

# **Evidence-based community interventions for diabetes prevention and control**

*GLOBAL HEALTH CONSORTIUM GHC  
9th INTERNATIONAL GLOBAL HEALTH CONFERENCE*

*Edward W. Gregg, PhD  
Department of Epidemiology and Biostatistics  
School of Public Health, Imperial College London*

# Outline

- Diabetes as a public health problem
- The Central role of communities in prevention
- Evidence for action to prevent complications
- Evidence for action to prevent diabetes
- Needs and the way forward

# Diabetes as a Public Health Problem

- High and growing prevalence
- Extensive and diverse social determinants
- Diverse comorbidity and complex care
- Difficult and varying barriers to both care and prevention
- Beyond what health care can provide alone

## What *should* prevention look like?

- Have **multiple avenues** of public health action, including health systems, health promotion, and population-wide policies:
- Include both a **high-risk** and **population approach**.

# Classic Public Health Avenues for Chronic Disease Prevention

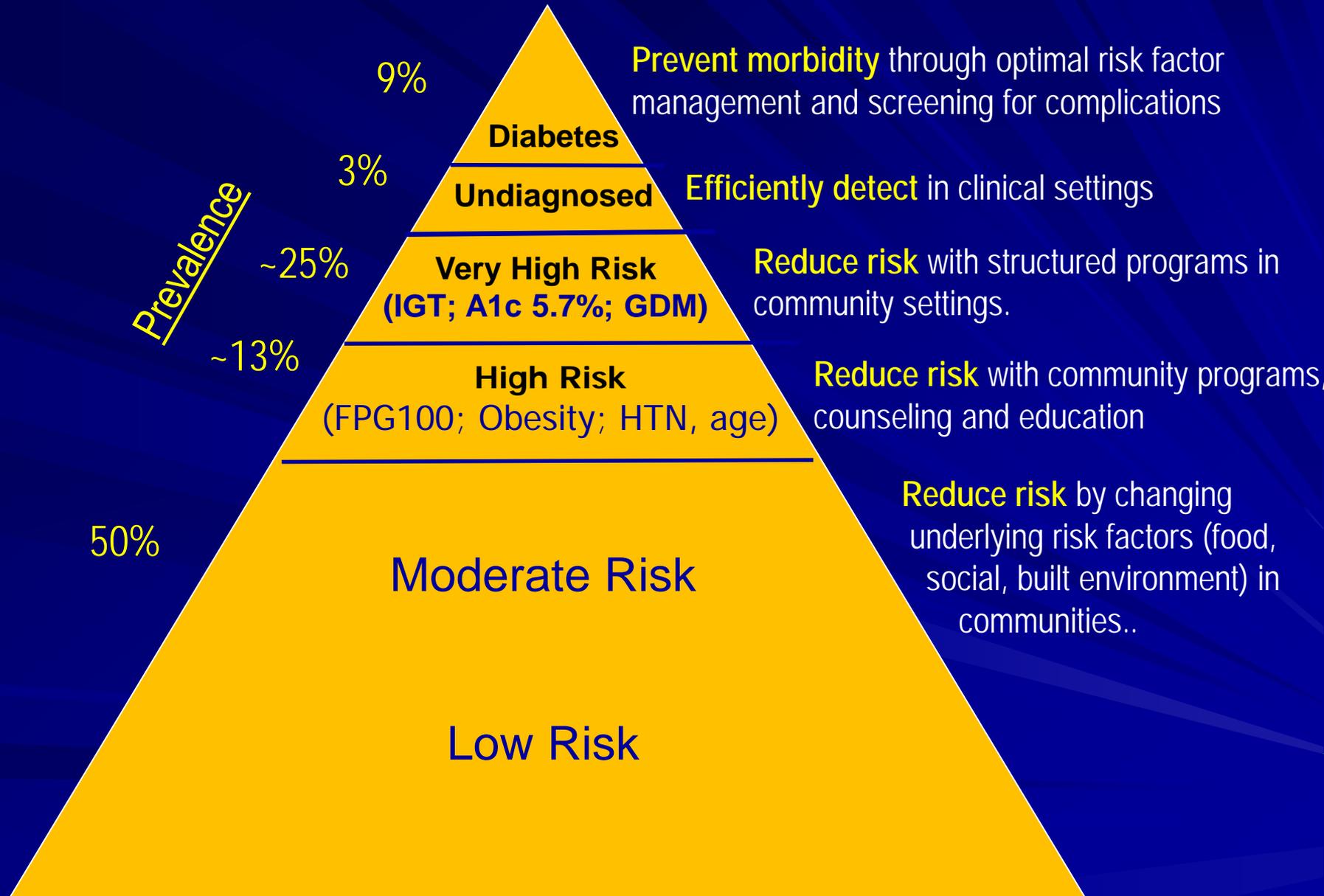


# What *should* prevention look like?

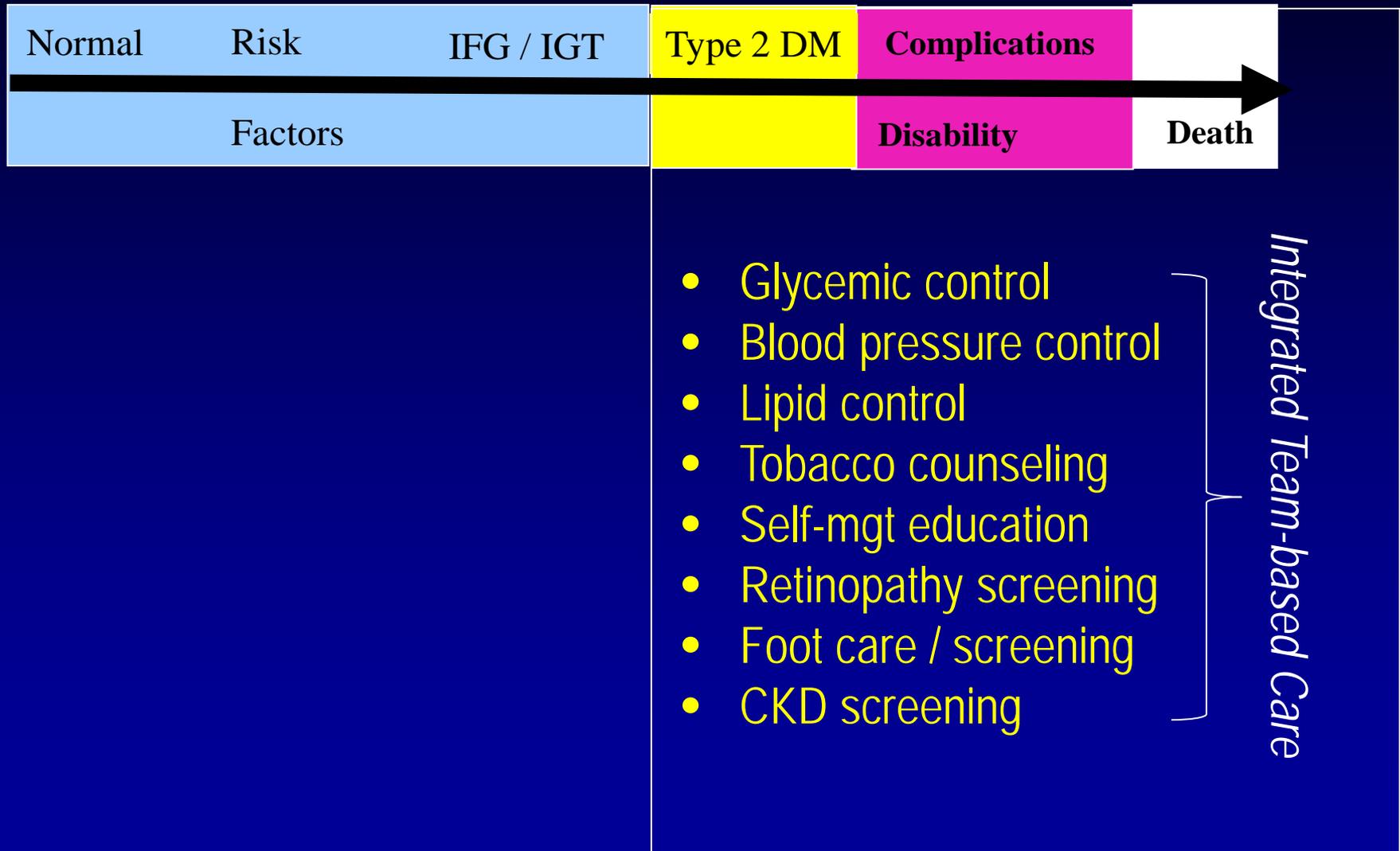
- Have **multiple avenues** of public health action, including health systems, health promotion, and population-wide policies:
- Include both a **high-risk** and **population approach**.
- Be **multi-tiered** using risk stratification approaches to link interventions to risk level.
- Consider **short-term** and **long-term** time horizons.



# Diabetes Pyramid of Prevention



# Range of Potential Public Health Priorities for Diabetes



# The eHealth Enhanced Chronic Care Model (eCCM)

Community – Health Systems – eCommunity – eHealth

**Delivery System Design**  
(care coordination, ACOs, interoperability, medical jargon, timeliness, policy, content, RHIO's, networking, design)

**Clinical Decision Support**  
(graphs, charts, protocols, guidelines, reminders, infobuttons, etc. )

**Clinical Information Systems**  
(EHR, PHR, patient portal, Internet, mHealth, smart phone, wearable devices, telehealth, etc. )

**Self-management Support**  
(24/7 access, convenience, communication, reminders, alerts, planning, empowerment, engagement)

