

# Seminarios de Epidemiología de Diabetes

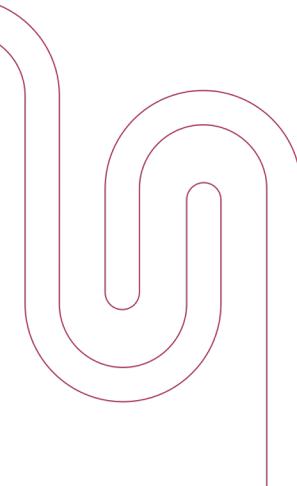
**Steno Diabetes  
Center Aarhus**

Comenzamos 13:00 hrs CdMx, 14:00 hrs Lima y Bogotá,  
15:00 hrs Santiago y La Paz, 16:00 hrs Buenos Aires  
20:00hrs Copenhague

# Steno Diabetes Center Aarhus

**Seminarios de Epidemiología de Diabetes**

# Prediabetes





## “Prediabetes”: Are There Problems With This Label? Yes, the Label Creates Further Problems!

*Diabetes Care* 2016;39:1468–1471 | DOI: 10.2337/dc15-2113

John S. Yudkin



## “Prediabetes”: Are There Problems With This Label? No, We Need Heightened Awareness of This Condition!

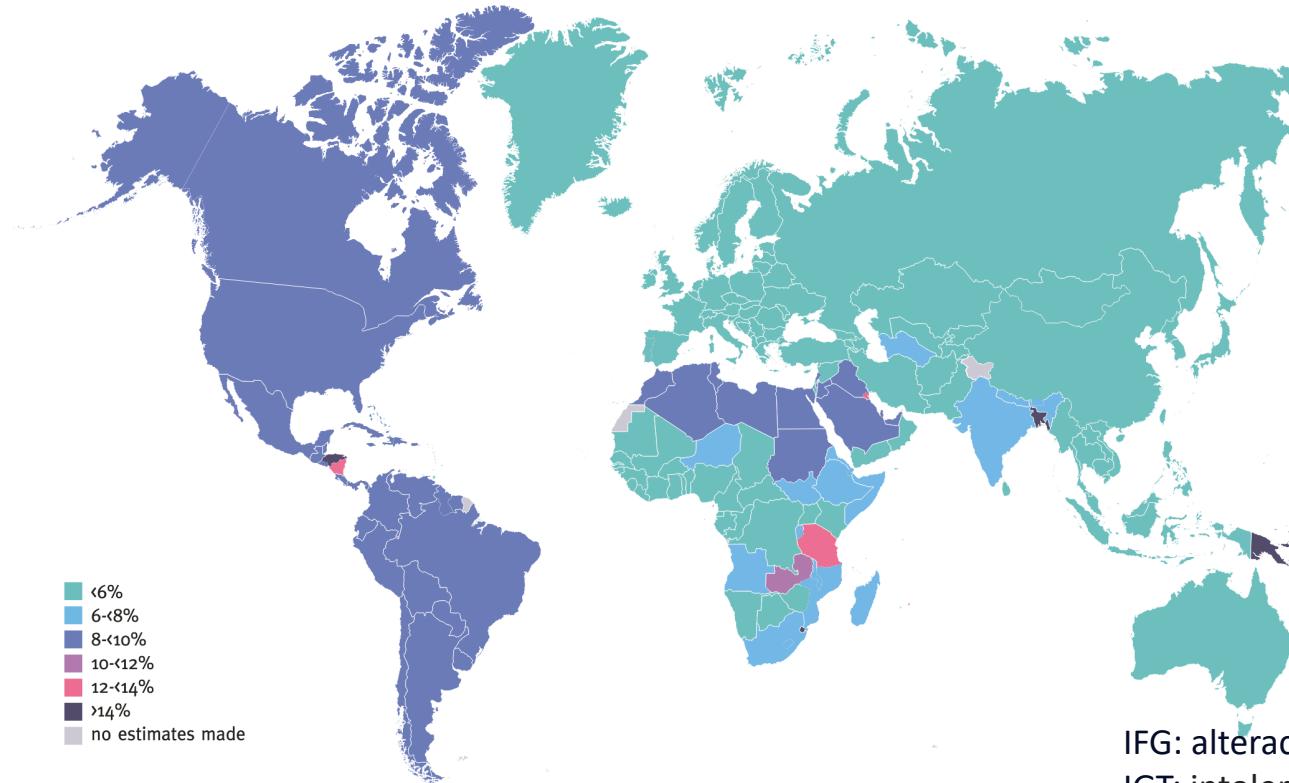
*Diabetes Care* 2016;39:1472–1477 | DOI: 10.2337/dc16-1143

