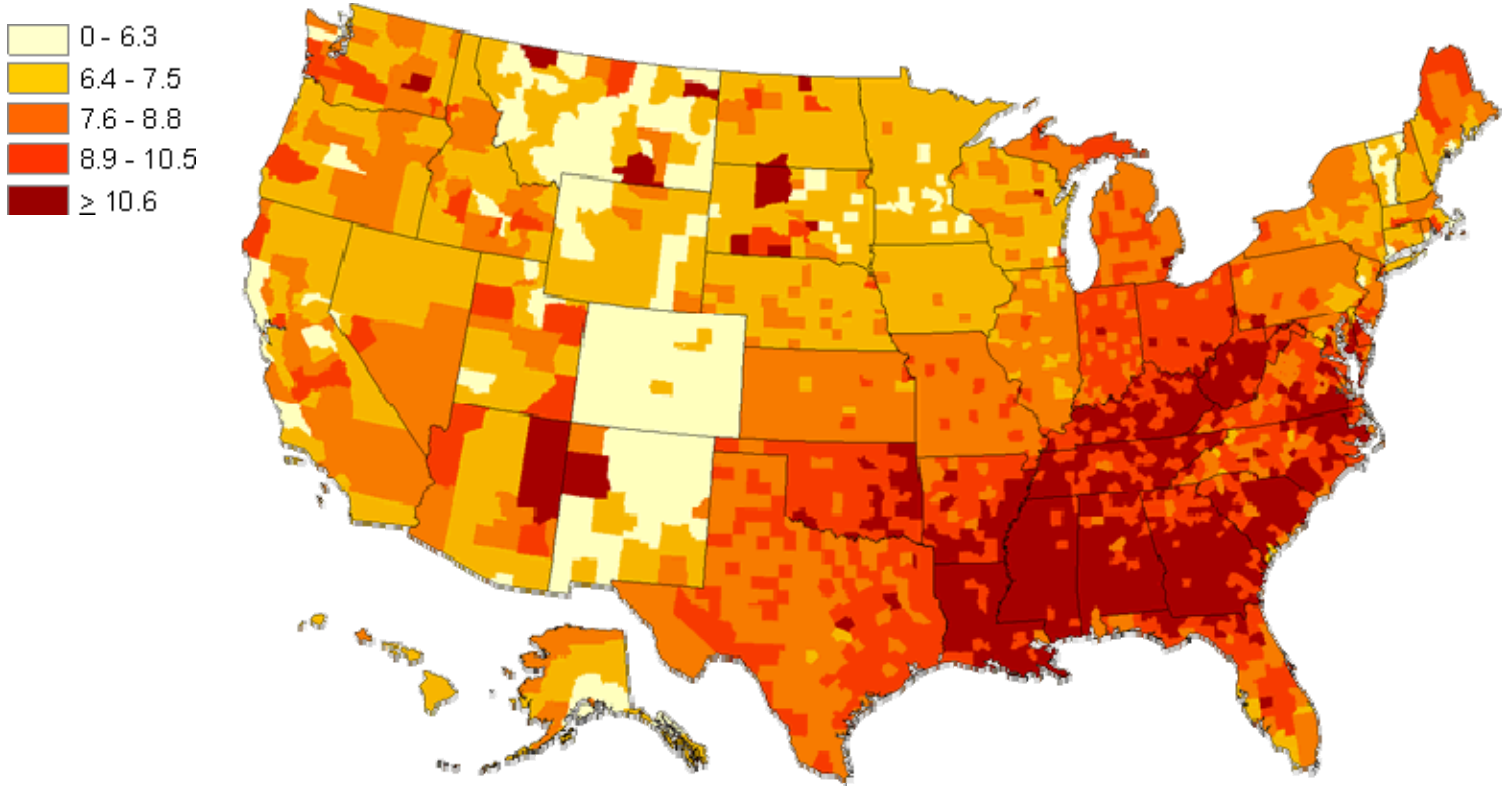
Diabetes Mellitus

- 2007 - CDC Statistics



Diabetes Mellitus

- 2008 - CDC Statistics



Diabetes Mellitus

- 26 million Americans (8.3%)
- 79 million with pre-diabetes (25%)
- 33% with diabetes by 2050 if trend continues