Data

Information

Knowledge

Wisdom

**Complete Feedback Loop**

Informed,  
Activated  
Patient

Productive  
Interactions

Prepared,  
Proactive  
Practice  
Team

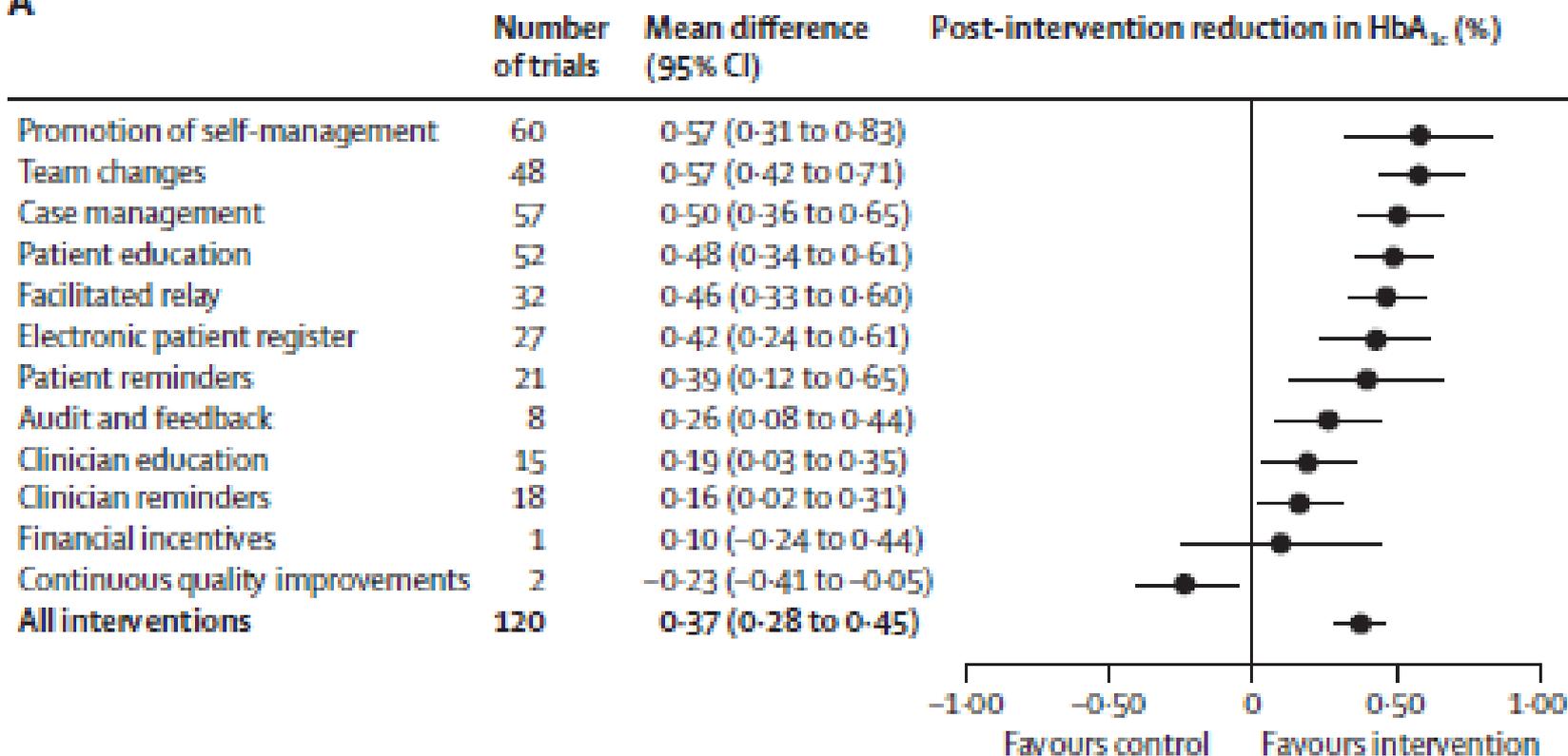
**eHealth Education**  
(message training, health education, technology training, eCommunity training, navigation training, accuracy, completeness, volume of information, customization, numeracy, literacy, usability, security)

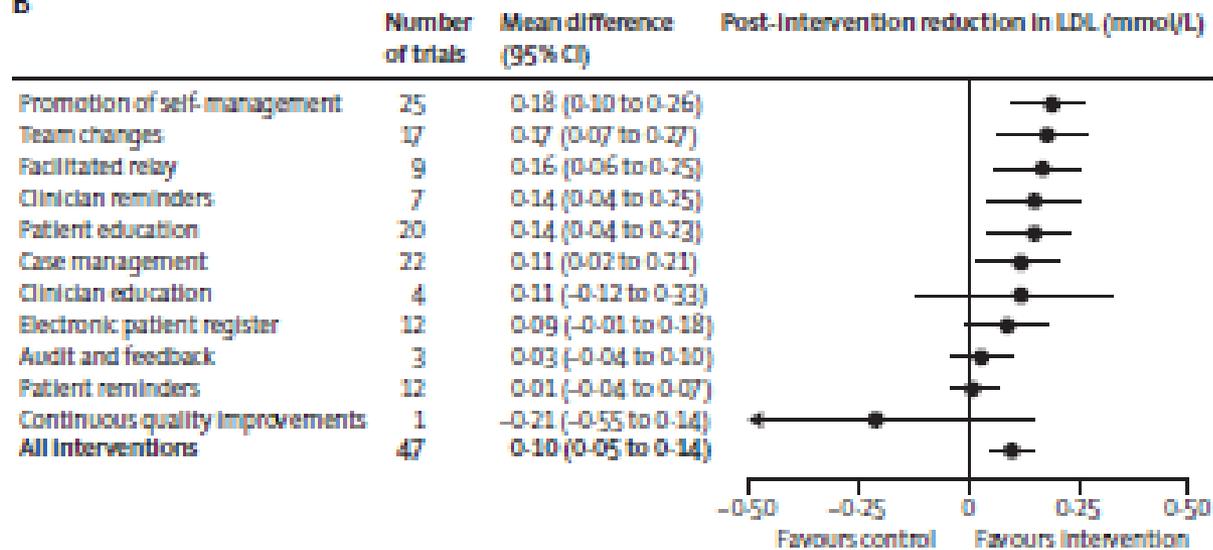
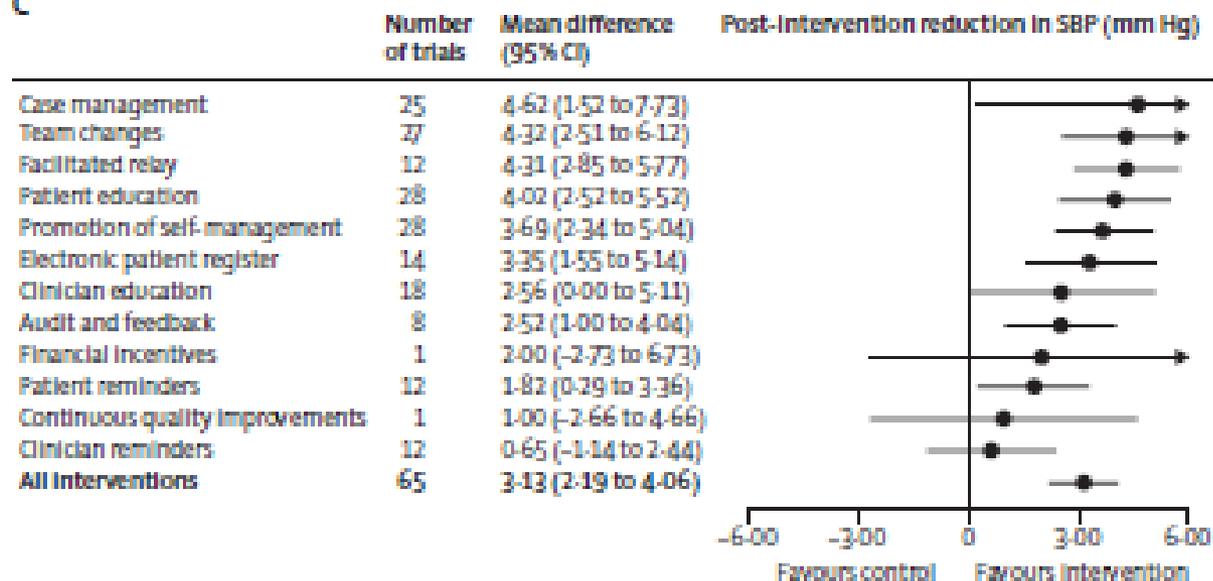
**Improved Outcomes**

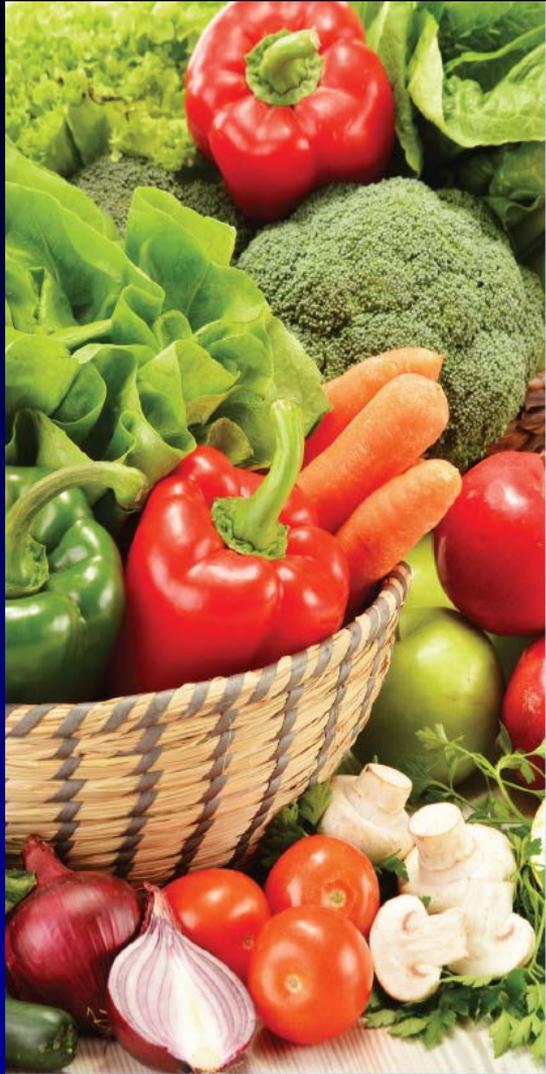
# Effectiveness of quality improvement strategies on the management of diabetes: a systematic review and meta-analysis

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



**B****C**



# The Community Guide

[www.thecommunityguide.org](http://www.thecommunityguide.org)

