

The Gaps and Opportunities for Data to Drive Action for Diabetes:

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to better health

Outline

- *Diabetes as a prototypical problem*
- *Evolution, success, and failures in data driving action*
- *Emerging models, systems, and opportunities*



Diabetes as a prototypical problem

- Diverse, *complex morbidity*

The Diverse Burden of Diabetes

BRAIN

People with diabetes have about twice the risk for **stroke**, a higher risk of **dementia**, and increased symptoms of **depression**.



TEETH & GUMS

People with diabetes, especially those with poorly controlled diabetes, have a greater risk for **gum disease**, a major cause of tooth loss.



HEART & BLOOD VESSELS

People with diabetes are twice as likely to have **heart disease** and have an increased risk of **peripheral artery disease**.



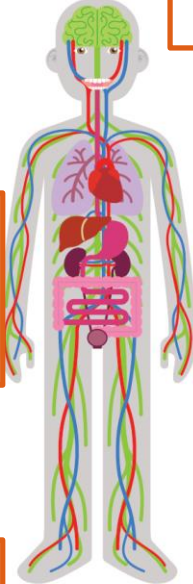
LIVER

People with diabetes are more than twice as likely to have **nonalcoholic fatty liver disease**, which can lead to cirrhosis and liver cancer.



FEET

Diabetic foot ulcers are common in people with diabetes. Healing of foot ulcers may take months to years, and ulcers can lead to **amputation**.



EYES

Diabetes increases the risk for eye diseases such as **retinopathy**, **cataracts**, and **glaucoma**, contributing to an overall increased risk of **vision loss**.



EARS

Diabetes approximately doubles the risk of **hearing loss**, especially in the speaking range.



AIRWAYS

Two in three people with diabetes have **obstructive sleep apnea**, which can lead to fatigue, irritability, and deficits in attention and memory.



KIDNEYS & LOWER URINARY TRACT

Diabetes is the leading cause of **kidney failure** and can also lead to complications of the lower urinary tract, such as **urinary incontinence** and **erectile dysfunction**.



BONE

Bone fractures, **osteoarthritis**, and **rheumatoid arthritis** are more common in people with diabetes.



Three types of Morbidity:

- “Classic complications with high-specificity and high relative risk”
- “Diversifying”, with moderate association but often high prevalence
- “Emerging” of unclear aetiology

Mechanisms through diverse pathways:

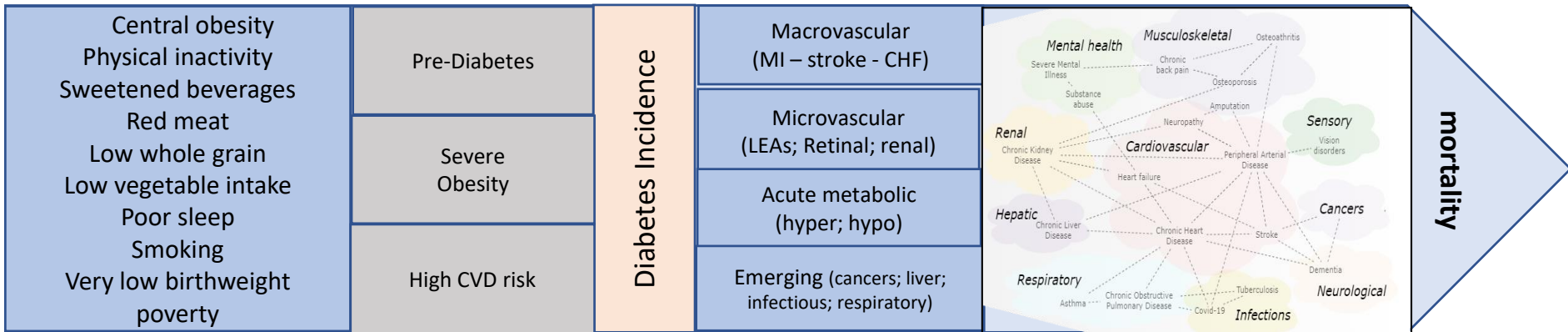
- Long-term hyperglycaemia
- “Common soil” of obesity, insulin resistance, inflammation, etc.
- Behavioural- or treatment-driven

Diabetes as a prototypical problem

- Diverse, *complex morbidity*
- Multiple *stages for intervention*



Risk Factors / Very High Risk / Incidence / Complications / Multimorbidity



Structured lifestyle interventions to:

- Reduce weight
- Achieve healthy diet
- Increase physical activity

Risk Factor management in primary care

Community and public policies:

- Food policies
- Built environment
- Education and health promotion

- Glycemic control
- Blood pressure control
- Lipid control
- Tobacco counseling
- Self-mgt education
- Retinopathy screening
- Foot care / screening
- CKD screening