William T. Cefalu

Yudkin JS. *Diabetes Care* 2016;39:1468–1471.  
Cefalu WT. *Diabetes Care* 2016;39:1472–1477

# PREVALENCIA A NIVEL GLOBAL : IFG

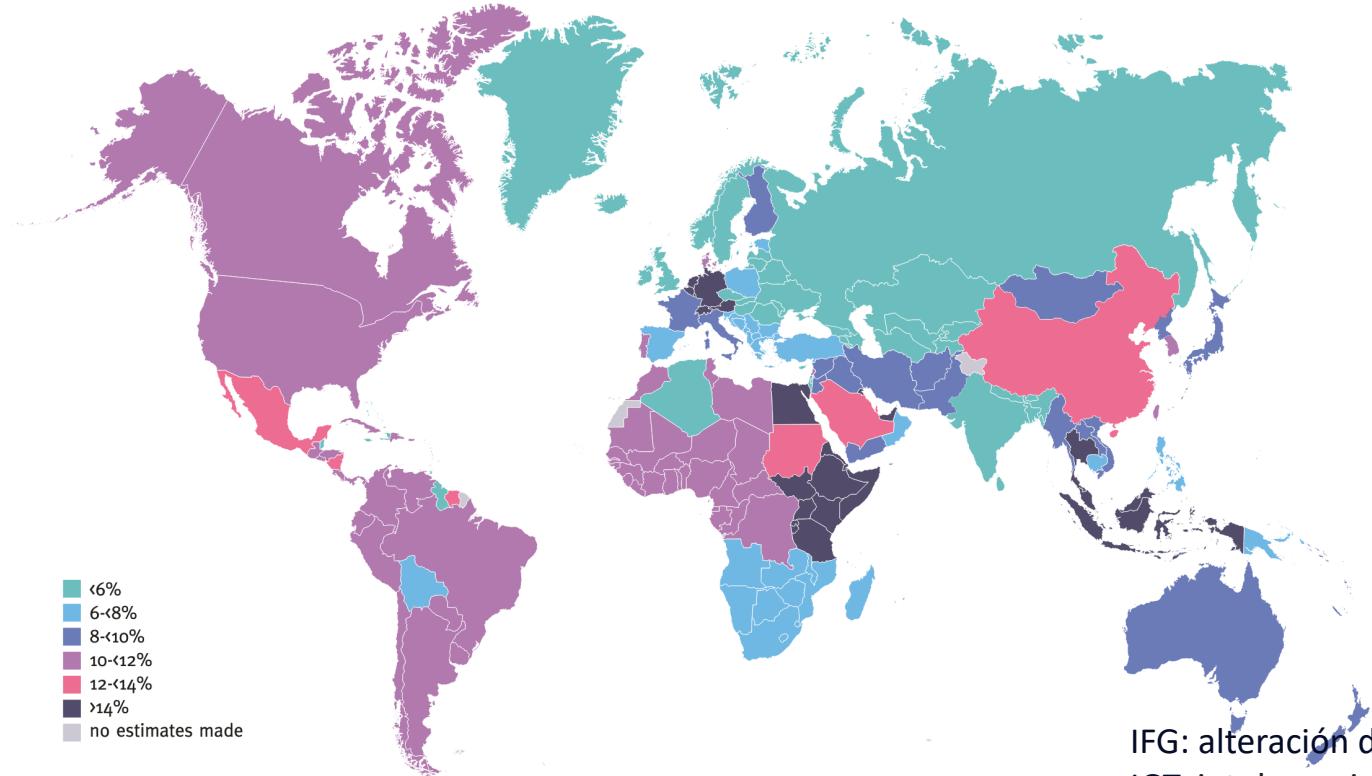
Map 3.6 Age-adjusted comparative prevalence of impaired fasting glucose in adults in 2021