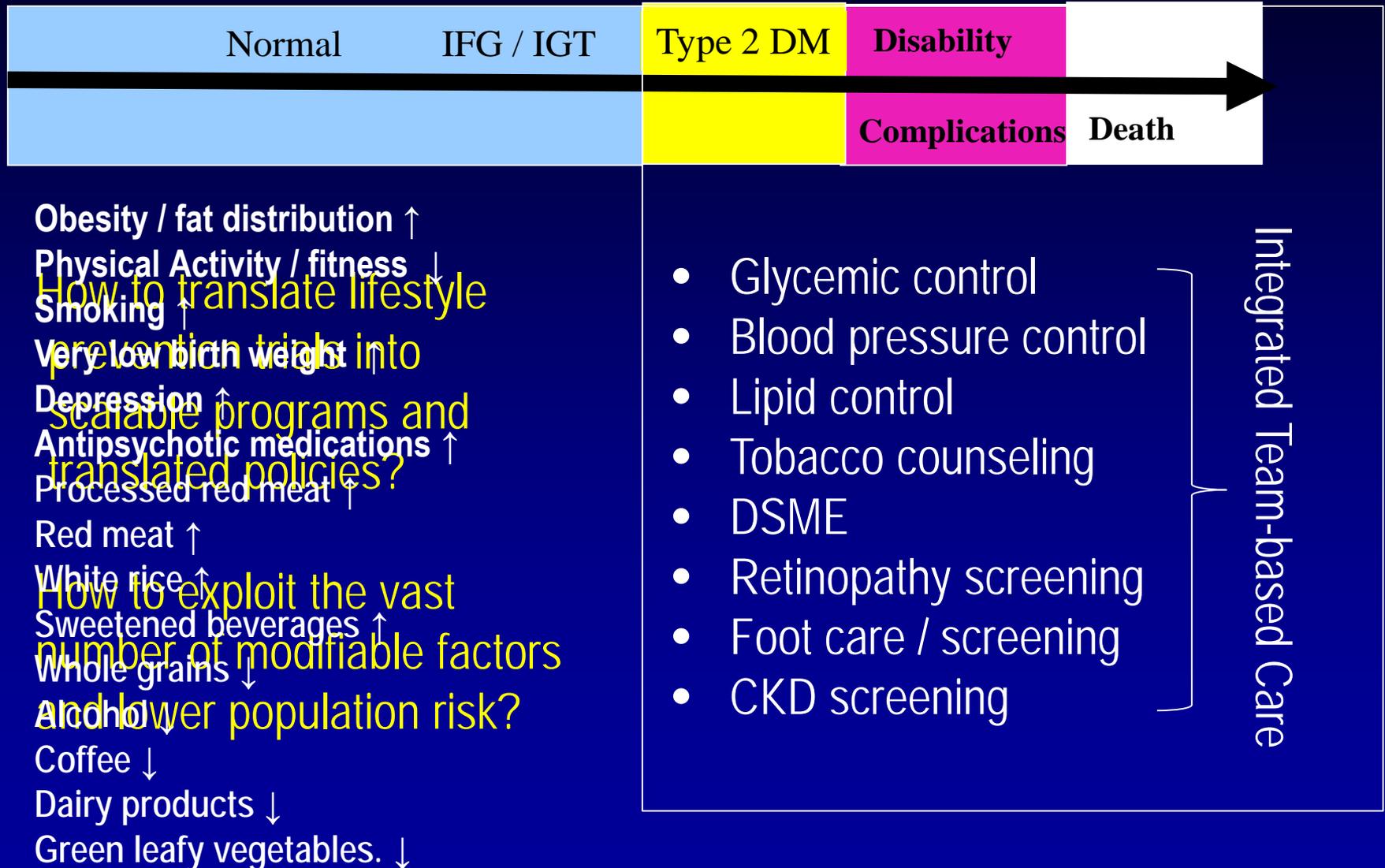
## WHAT WORKS

### Diabetes Prevention and Control

*Evidence-Based Interventions for Your Community*

- **Team-based care interventions** to help patients manage type 2 diabetes and improve ABCs.
- **Case management interventions** to coordinate and provide care.
- Engage **community health workers** in care and prevention to improve glycemic control and weight-related outcomes.
- **Intensive lifestyle interventions** for patients with type 2 diabetes to improve glycemic control, dietary, PA, and weight management.
- Implement **telehealth interventions** to assist in efficient interaction between providers and patients to improve dietary practice.

# Range of Potential Public Health Priorities for Diabetes



- How to translate lifestyle prevention trials into scalable programs and translated policies?
- How to exploit the vast number of modifiable factors and lower population risk?

## Effects of Diet and Exercise in Preventing NIDDM in People With Impaired Glucose Tolerance

The Da Qing

XIAO-REN PAN, MD  
GUANG-WEI LI, MD  
YING-HUA HU, MD  
JI-XING WANG, MD  
WEN-YING YANG, MD  
ZHU-XIN AN, MD  
ZE-XI HU, MD  
JUAN-LIN, MD  
JIAN-ZHONG XIAO, MD

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VOLUME 346

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REDUCTION IN THE INCIDENCE OF TYPE 2 DIABETES WITH LIFESTYLE INTERVENTION OR METFORMIN

Review article

## Behavioral strategies in diabetes prevention programs: A systematic review of randomized controlled trials

Michael K. Raber<sup>a,\*</sup>, Kylie Simpson<sup>b</sup>, Bradley Lloyd<sup>b</sup>,  
Adrian

The New England  
Journal of Medicine

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VOLUME 344

MAY 3, 2001

NUMBER



PREVENTION OF TYPE 2 DIABETES MELLITUS BY CHANGES IN LIFESTYLE AMONG SUBJECTS WITH IMPAIRED GLUCOSE TOLERANCE

Diabetologia (2006) 49: 289–297  
DOI 10.1007/s00125-005-0097-z

ARTICLE

A. Ramachandran · C. Snehalatha · S. Mary ·  
B. Mukesh · A. D. Bhaskar · V. Vijay ·  
Indian Diabetes Prevention Programme (IDPP)

## The Indian Diabetes Prevention Programme shows that lifestyle modification and metformin prevent type 2 diabetes in Asian Indian subjects with impaired glucose tolerance (IDPP-1)

Received: 20 August 2005 / Accepted: 18 October 2005 / Published online: 20 October 2005  
© Springer-Verlag 2006

## Translating the Diabetes Prevention Program into the Community The DEPLOY Program

Prevention of type 2 diabetes by lifestyle intervention: a Japanese trial in IGT males

Kinori Kosaka<sup>a</sup>, Mitsuhiko Noda<sup>a,\*</sup>, Takeshi Kuzuya<sup>b</sup>

LINDSTRÖM, M.S., JOHAN G. ERIKSSON, M.D., PH.D., TIMO T. VALTONEN, M.D.,  
J. ILANNE-PARIKKA, M.D., SIRKKA KEINÄNEN-KIUKAANNIEMI, M.D., PIETRI  
J. HERANTA, M.S., MERJA RASTAS, M.S., VIRPI SALMINEN, M.S.,  
M. H. HELIN, M.D., FOR THE FINNISH DIABETES PREVENTION STUDY GROUP

The long-term effect of lifestyle interventions to prevent diabetes in the China Da Qing Diabetes Prevention Study: a 20-year follow-up study

Guangwei Li, Ping Zhang, Jingjing Wang, Edward W. Gregg, Wenying Yang, Qihong Gong, Huili Li, Hongfeng Li, Youjun Jiang, Yuli An, Ying Shui, Bo Zhang, Jingjing Zhang, Theodore J. Thompson, Robert B. Gerzoff, Gajjar Kogut, Yinghua Hu, Peter H. Bennett

### Summary

**Background** Intensive lifestyle interventions can reduce the incidence of type 2 diabetes in people with impaired glucose tolerance, but how long these benefits extend beyond the period of active intervention, and whether such interventions reduce the risk of cardiovascular disease (CVD) and mortality, is unclear. We aimed to assess whether intensive lifestyle interventions have a long-term effect on the risk of diabetes, diabetes-related macrovascular and microvascular complications, and mortality.

Annals 2006; 57: 279–89  
See Comment page 273  
Department of Endocrinology,  
Chang-Aiwan Friendship  
Hospital, Beijing, China



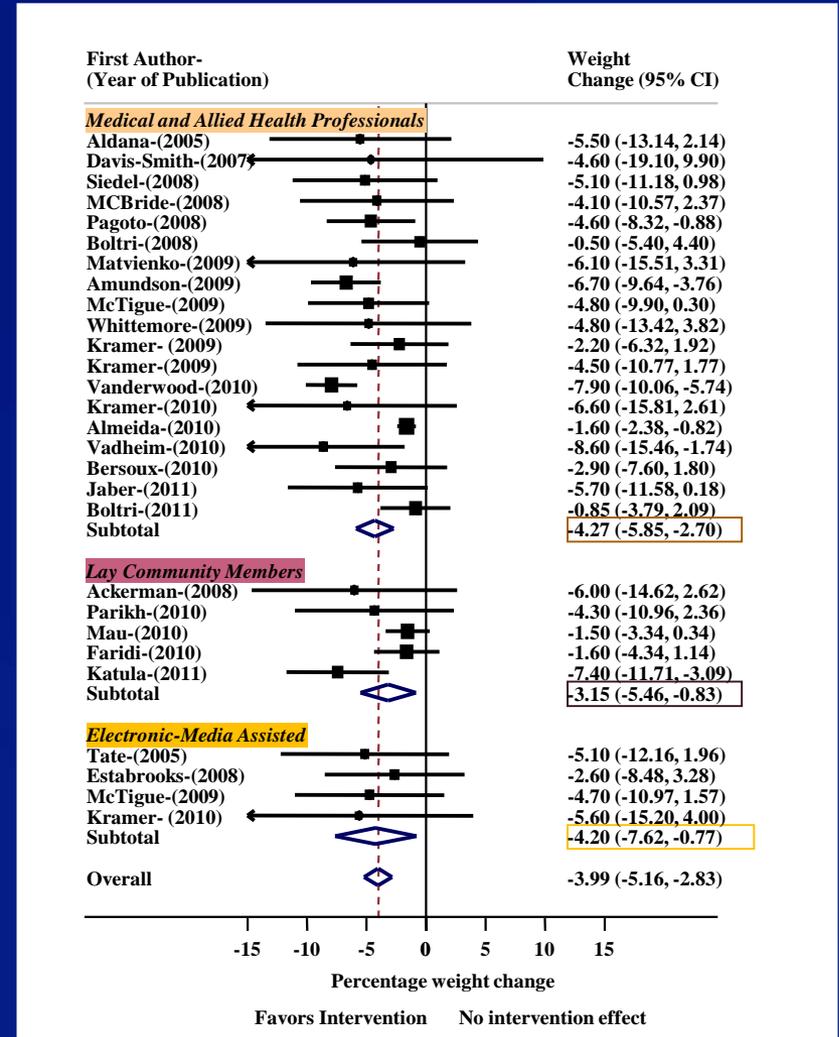
# Range of Options for Prevention

## ■ Individual-Focused:

- Structured, multi-disciplinary lifestyle
- Metformin and other drugs
- Nutrition and education referral
- Low intensity, high reach counseling approaches
- Worksite wellness

# How effective were lifestyle interventions in real-world settings that were modeled on the Diabetes Prevention Program?