Integrated Team-based Care

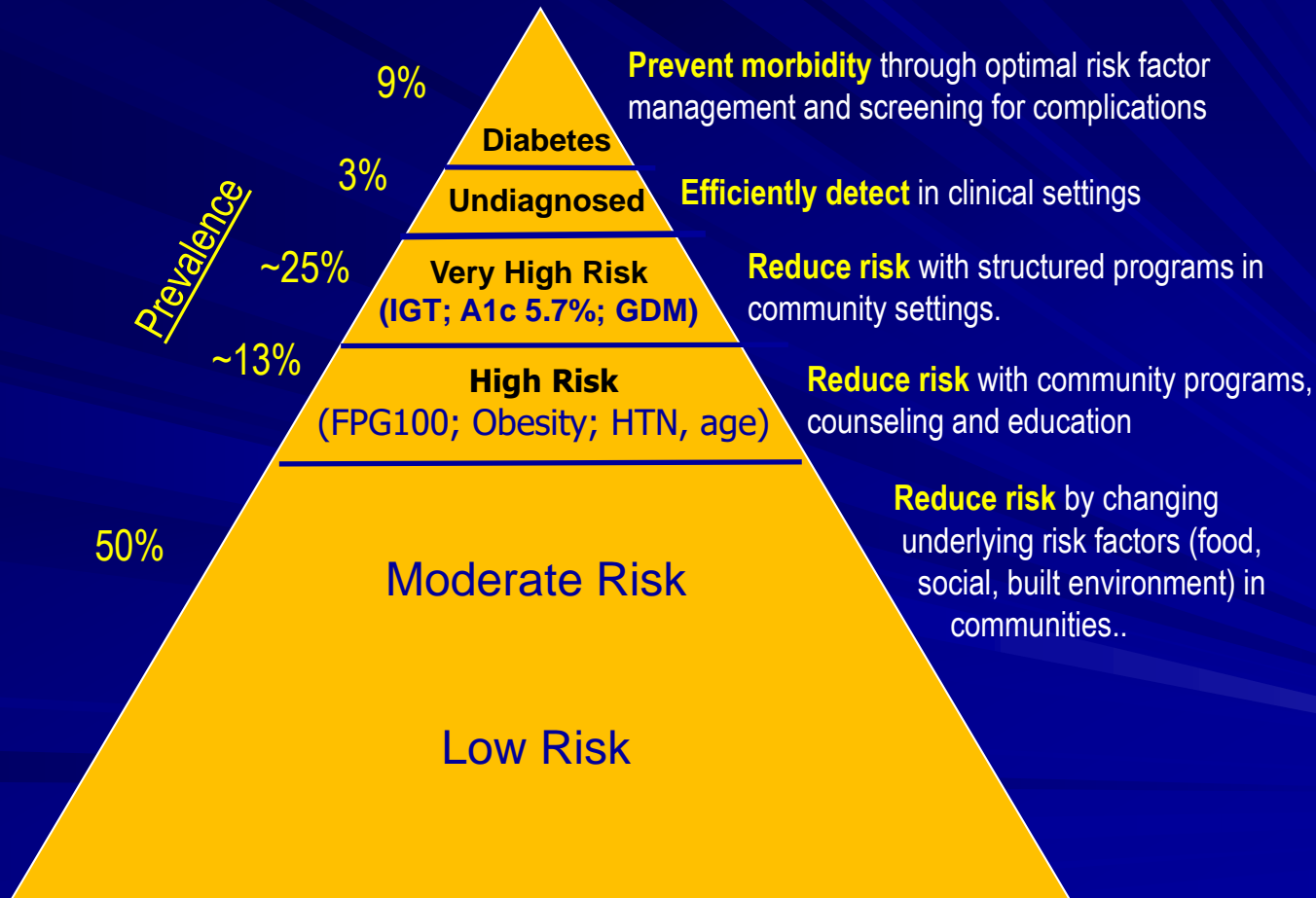
Diabetes as a prototypical problem

- Diverse, *complex morbidity*
- Multiple *risk and disease stages for intervention*
- Multiple *public health avenues of action*

Classic Public Health Avenues To Reduce the Burden of Diabetes



Multiple Levels / Needs for Intervention



Diabetes as a prototypical problem

- Diverse, *complex morbidity*
- Multiple *risk and disease stages for intervention*
- Multiple *public health avenues of action*
- Multiple *stakeholders and beneficiaries*

Multiple Perspectives, Beneficiaries and Stakeholders

- Individuals with diabetes and *at risk* for diabetes
- Families caring for people with diabetes
- Employers and communities
- Clinicians managing risk and preventing progression
- Health-systems managing sub-populations
- Counties, states, nations trying to reduce disease and costs



Evolution of Data Systems for Diabetes:

- *Health Systems perspective*
- *National Public health perspective*



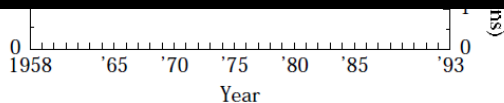
Status of Type 2 Diabetes in the U.S. 1995

Figure 4.3

Time Trends in the Number and Percent of the
Popu

- Relative risk of amputation: 20
- Relative risk of ESRD: 10
- Self-monitoring glucose: 14 %
- HbA1c > 9%: 30 %