IFG: alteración de la glucemia en ayunas  
IGT: intolerancia a la glucosa

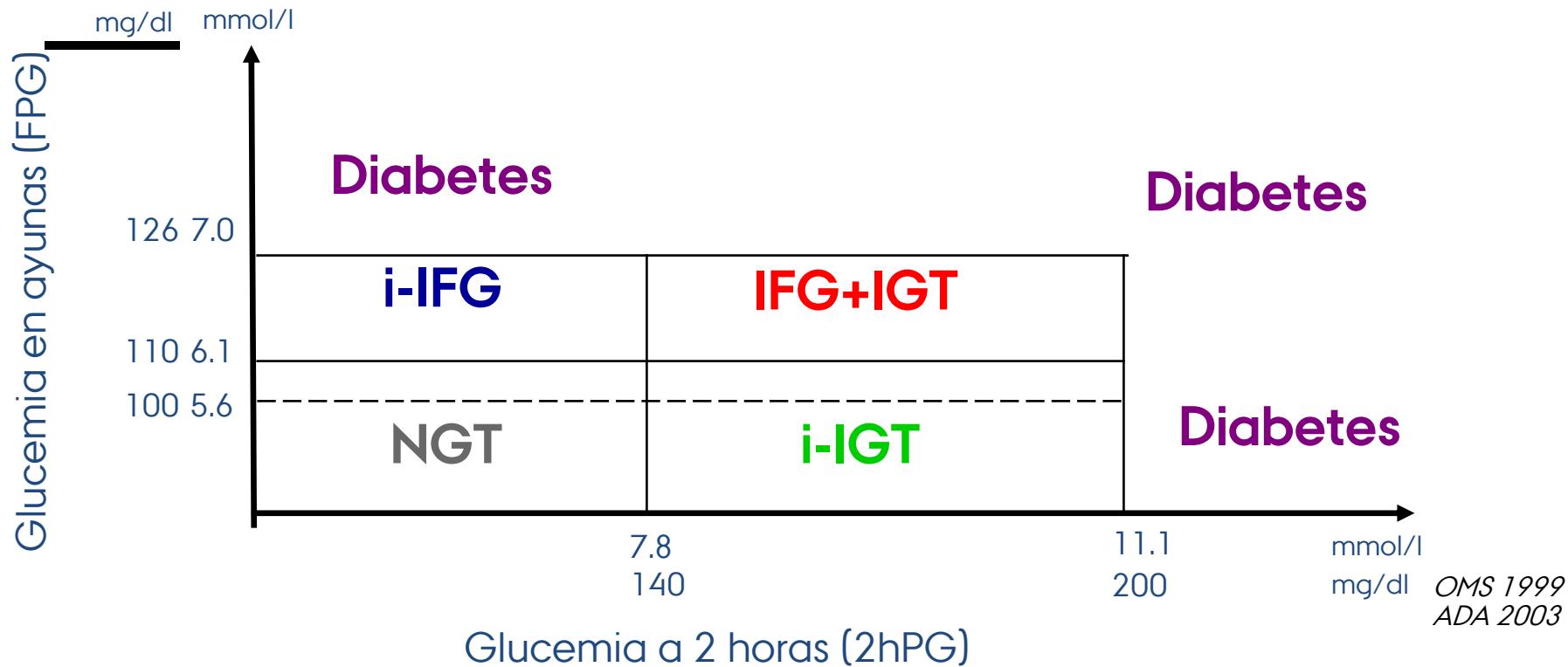
# PREVALENCIA A NIVEL GLOBAL : IGT

Map 3.7 Age-adjusted comparative prevalence of impaired glucose tolerance in adults in 2021