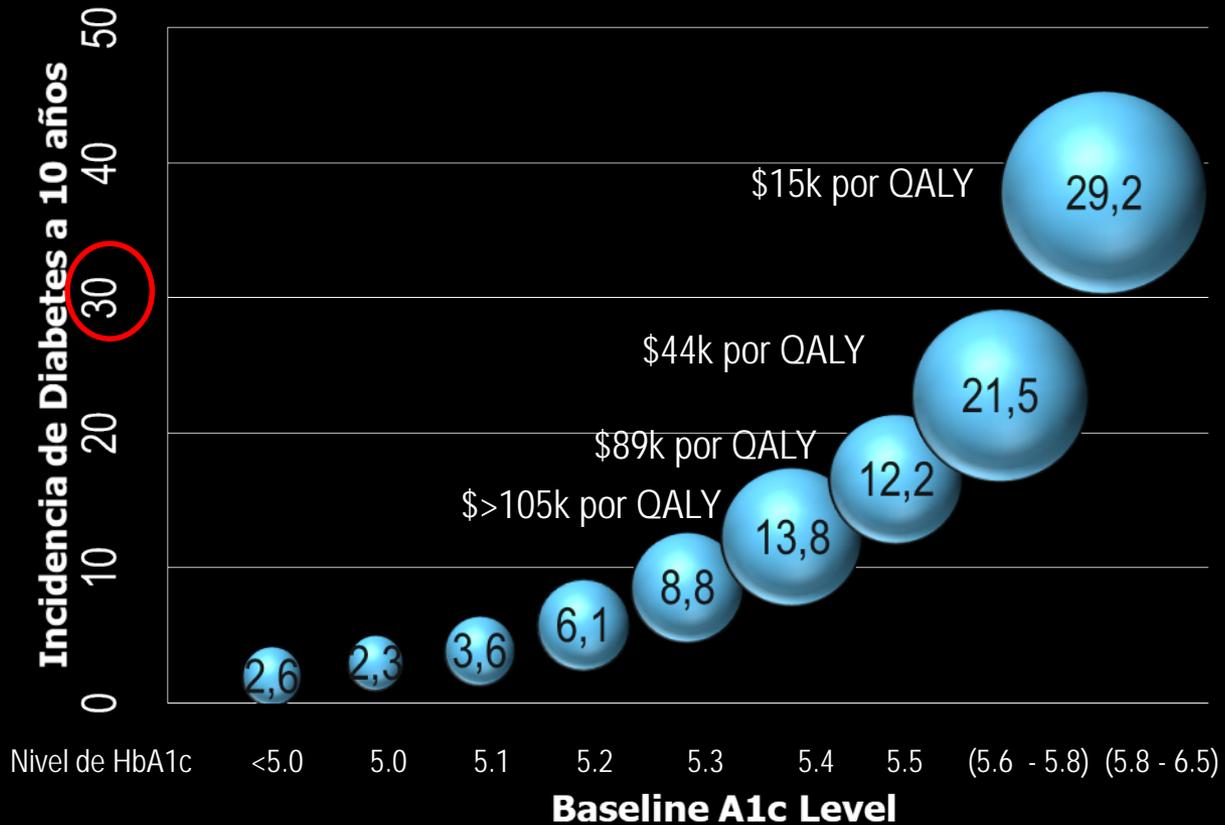
- 26 studies of 3797 high risk adults:
- Diverse settings:
  - 12 community (recreation, faith)
  - 11 health care
- Mean weight change: 4%
- Every 4 sessions attended: 1 percentage point added weight loss



## Systematic Review: Cost-effectiveness of individual-level T2DM Prevention

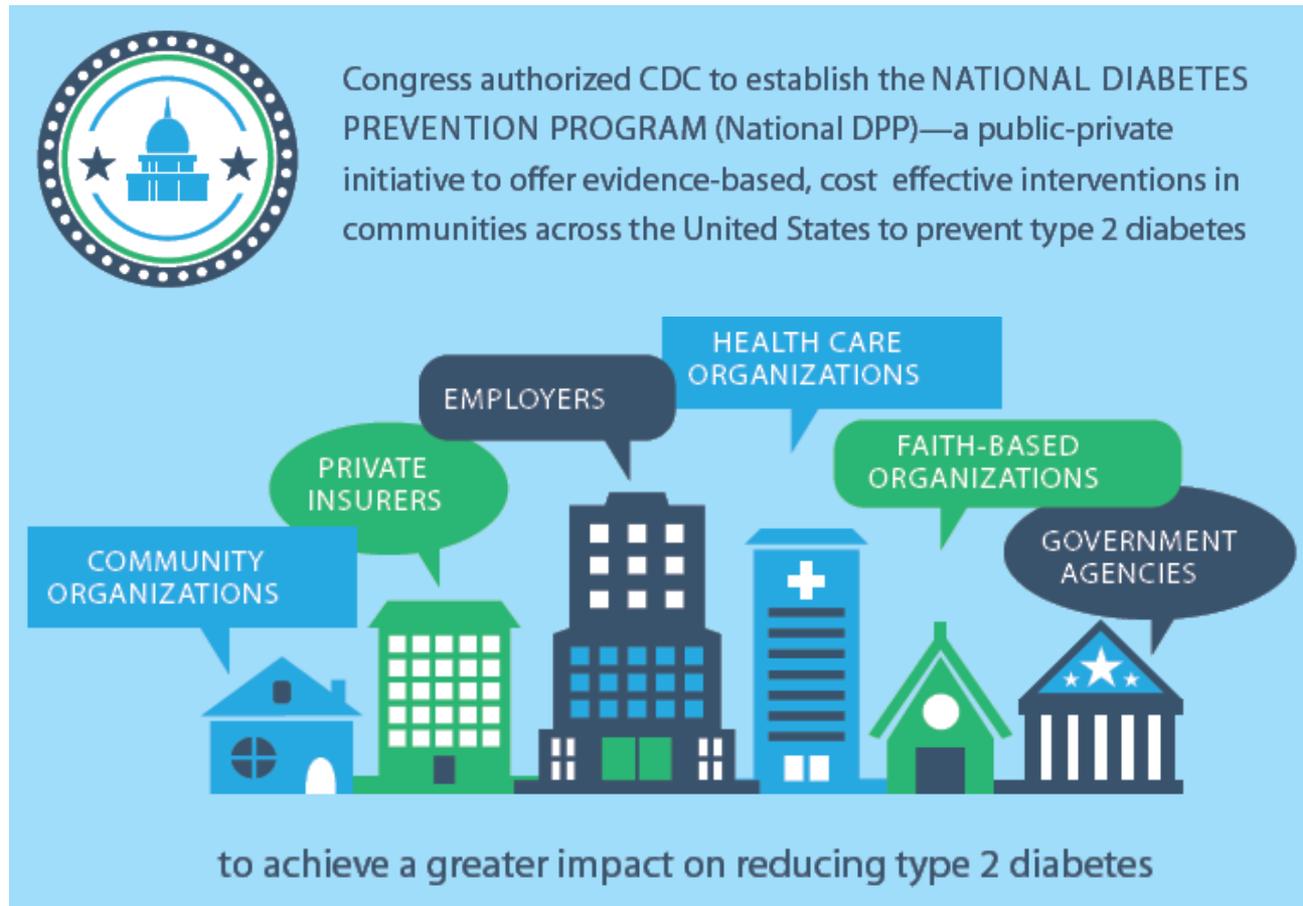
Group	Study, n	Median (range), \$/QALY, healthcare perspective
Prevention strategy: Lifestyle	11	\$12,557 (CS-\$23,957)
Metformin	2	\$17,153
Time horizon: < 10 years	5	\$19,686 (\$6,235-\$45,530)
>=10 years	8	\$13,127 (CS-\$23,957)
Modality: In-person	6	\$10,930 (CS-\$22,516)
Virtual	3	\$12,557 (CS-\$13,155)
Combination	2	\$10,768
Delivery setting: One-to-one	3	\$19,686 (CS-\$22,516)
Group	2	\$7,126
Combination of both	1	\$13,844
Provider type: Health professionals	3	\$19,686 (CS-\$23,957)
PCP + trained lay health workers	3	\$8,016 (\$6,235-\$13,844)

Relación de la Hb-a1c (eje de las x) y la Incidencia de Diabetes a 10 años (eje de las y).  
El tamaño del círculo representa la proporción de los casos de diabetes a lo largo de 10 años.



Adaptado de Zhang et al., 2010; Zhuo et al., 2012; Gregg et al., 2013

*The National Diabetes Prevention Program:*  
A Public-private partnership to scale the translated model of the DPP.



The core of the National DPP is a CDC-recognized, year-long lifestyle change program that offers participants:



A TRAINED  
LIFESTYLE COACH

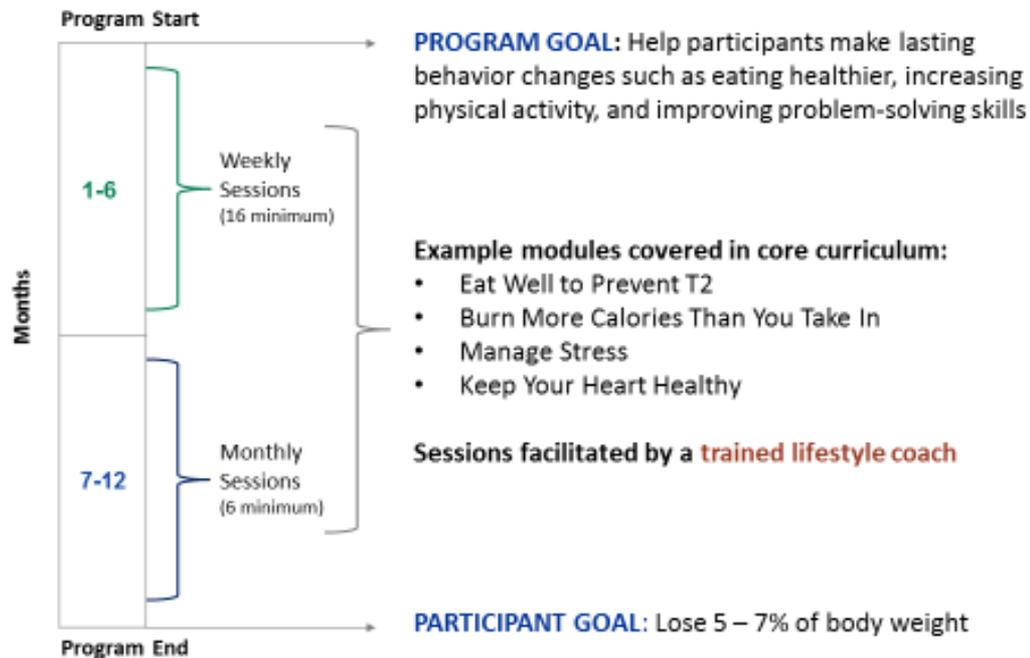


CDC-APPROVED  
CURRICULUM



GROUP OR INDIVIDUAL  
SUPPORT OVER THE COURSE  
OF A YEAR DEPENDING ON  
IN-PERSON OR VIRTUAL  
PROGRAM

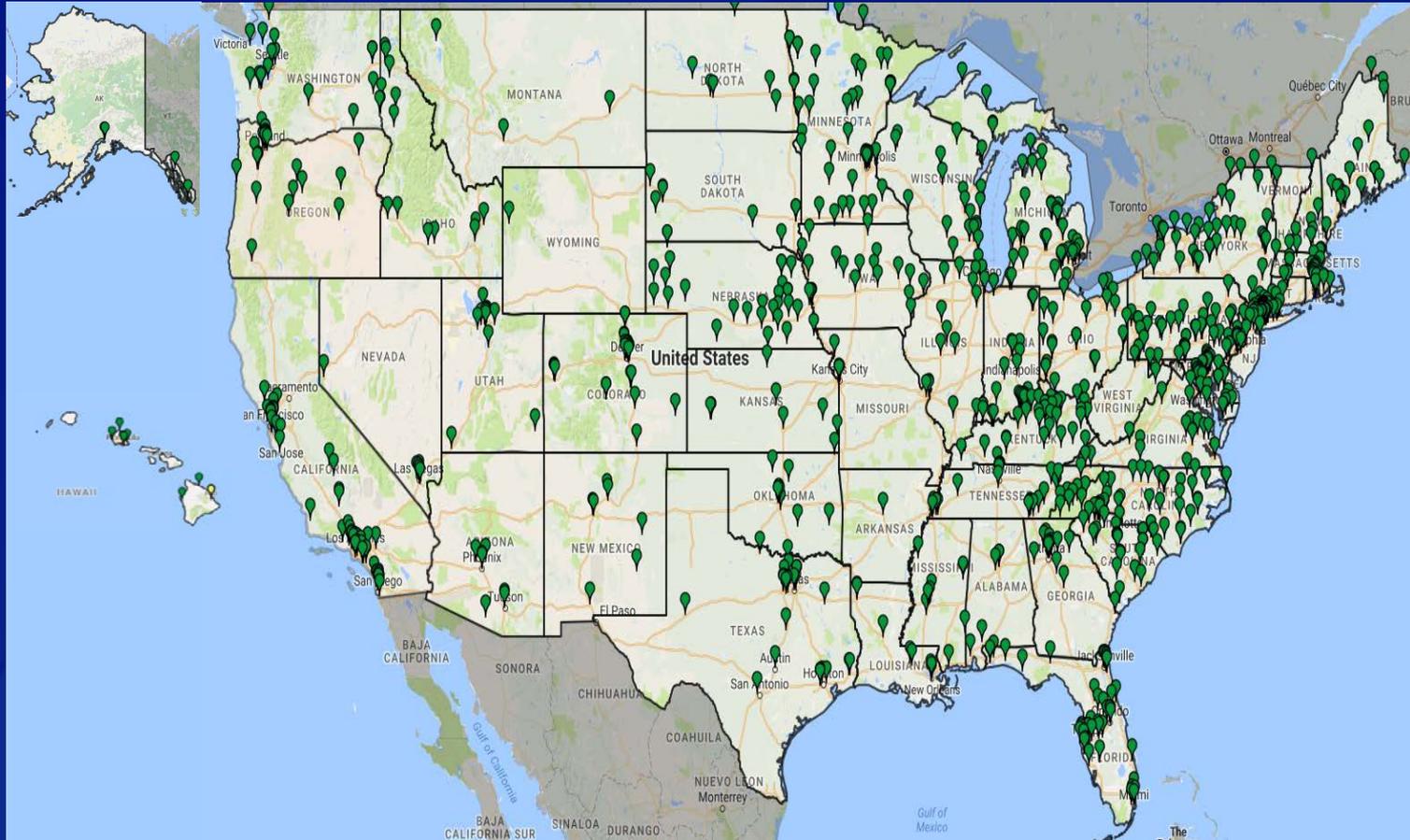
## Elements of the National DPP Lifestyle Change Program



## National DPP Strategic Goals

- Increase *supply* of quality programs.
- Build *workforce* to deliver program
- Increase *coverage* among public and private payers
- Increase *referrals* from healthcare providers
- Increase *demand* for the National DPP among people at risk
- Maintain *quality standards* through a recognition program and registry.

## CDC Diabetes Prevention Recognition Program



- 1557 CDC-recognized programs across 50 states/territories.
- >10,300 coaches (lay people; health professionals) trained.
- Serving 156,935 eligible participants.
- 65 commercial health plans providing some coverage for 3M in 11 states

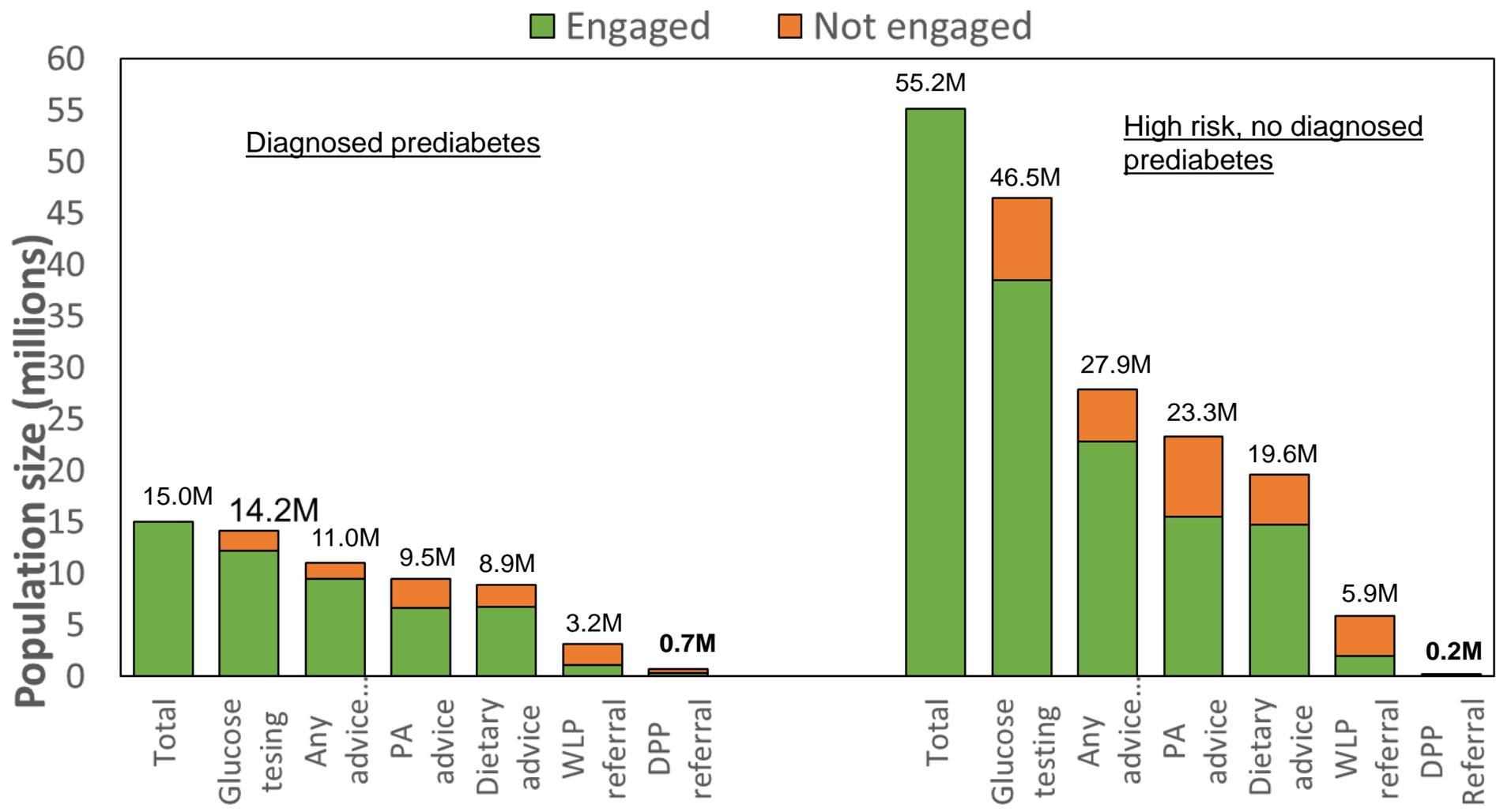


## Evaluation of 117 NDPP Sites Based on Interviews and Surveys

- Keys to *enrollment success* include:
  - Offering multiple class locations.
  - Using multiple recruitment strategies.
  - Information sessions.
  
- Keys to *retention success* include:
  - Monitoring early logistical challenges related to space, timing.
  - Non-financial incentives, such as gym memberships, cookbooks, athletic gear, transportation.
  - Lifestyle coach training & background
  - Cultural adaptation for curricula, including cultural themes, images, language, dietary restrictions.

# Challenges / Barriers to Individual-Targeted Approaches

- Structure, reimbursement, scalability
- Engagement, Participation, Sustainability
- Too late in the pathogenesis of diabetes?
- Diabetes is a common-source epidemic rooted in culture and society?
- Risk factor levels of the general population remain high.
- Over long time horizon, the general population contributes most cases.