Percent of population



Source: Reference

THE EFFECT OF INTENSIVE TREATMENT OF DIABETES ON THE DEVELOPMENT AND PROGRESSION OF LONG-TERM COMPLICATIONS IN INSULIN-DEPENDENT DIABETES MELLITUS

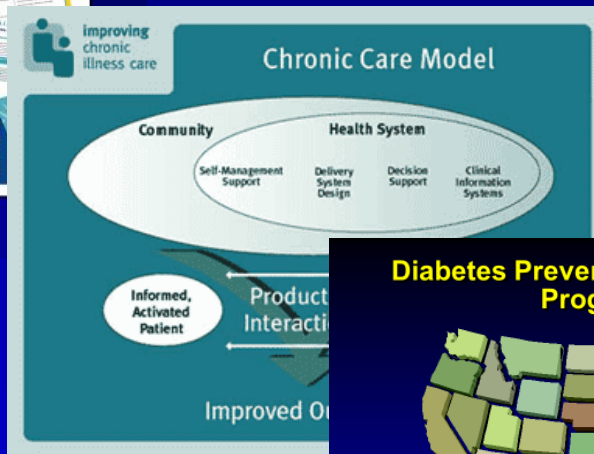
THE DIABETES CONTROL AND COMPLICATIONS TRIAL RESEARCH GROUP*

Tight blood pressure control and risk of macrovascular and microvascular complications in type 2 diabetes:
UKPDS 38