IFG: alteración de la glucemia en ayunas  
IGT: intolerancia a la glucosa

# Matriz Diagnóstica (OMS 1999)



IFG: alteración de la glucemia en ayunas

IGT: intolerancia a la glucosa

# Matriz diagnóstica Hemoglobina Glicosilada (HbA1c)

---

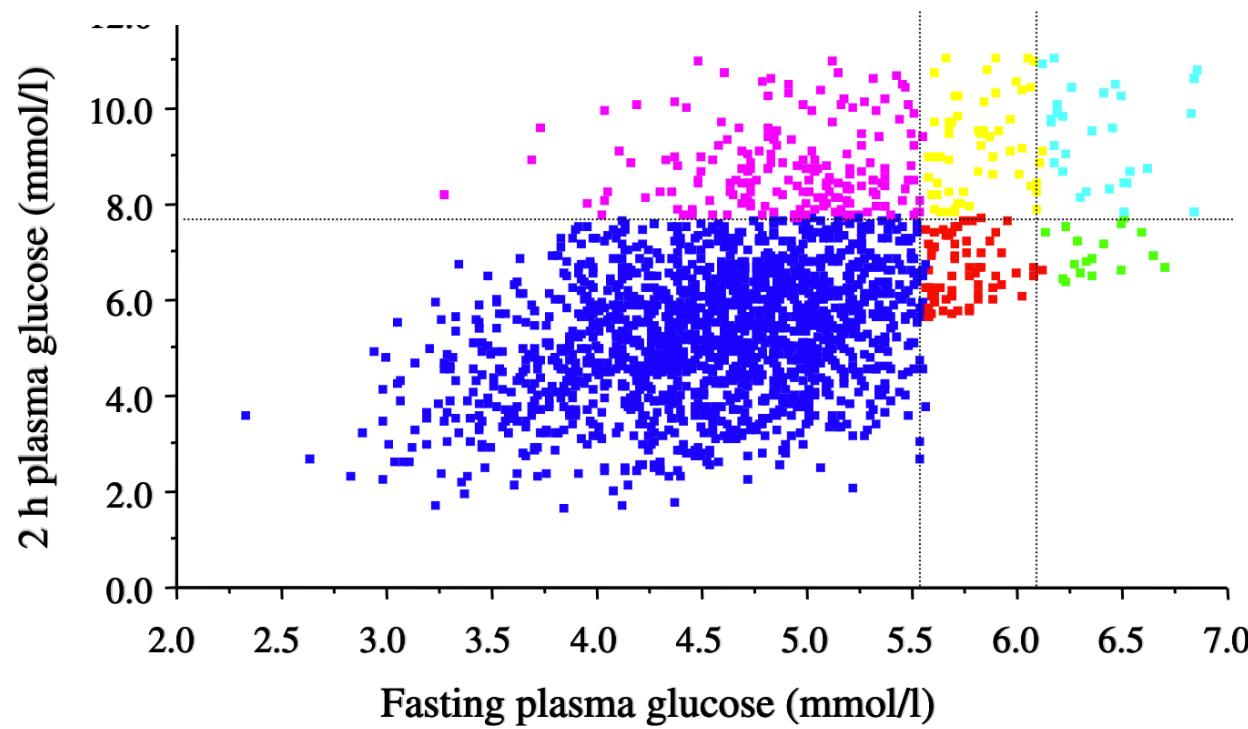
Normoglucemia		Pre-diabetes	Diabetes
5.7	6.0	6.5	6.5
39	42	49	49