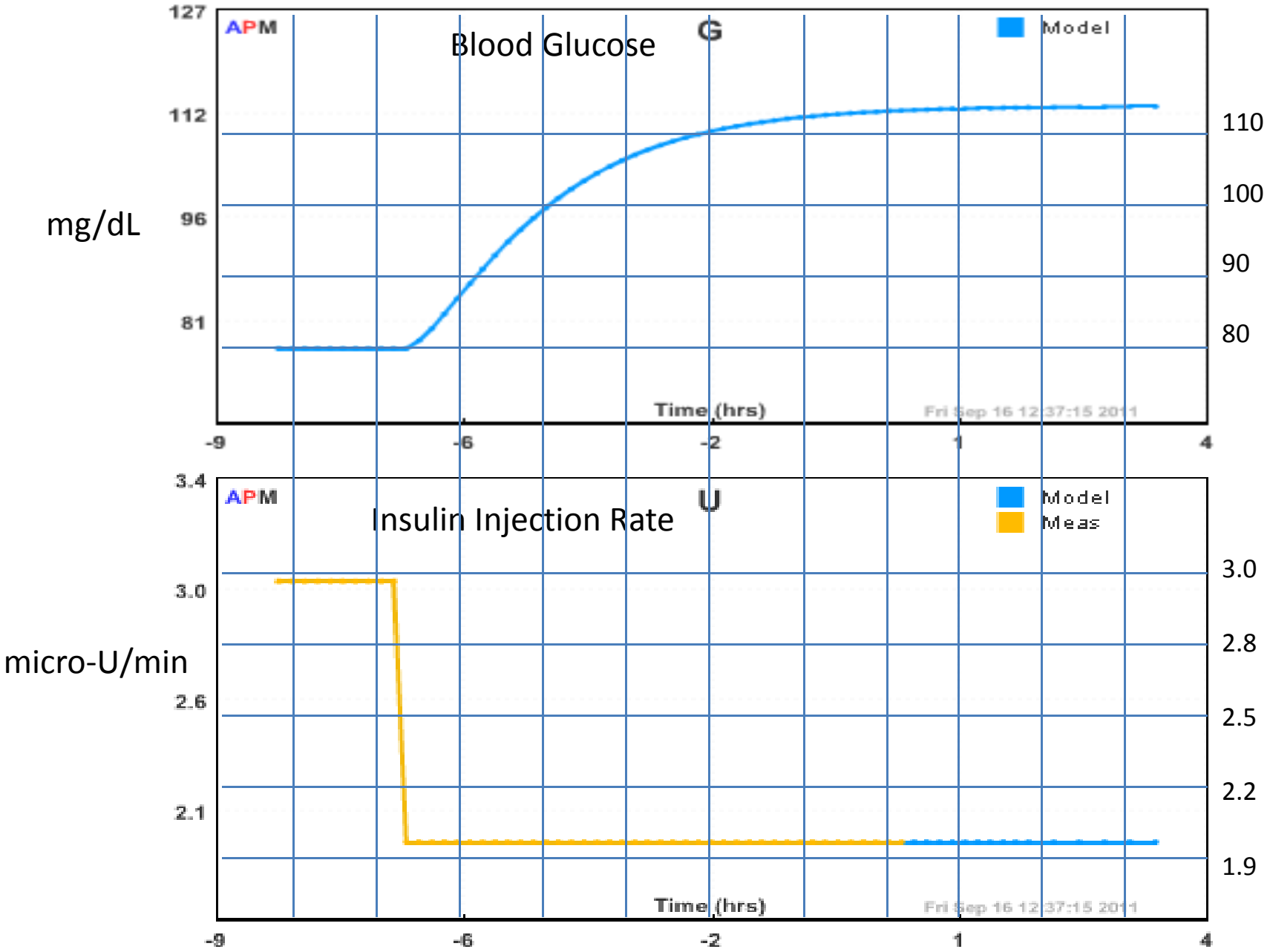
Estimated diabetes costs in the United States, 2007	
Total (direct and indirect)	**$174 billion**
Direct medical costs	**$116 billion** **After adjusting for population age and sex differences, average medical expenditures among people with diagnosed diabetes were 2.3 times higher than what expenditures would be in the absence of diabetes.**
Indirect costs	**$58 billion (disability, work loss, premature mortality)**

Medical expenses for people with diabetes are more than two times higher than for people without diabetes.

Can We Design an Artificial Pancreas?

- Requires:
  - Actuator: Insulin pump
  - Sensor: Blood glucose sensor technology
  - Results Validation (low tolerance for mistakes):
    - Sensor validation
    - Robustness under uncertainty
    - Insulin / blood glucose dynamic model

Fit FOPDT Model & Design Optimal Controller



Artificial Pancreas Design Considerations