The Diabetes Quality Improvement Project

Moving science into health policy to gain an edge on the diabetes epidemic

National Diabetes Education Program*

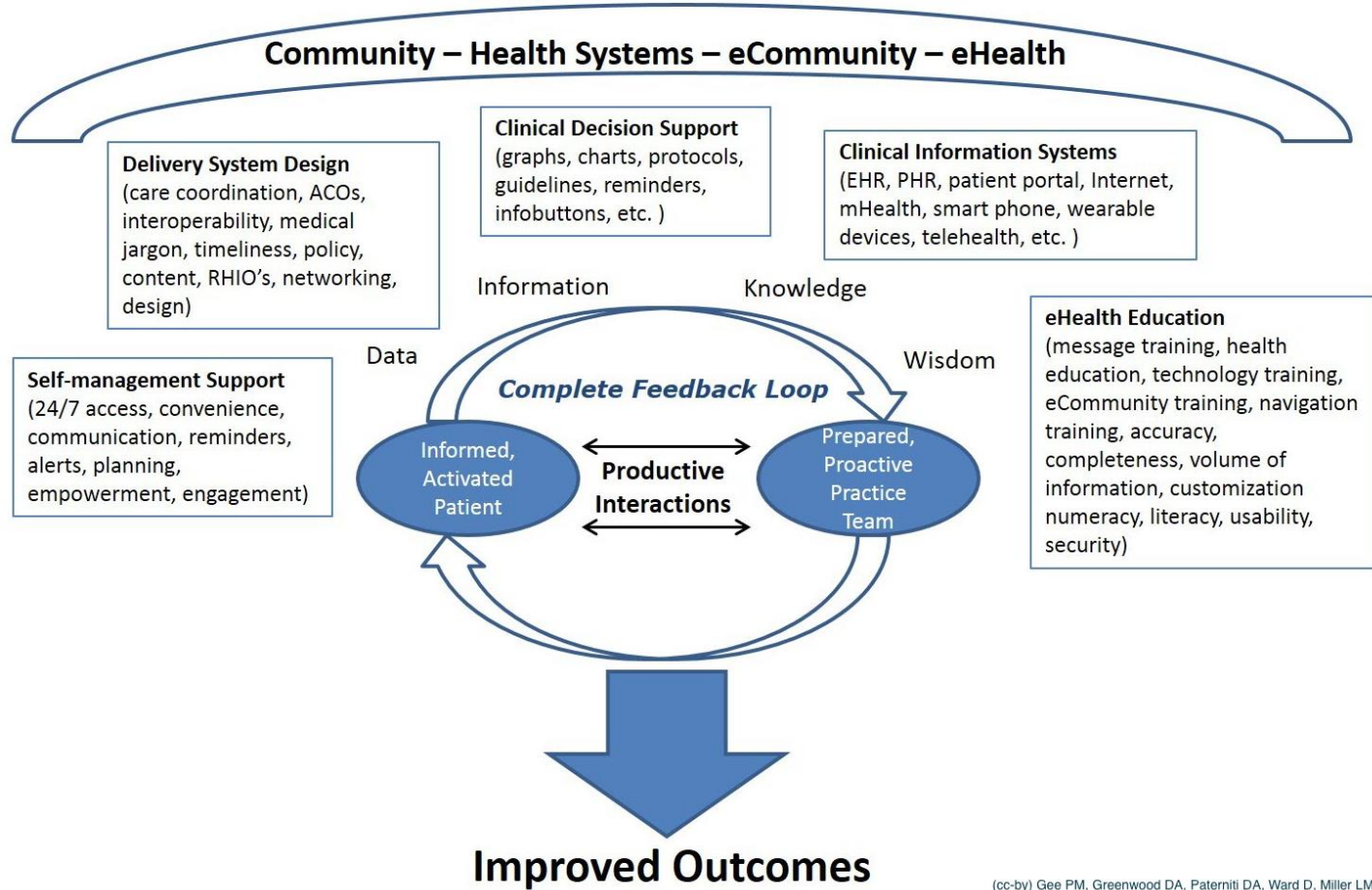


Diabetes Prevention and Control Programs



50 States & DC
8 Territories
17 Tribes
Vulnerable Pops

The eHealth Enhanced Chronic Care Model (eCCM)



The Growth of Diabetes Registries for Diabetes Care and Disease Management

Panel of patients
With single or few
Risk factors

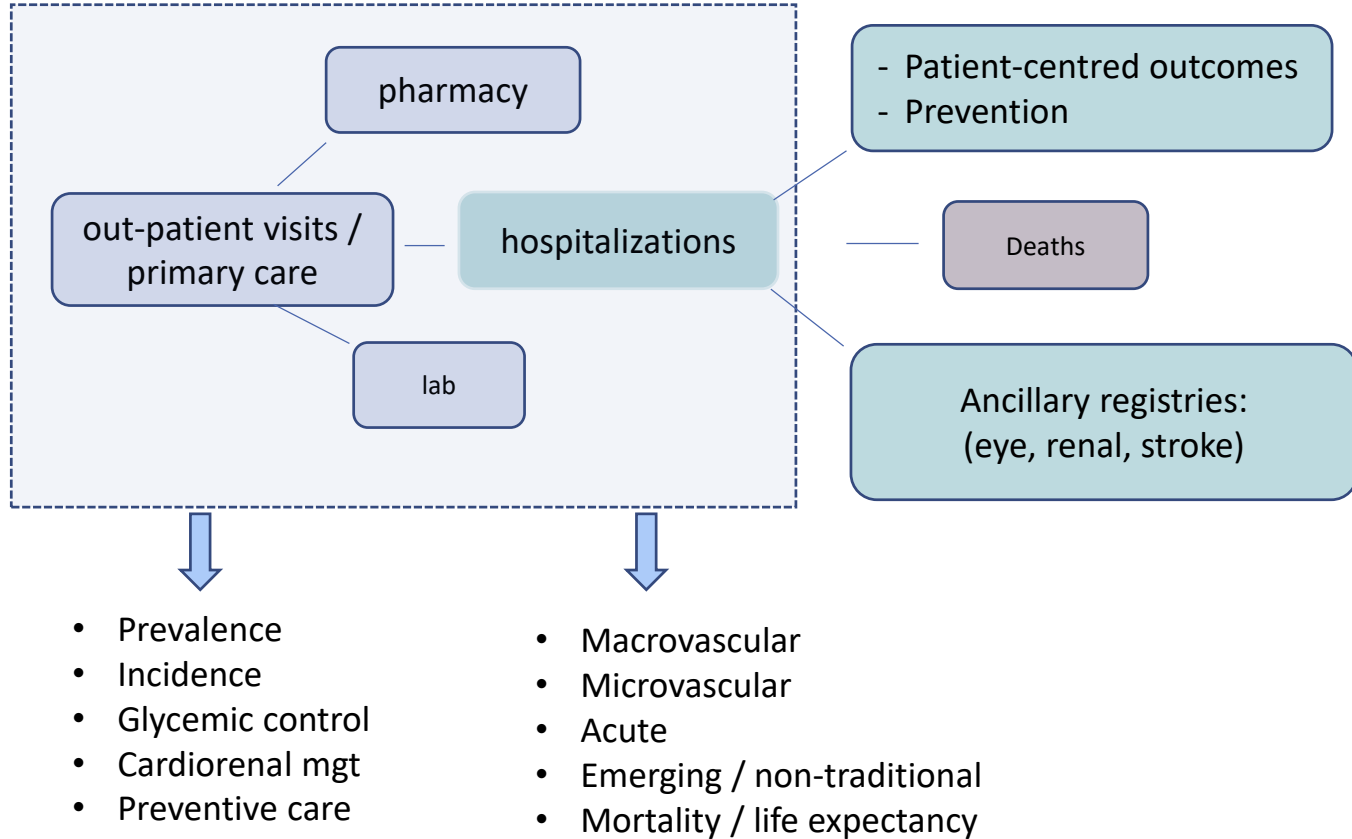
Expansion to Comprehensive Care:

- Multiple risk factors
- Testing/ screening
- Pharmacy
- Lab
- EMR

High Capacity Systems:

- Multiple component linkage
- Continuous monitoring
- Direct feedback
- Applied analyses
- Comparative effectiveness
- Expanded outreach