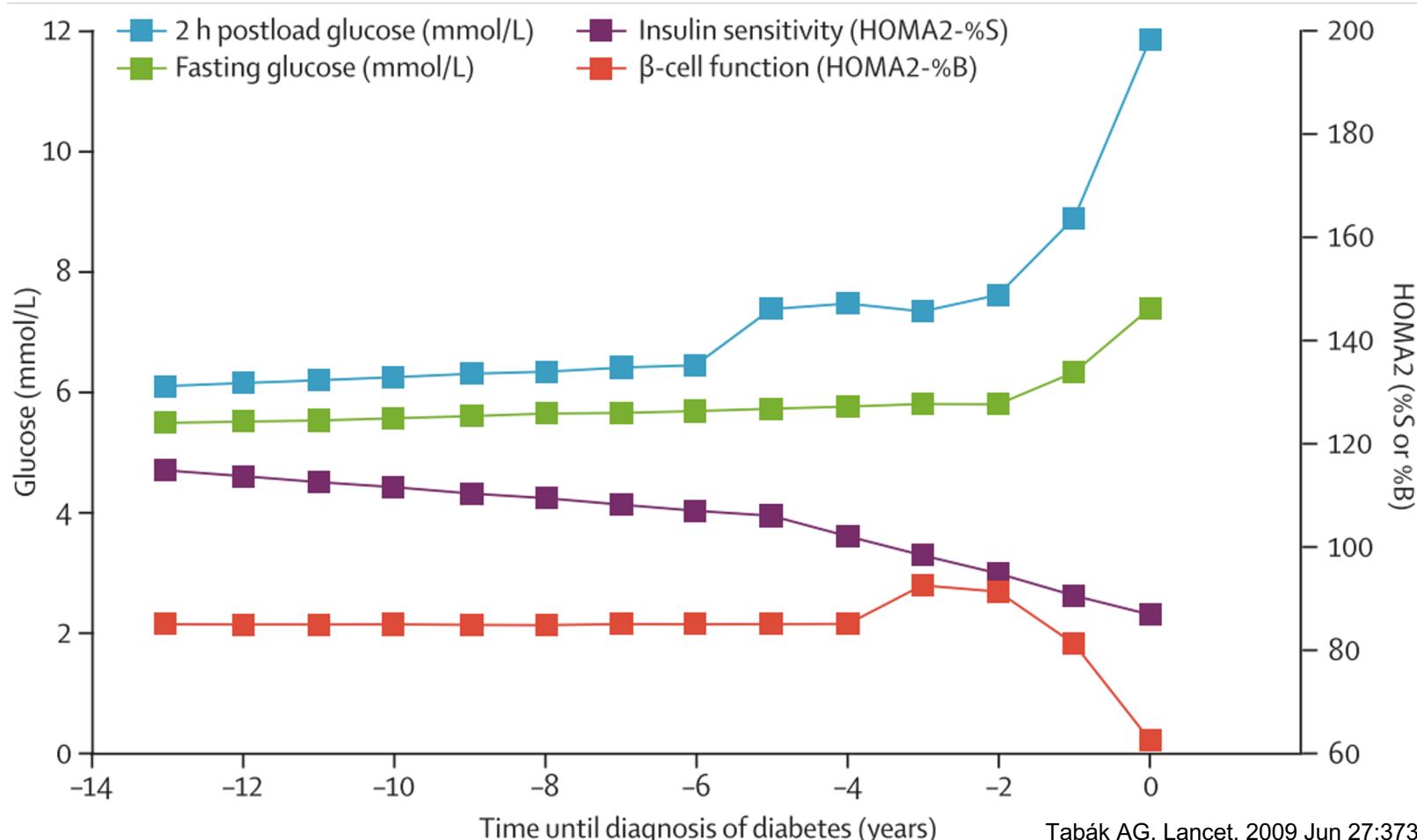
%  
mmol/mol

ADA 2010  
WHO 2011

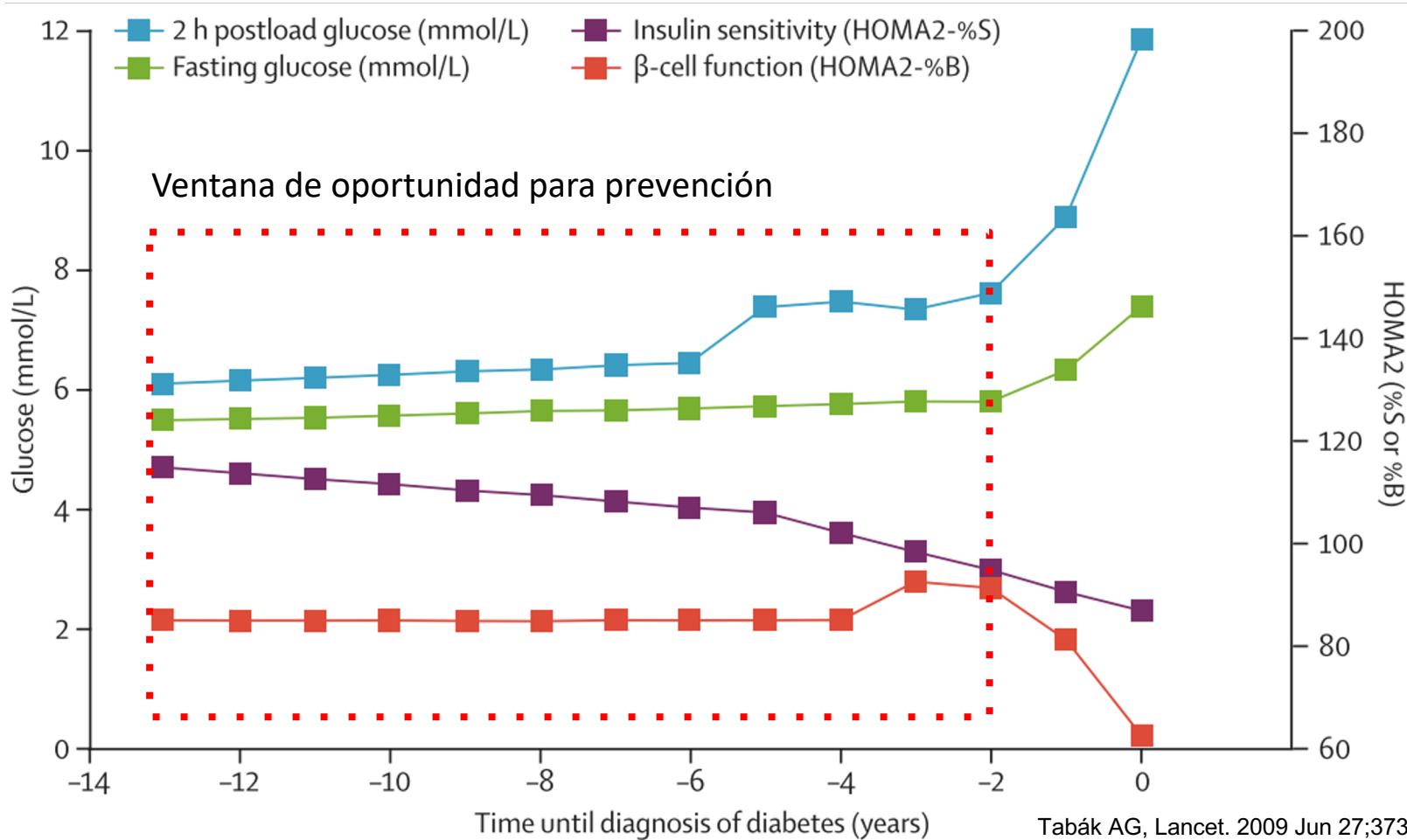
## Plasma glucose levels as predictors of diabetes: the Mexico City diabetes study

E. Ferrannini · M. Massari · M. Nannipieri · A. Natali ·  
R. Lopez Ridaura · C. Gonzales-Villalpando





Tabák AG, Lancet. 2009 Jun 27;373(9682):2215-21.  
Tabák AG, Lancet. 2012 Jun 16;379(9833):2279-90



Tabák AG, Lancet. 2009 Jun 27;373(9682):2215-21.  
Tabák AG, Lancet. 2012 Jun 16;379(9833):2279-90