## Proportion of Non-diabetic Adults Meeting Key Healthy Targets for Diabetes Risk Reduction, NHANES 2007-2012

	Men	Women	Total
Vegetables	26	27	27
Dairy	18	9	13
Whole Grains	29	23	26
Added Sugars	26	27	26
Saturated Fats	42	45	43
Leisure-Time Phys Activity	40	32	36

# Range of Options for Prevention

## ■ Individual-Focused:

- Structured, multi-disciplinary lifestyle
- Metformin and other drugs
- Nutrition and education referral
- Low intensity, high reach counseling approaches
- Worksite wellness

## ■ Population-wide

- Fiscal Food and crop policies
- Incentives for Healthy foods in food deserts
- Community / urban re-design for physical activity
- Food and menu labeling
- School food and physical education policies
- Broad awareness and social marketing

# Promising Targets for Population-Wide Food Policies to Influence Cardiometabolic Risk

12 August 2011 Last updated at 06:44 ET

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## Cutting salt 'should be global priority'

By Matt McGrath

Science reporter, BBC World Service

## Soft Drink and Juice Consumption and Risk of Physician-diagnosed Incident Type 2 Diabetes

The Singapore Chinese Health Study

BMJ



## Fruit and vegetable intake and incidence of type 2 diabetes mellitus: systematic review and meta-analysis

Patrice Carter, research nutritionist,<sup>1</sup> Laura J Gray, research associate in medical statistics,<sup>2</sup> Jacqui Troughton, senior research associate,<sup>3</sup> Kamlesh Khunti, professor of primary care diabetes and vascular medicine,<sup>2</sup> Melanie J Davies, professor of diabetes medicine<sup>1</sup>

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PLOS MEDICINE

## Whole Grain, Bran, and Germ Intake and Risk of Type 2 Diabetes: A Systematic Review and Meta-Analysis

Jeroen S. L. de Munter<sup>1,2</sup>, Frank B. Hu<sup>1,3,4</sup>, Donna

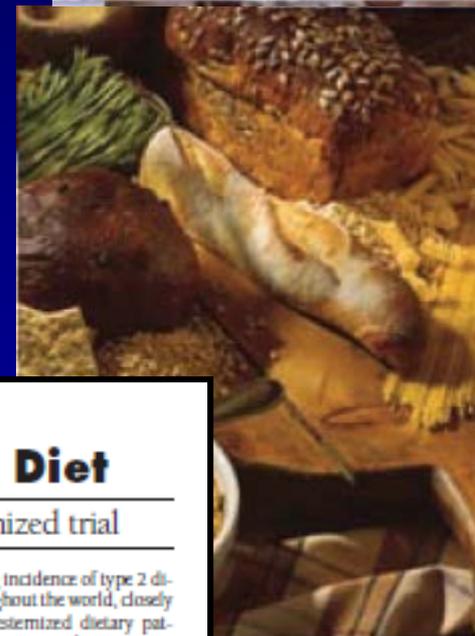
## Reduction in the Incidence of Type 2 Diabetes With the Mediterranean Diet

Results of the PREDIMED-Reus nutrition intervention randomized trial

JORGE SALAS-SALVADÓ, MD, PhD<sup>1,2</sup>  
MONICA BULLÓ, BSc, PhD<sup>1,2</sup>  
NANCY BARBO, BSc, PhD<sup>1,2</sup>  
MIGUEL ANGEL MARTÍNEZ-GONZÁLEZ, MD, PhD<sup>2,3</sup>  
NÚRIA IBARROLA-JURADO, RD<sup>1,2</sup>  
JOSEP BASORA, MD<sup>1,2,4</sup>  
RAMON ESTRUCH, MD, PhD<sup>2,5</sup>

MARIA ISABEL COVAS, DPHARM, PhD<sup>2,6</sup>  
DOLORES CORRELLA, DPHARM, PhD<sup>2,7</sup>  
FERNANDO ARÓS, MD, PhD<sup>2,8</sup>  
VALENTINA RUIZ-GUTIÉRREZ, DPHARM, PhD<sup>9</sup>  
EMILIO RÍOS, MD, PhD<sup>2,10</sup>  
FOR THE PREDIMED STUDY INVESTIGATORS

The increasing incidence of type 2 diabetes throughout the world, closely linked to westernized dietary patterns, physical inactivity, and raising rates of obesity, is a challenging health problem. Lifestyle changes are effective measures to prevent diabetes, and weight loss is the main predictor of success (1). Five clinical trials that examined the effects of



# Summary of the cost-effectiveness of fiscal policies to prevent T2DM

Category	Intervention	Study, n	CE outcome
<b>Fiscal policy</b>			
SSB tax	20%, penny-per-ounce, 10%, or \$0.5/L tax on SSB	9	CS
Sugar tax	\$0.99/100mL ice cream; \$0.9/100g other products	1	CS
Subsidy	30% or 0.15/100g subsidy for fruit/veg consumption	4	CS to worse health
Combination tax and subsidy	Tax SSB, sat fat., sodium, sugar; subsidy fruit/veg	1	CS
<b>Environmental change</b>			
Fresh food in low-income area	Open supermarket	1	CS
Workplace healthy food	Provide healthy food in cafeteria	1	CS
Enhanced phys act access	Increase facilities for physical activities	1	\$36k/QALY
<b>Health promotion</b>			
Campaign	Community-wide, mass media, or internet campaign to promote physical activity	4	\$87k/QALY to CS
Healthy eating education in low-income community	Diet education and cooking classes	1	More QALY but no change in cost
Social support PA promotion	Use organized groups to promote physical activity	3	\$35 – 50k/QALY
Physical activity promotion for targeted population	Encourage walking and reduce car use using tailored educational information	2	\$17,658/QALY – CS

# Key Considerations in Design of Prevention Strategy

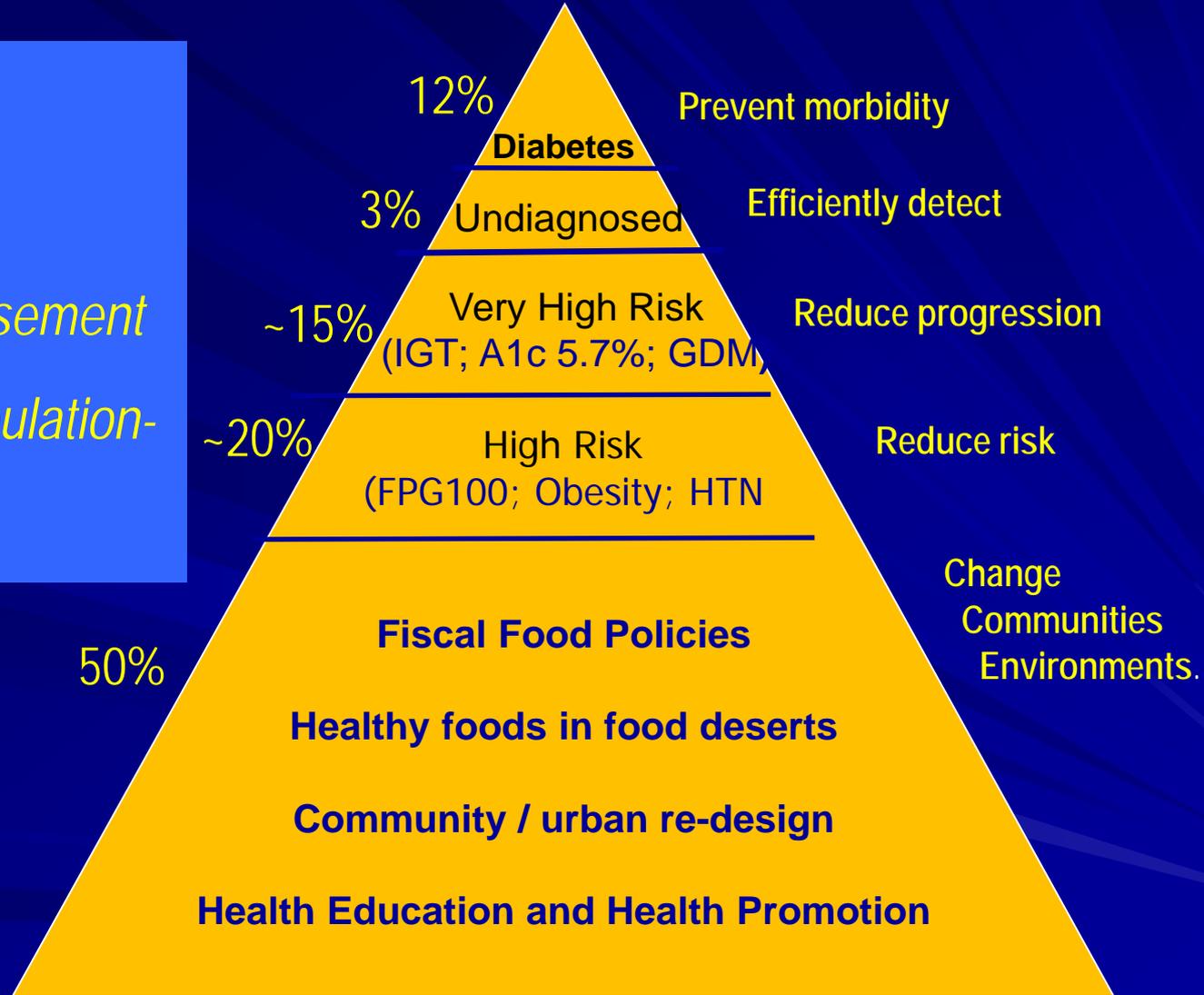
- Prevalence/Burden of Diabetes
- Prevalence/burden of undiagnosed diabetes.
- Current status/trajectory of environmental/cultural risk.
- Capacity of health system to manage diabetes.
- Potential of communities and insurers to support high risk individuals.
- Political context/will for population-wide intervention.
- Time horizon of public health goals

# High Prevalence / High Income Countries

Goal: Act at all levels

Pivotal Factors:

- Prevention reimbursement
- Political will for population-wide interventions



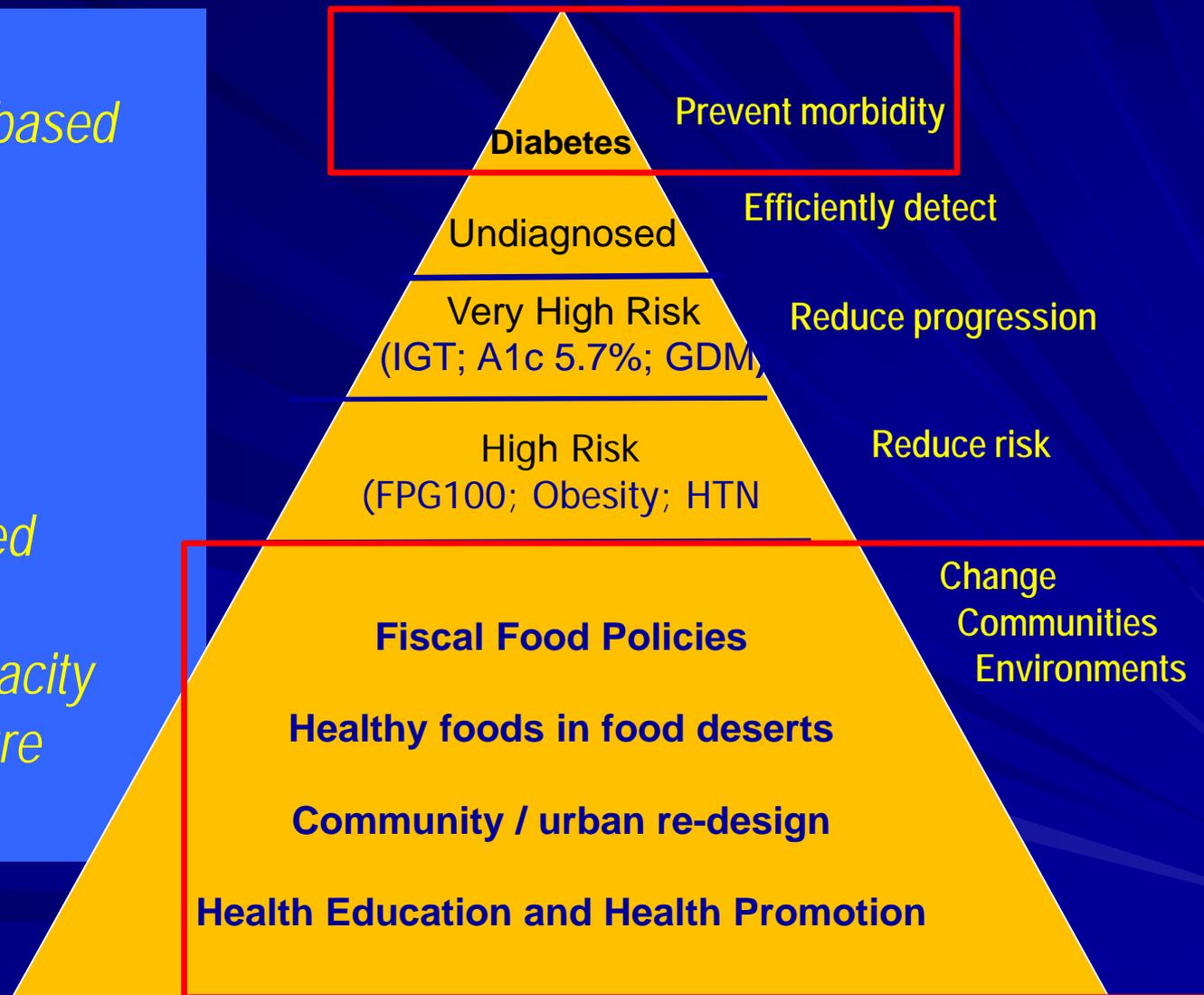
# High Prevalence / Low- and Mid-income

## Goal: Prioritize

- 1) *Integrated team-based care and*
- 2) *Population-wide interventions*

## Pivotal Factors:

- *Size of undiagnosed population*
- *Health system capacity*
- *Community structure*
- *Political will*



# Summary

- Diabetes demands a multi-tiered strategy to reduce complications, progression of high risk individuals, and population-wide risk.
- Science base to prevention complications and individual-targeted prevention approaches is strong, from RCTs and CE modeling.
- Science base for *population-wide policies* is encouraging and growing, with need for rigorous natural experiments of real-world policies.
- High income, high prevalence countries should invest in all areas, depending on the political and health care insurance context.
- Low and middle income countries should prioritize team-based integrated care and population-wide approaches, with individual-targeted approaches under optimal settings.

extras

# *Prioritizing our Core Science Base*

- Systematic reviews of trials
- Randomized controlled clinical and community trials
- Well-designed natural experiments
- Rigorously designed modeling efforts
- Prospective cohorts

# Long-term Sustainability of Diabetes Prevention Approaches

## A Systematic Review and Meta-analysis of Randomized Clinical Trials

Table. Random-Effects Meta-analyses Exploring RR for Diabetes Among LSM and Medication Studies After Treatment Withdrawal

Source	Intervention	Active Intervention, y	End of Active Intervention, RR (95% CI)	Follow-up <sup>a</sup>	End of Follow-up, RR (95% CI)
<b>LSM Trials</b>					
Swinburn et al, <sup>40</sup> 2001	Reduced-fat diet	1.0	0.76 (0.25-2.34)	5.0 y	0.70 (0.26-1.88)
DPP, <sup>33,34</sup> 2002, 2009 <sup>b</sup>	Diet and physical activity	2.8	0.48 (0.41-0.58)	5.7 y	0.68 (0.63-0.73)
DPS, <sup>35,36</sup> 2001, 2013	Diet and physical activity	4.0	0.44 (0.29-0.68)	9.0 y	0.63 (0.54-0.73)
Da Qing, <sup>37,38</sup> 1997, 2008	Diet and physical activity	6.0	0.68 (0.54-0.85)	9.4 y	0.86 (0.81-0.92)
Pooled estimate			0.55 (0.43-0.70)		0.72 (0.60-0.86)
<b>Medication Trials</b>					
Eriksson et al, <sup>65</sup> 2006	Glipizide	0.5	0.41 (0.01-11.3)	52 wk	0.20 (0.03-1.53)
DREAM, <sup>22,72</sup> 2006, 2011	Rosiglitazone	3.0	0.43 (0.37-0.48)	10 wk	1.07 (0.88-1.32)
DREAM, <sup>22,57</sup> 2006, 2011 <sup>b</sup>	Ramipril	3.0	0.93 (0.82-1.04)	10 wk	1.08 (0.89-1.33)
DPP, <sup>21,33</sup> 2002, 2003	Metformin	2.8	0.76 (0.66-0.88)	2 wk	0.76 (0.68-0.85)
STOP-NIDDM, <sup>69</sup> 2002	Acarbose	3.0	0.78 (0.68-0.90)	12 wk	1.46 (0.90-2.36)
ORIGIN, <sup>67</sup> 2012	Insulin glargine	6.2	0.79 (0.67-0.94)	14 wk	0.86 (0.74-0.99)
Pooled estimate			0.71 (0.55-0.92)		0.95 (0.79-1.14)

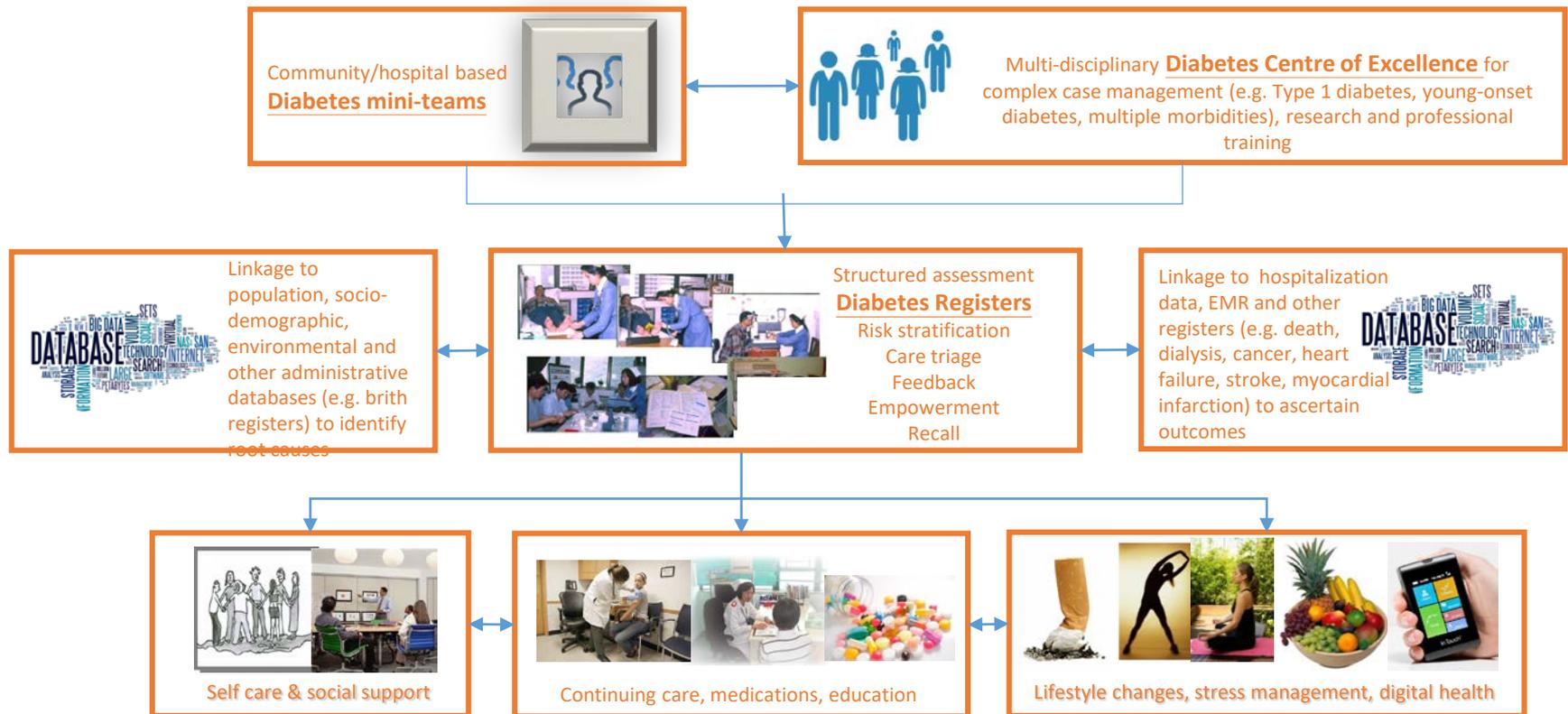
## Diabetes Prevention: Interventions Engaging Community Health Workers

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### Community Preventive Services Task Force Finding and Rationale Statement Ratified August 2016

- Screening and health education—CHWs deliver individual or group education on diabetes self-management, provide adherence support for medications, and monitor patients' blood pressure as recommended by the American Diabetes Association.
- Outreach, enrollment, and information—CHWs reach out to individuals and families who are eligible for medical services, help them apply for these services, and provide them with proactive follow-up and monitoring, such as appointment reminders and home visits.
- Member of a care delivery team—CHWs partner with the patient, their primary care provider, and other health professionals to improve coordination of diabetes care, education, and support.
- Patient navigation—CHWs help individuals and families navigate complex medical service systems and processes to improve their access to care.
- Community organization—CHWs facilitate self-directed change and community development by serving as liaisons between the community and healthcare systems.