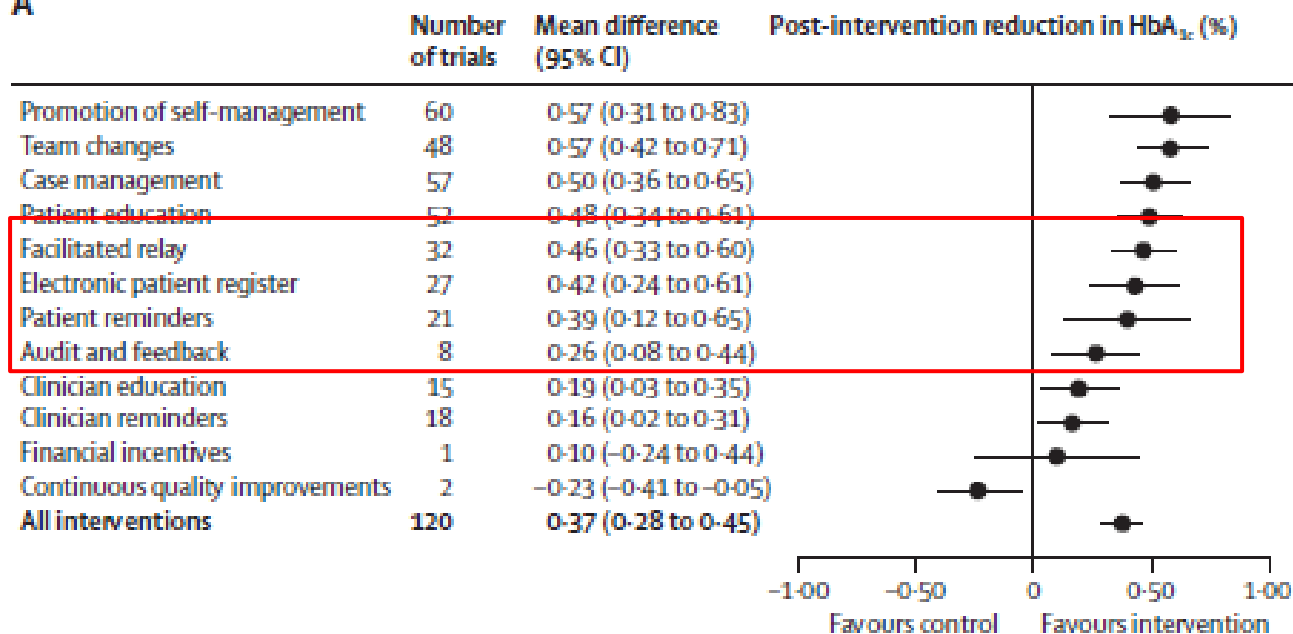
Essential Elements of Population-Based Diabetes Registries



Effectiveness of quality improvement strategies on the management of diabetes: a systematic review and meta-analysis

Andrea C Tricco, Noah M Ivers, Jeremy M Grimshaw, David Moher, Lucy Turner, James Galipeau, Ilana Halperin, Brigitte Vachon, Tim Ramsay, Braden Manns, Marcello Tonelli, Kaveh Shojania

A



National Diabetes Surveillance System

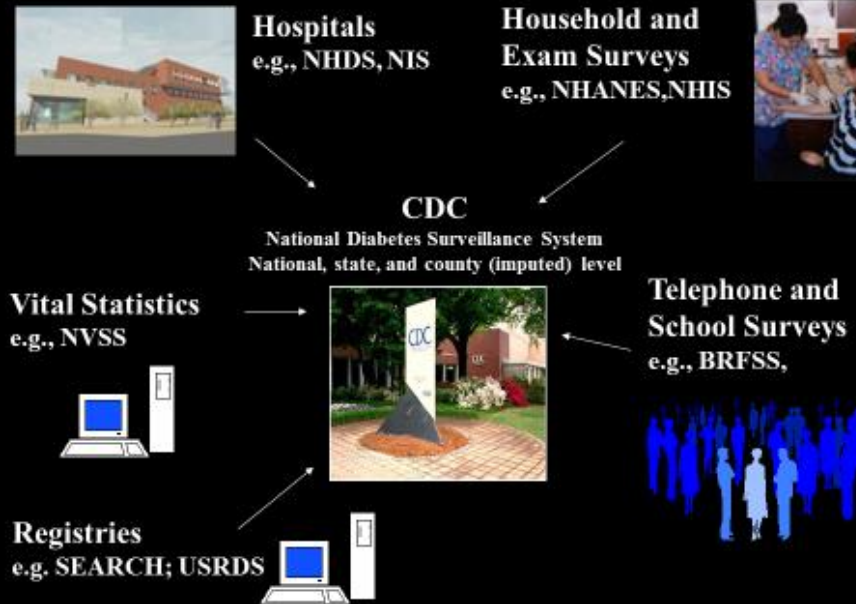
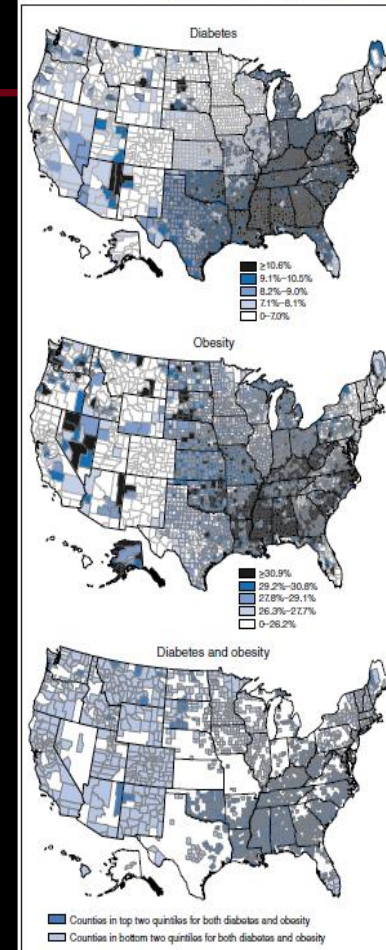