## Environment

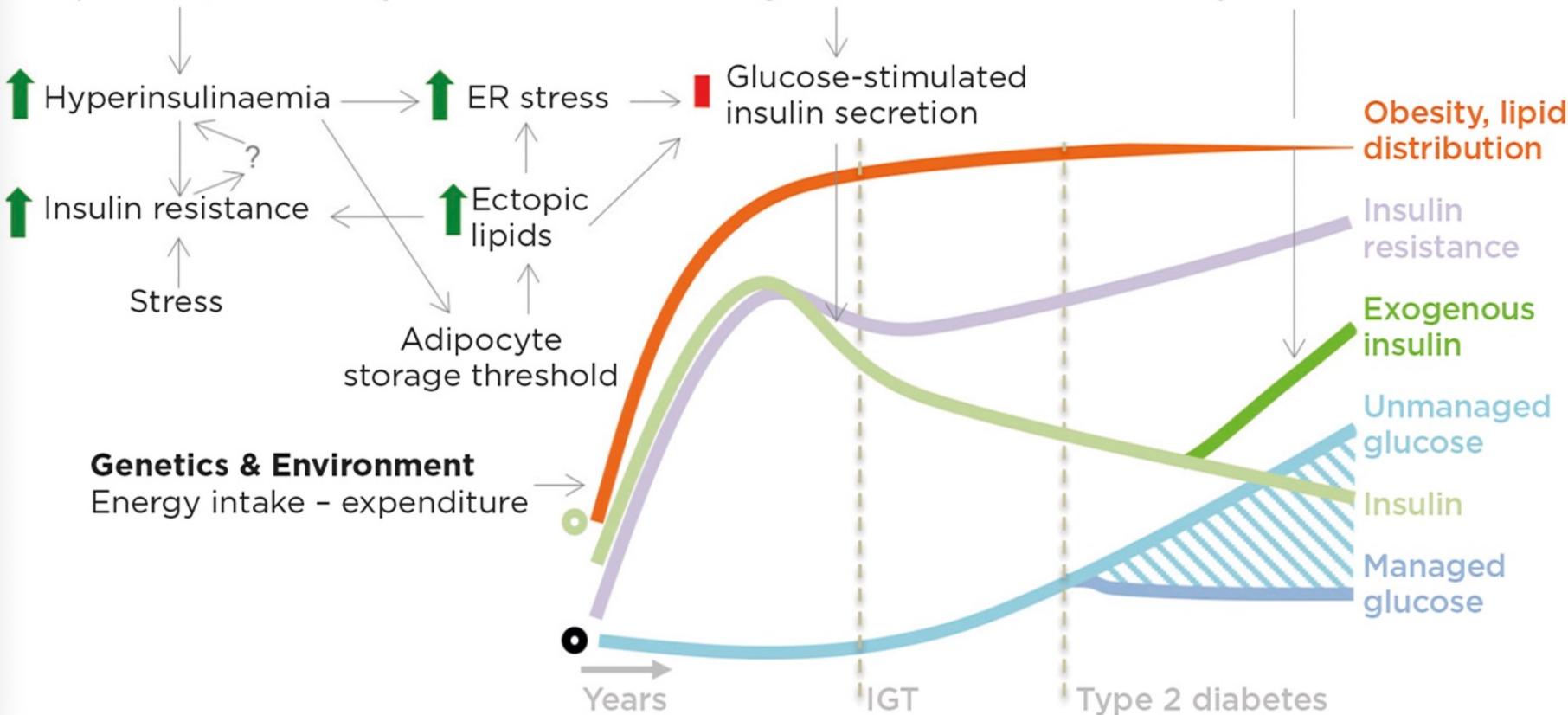
Meal size, timing,  
composition, low activity