**Figure 15. A schematic diagram showing how to use diabetes centres, diabetes teams and diabetes registers to integrate professional education, research and practice with linkage of register data to other databases to identify root causes, evaluate care standards, monitor clinical outcomes, perform surveillance of prevalence (burden) and incidence (intervention) of diabetes and its complications to inform practices and policies.**



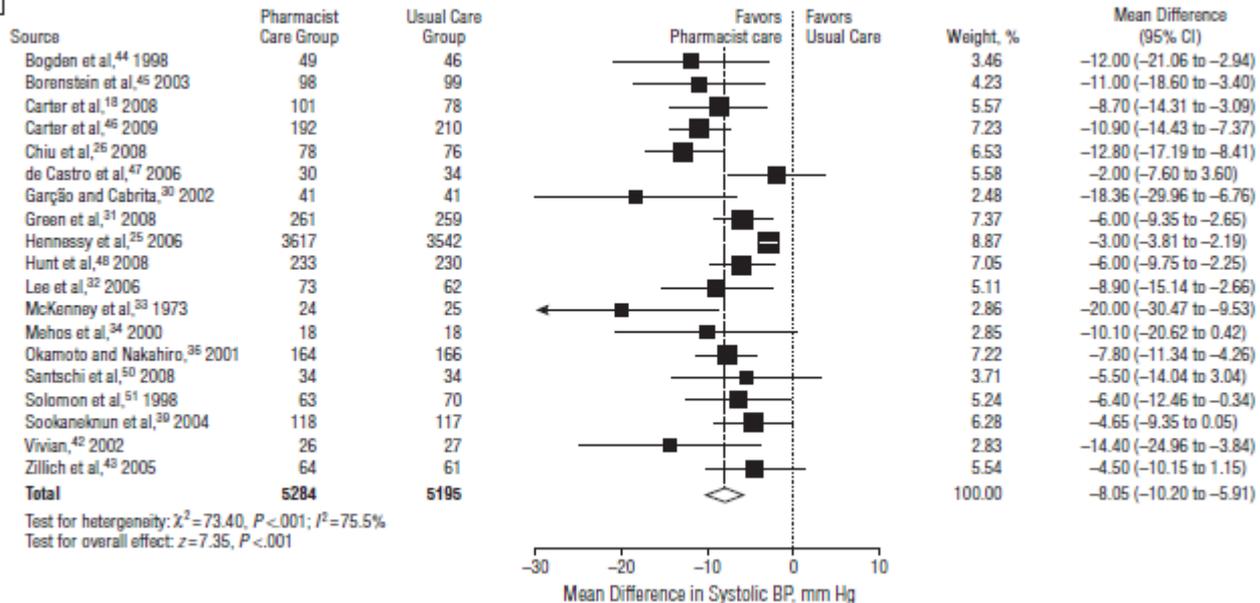
HEALTH CARE REFORM

# Impact of Pharmacist Care in the Management of Cardiovascular Disease Risk Factors

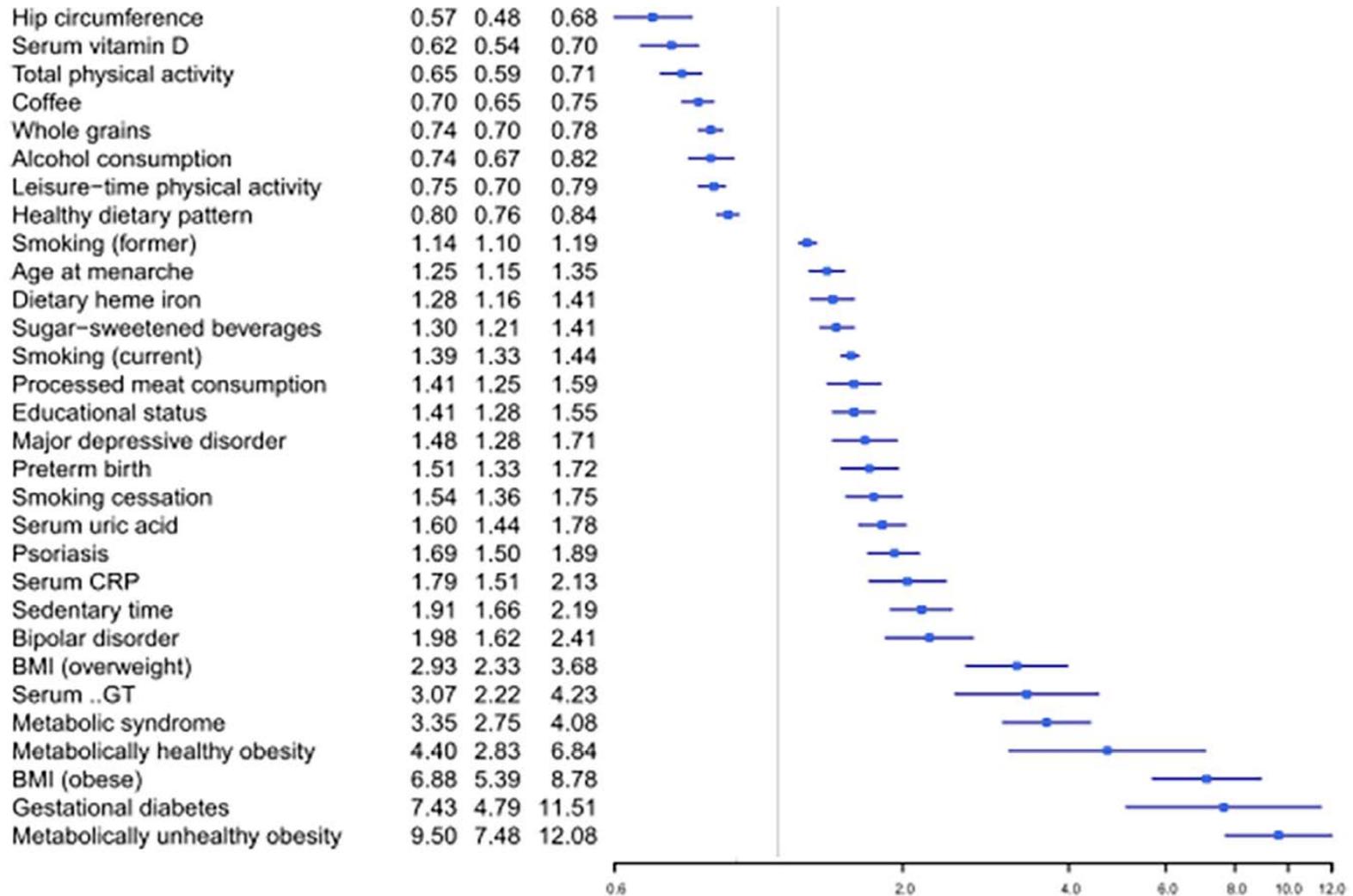
## A Systematic Review and Meta-analysis of Randomized Trials

Valérie Santschi, PharmD, PhD; Arnaud Chiolero, MD, MSc; Bernard Burnand, MD, MPH; April L. Colosimo, MSc, MLIS; Gilles Paradis, MD, MSc

A



# Risk factors for type 2 diabetes mellitus: an exposure-wide umbrella review of meta-analyses



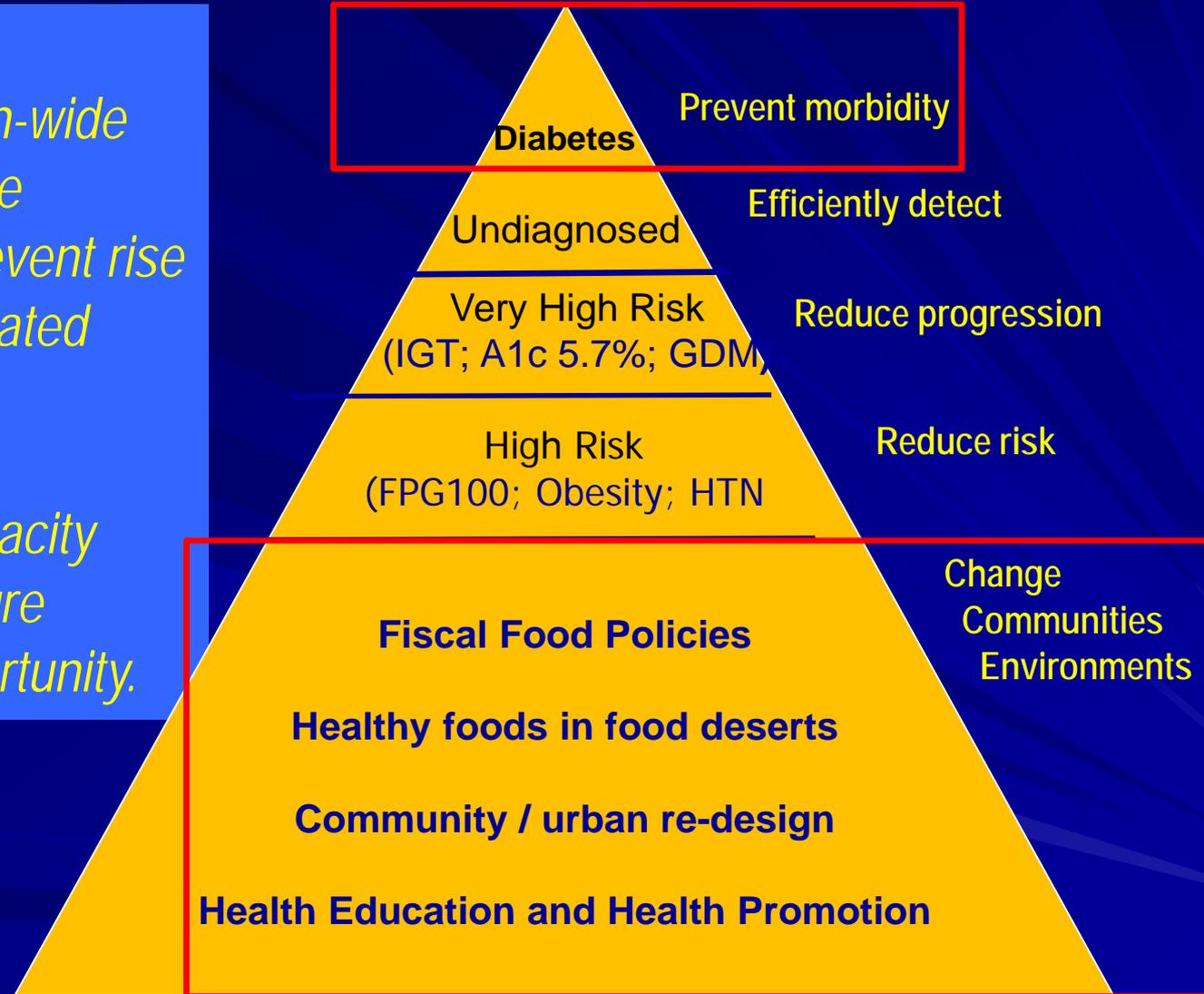
# Low Prevalence / Low- and Mid-income

## Goal: Prioritize

*Prioritize 1) population-wide interventions to reduce complications and prevent rise in incidence; 2) Integrated team-based care.*

## Pivotal Factors:

- *Health system capacity*
- *Community structure*
- *Recognizing opportunity.*



**Figure 13. A meta-analysis of 181 trials (N = 135,112) showing the effects of multi-component integrated care on mean difference (MD) in A1c, systolic blood pressure (SBP) and LDL-C in different regions and patient groups compared to usual care with team change, facilitated patient relay and patient education/self management having the largest effect size (Lim LL et al Diabetes Care 2018) .**