FIGURE. Age-adjusted percentages of persons aged ≥ 20 years with diabetes and obesity, by county — United States, 2007

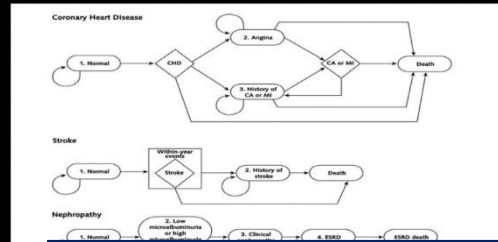


Main Categories of Diabetes Surveillance Indicators

- **Measures of *Disease Burden***
 - Clear impact on quality of life, health status, or economics
 - Examples: (prevalence, incidence, complications).
- ***Modifiable Risk Factors for Diabetes***
 - Based on controlled trials or consistent cohort studies.
 - Examples: (HbA1c levels, physical activity levels)
- ***Effective Interventions***
 - May be behavioral, clinical, community-based, or policy- based
 - Based on controlled trials, meta-analyses, strong clinical consensus.
 - Examples: (lifestyle programs; eye exams; ABCs testing)
- **Safety concerns / Harms of treatment**

Analytic and Modeling Applications

- Ongoing national, state, county surveillance
- Small area estimation
- Disease Forecasting
- Lifetime risk and disease progression
- Healthy and disabled years of life.
- Cost-effectiveness of interventions.



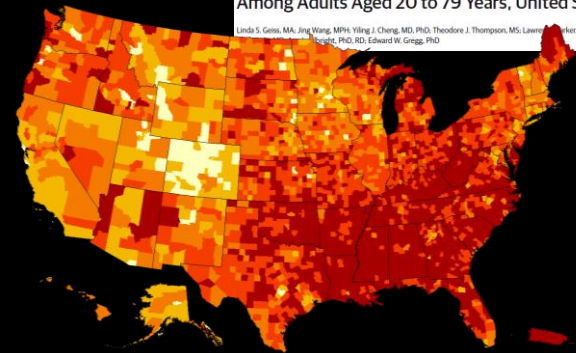
Trends in lifetime risk and years of life lost due to diabetes in the USA, 1985-2011: a modelling study

Trends in cause-specific mortality among adults with and without diagnosed diabetes in the USA: an epidemiological analysis of linked national survey and vital statistics data

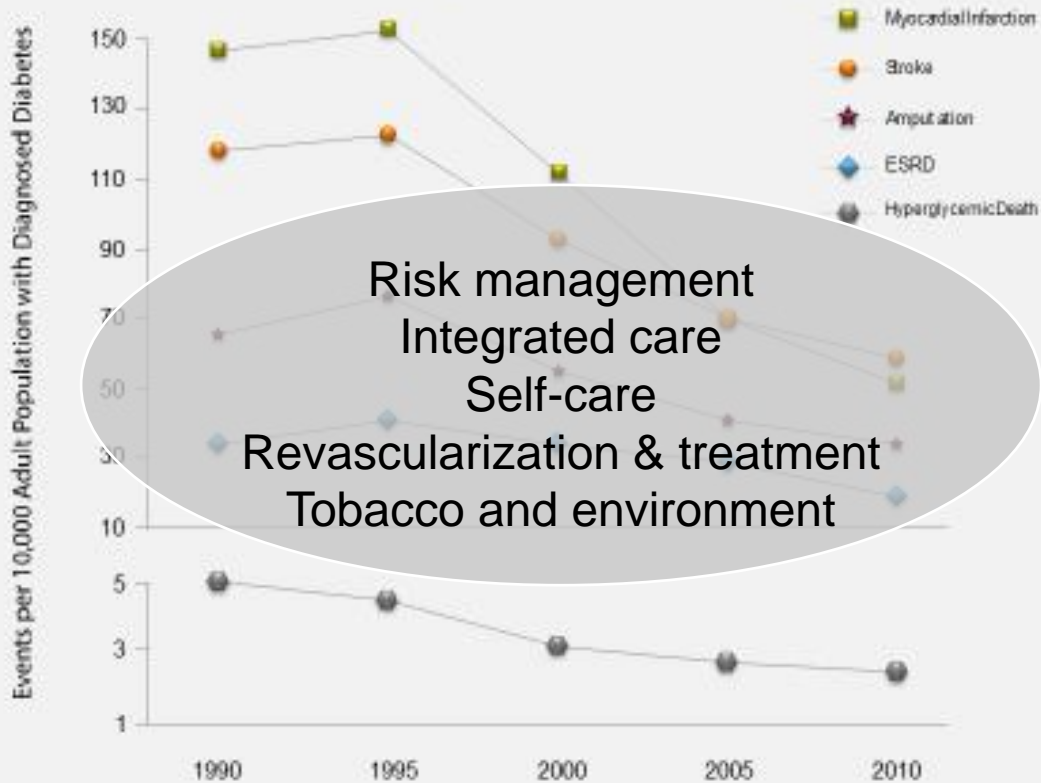
Original Investigation

Prevalence and Incidence Trends for Diagnosed Diabetes Among Adults Aged 20 to 79 Years, United States, 1980-2012

Linda S. Geiss, MA, Jing Wang, MPH, Ying J. Cheng, MD, PhD, Theodore J. Thompson, MS, Lawrence A. Green, PhD, Edward W. Gregg, PhD



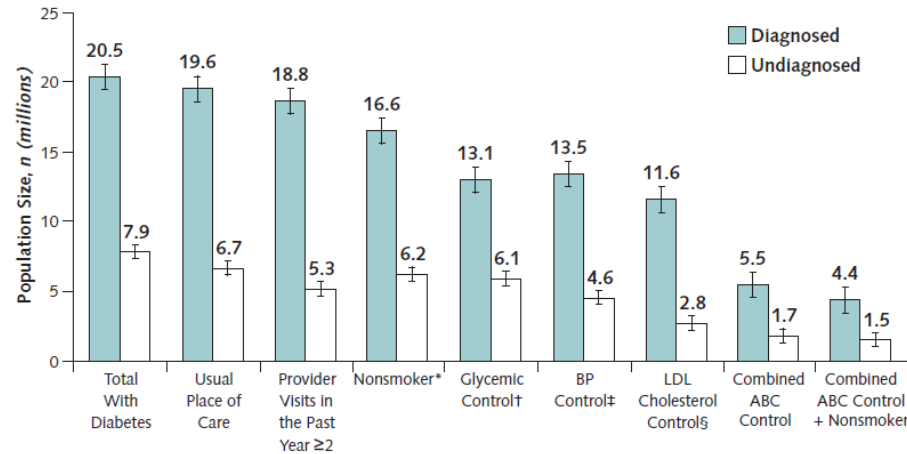
Trends in Age-standardized Rates of Diabetes-Related Complications from 1990 to 2010 among U.S. Adults with Diagnosed Diabetes



A Cascade of Care for Diabetes in the United States: Visualizing the Gaps

Mohammed K. Ali, MBChB, MSc, MBA; Kai McKeever Bullard, MPH, PhD; Edward W. Gregg, PhD; and Carlos del Rio, MD

Figure 1. Cascade of care for U.S. adults with diabetes aged 18 years or older in 2012, NHANES 2007–2012.



Data are presented as numbers in millions (lines at top of each bar indicate 95% CIs). In 2012, an estimated 28.4 million adults had diabetes (calculated as: 2012 resident population [$n = 240\,185\,952$] \times estimated prevalence of total diabetes [11.8%]). ABC = combined control of hemoglobin A_{1c} level, BP, and LDL cholesterol level; BP = blood pressure; LDL = low-density lipoprotein. NHANES = National Health and Nutrition Examination Survey.

* Defined by negative response to a question about current smoking and serum cotinine levels ≤ 56.8 nmol/L (≤ 10 ng/mL).

† Defined by individualized hemoglobin A_{1c} targets based on age and presence of complications (existing retinopathy, nephropathy, or cardiovascular disease).

‡ Defined as $<140/80$ mm Hg (per American Diabetes Association guidelines).

§ Defined as <2.6 mmol/L (<100 mg/dL) (per American Diabetes Association guidelines).

New Problems, threats, and opportunities

Problems and threats:

- Stagnation in care and outcomes
- Growing obesity and type 2 diabetes in youth/young adults
- Age divide in care and outcomes, with resurging complications.
- Persistent inequalities
- Diversifying morbidity and multimorbidity

Opportunities:

- New therapies and interventions
- New prevention programmes
- Big and better data
- New data systems



The *Lancet* Commission on diabetes: using data to transform diabetes care and patient lives

Community/hospital based
Diabetes mini-teams



Linkage to population, socio-demographic, environmental and other administrative databases (e.g. birth registers) to identify root causes



Structured assessment
Diabetes Registers

Risk stratification
Care triage
Feedback
Empowerment
Recall

Linkage to hospitalization data, EMR and other registers (e.g. death, dialysis, cancer, heart failure, stroke, myocardial infarction) to ascertain outcomes



Self care & social support

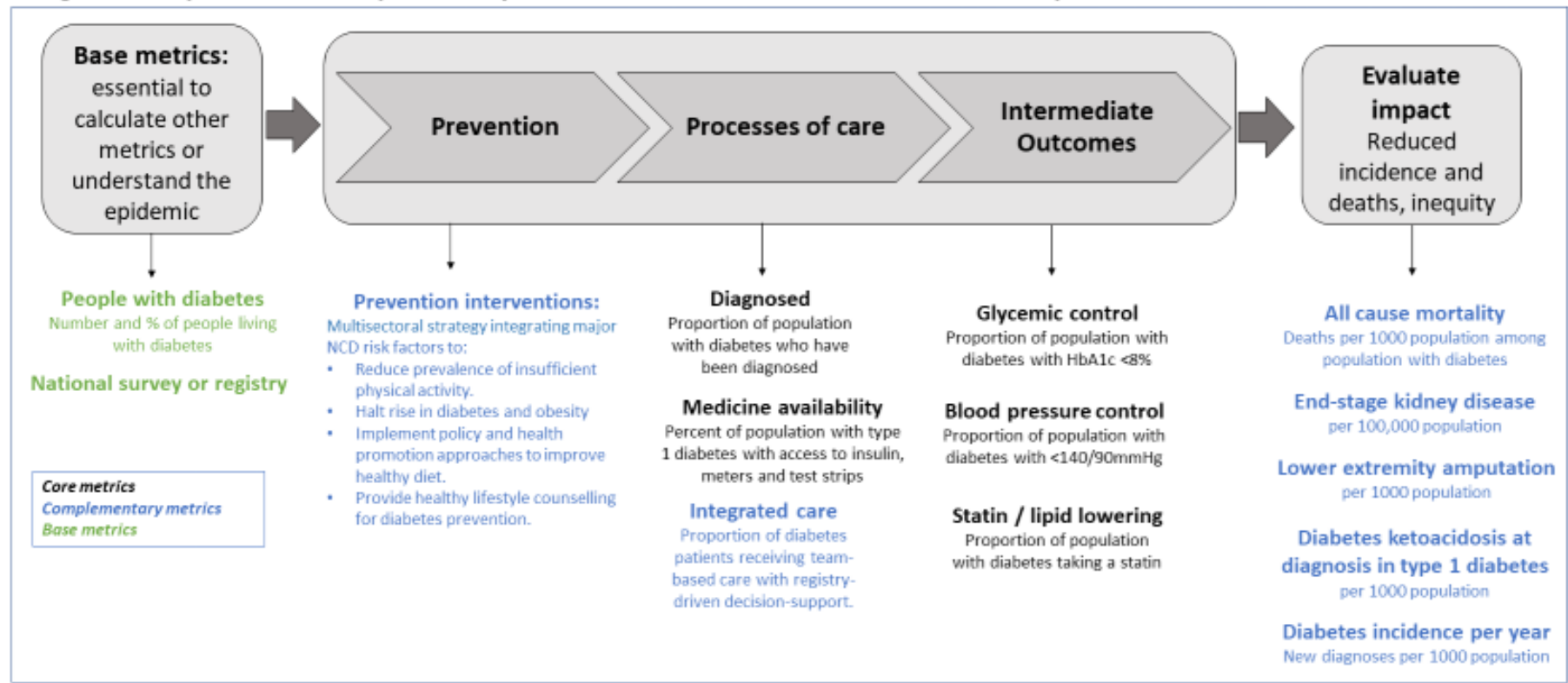


Continuing care, medications, education



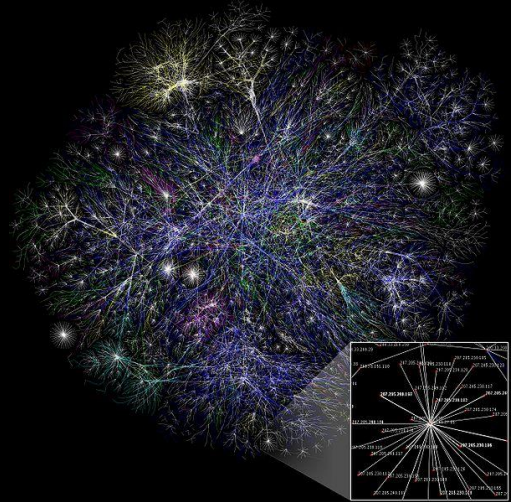
Lifestyle changes, stress management, digital health

Figure 2. Proposed core, complementary, and base metrics for the *Global Diabetes Compact*.



New Opportunities in Population Monitoring and Feedback

- Bigger Data
- Mobile and wearable data
- Patient-centred outcomes
- Applications:
 - Multiple levels
 - Tools and risk calculators
 - Epidemiologic
- Platforms for comparative effectiveness



Thank you

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