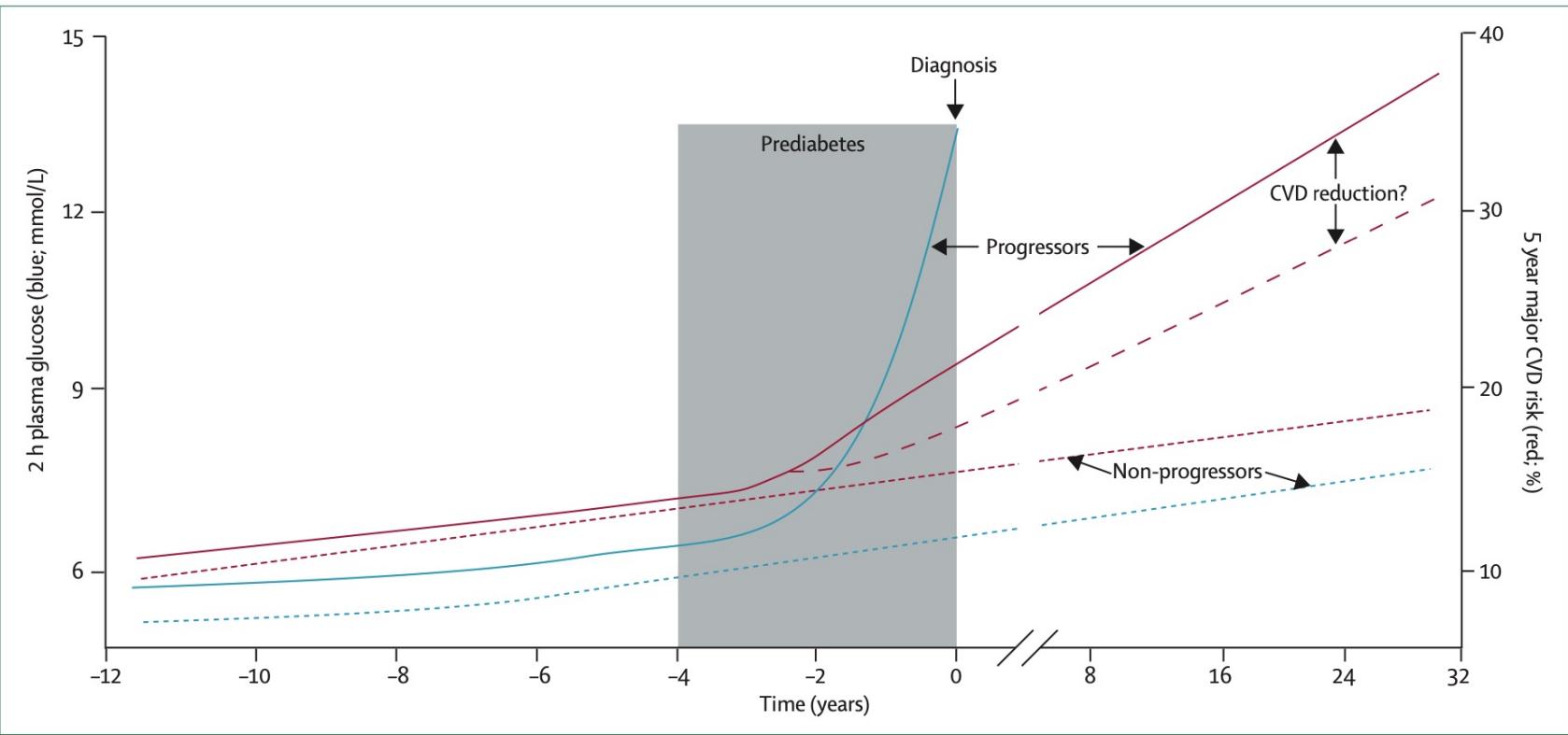
## Genetics

↓  
β-cell differentiation, function,  
resilience genes

## Management

Glucose-lowering drugs vs  
carbohydrate load





**Figure 6: Schematic representation of the timecourse of plasma glucose concentrations and cardiovascular disease in the natural history of individuals progressing from prediabetes to diabetes**

The ordinate scales are educated guesses from references 5, 27, and 29. In patients who do not progress to overt type 2 diabetes, both plasma glucose concentrations (dotted blue line) and CVD risk (dotted red line) increase gradually over decades. By contrast, in individuals progressing to diabetes plasma glucose (solid blue line) and CVD risk (solid red line) increase steeply. The therapeutic space for potential CVD reduction (dashed red line) could predate the diagnosis of overt diabetes in patients with prediabetes with a multiple risk phenotype. CVD=cardiovascular disease.

# Comparing different definitions of prediabetes with subsequent risk of diabetes: an individual participant data meta-analysis involving 76 513 individuals and 8208 cases of incident diabetes

**Table 2** Pooled HRs for incident diabetes association with prediabetes status at baseline and Harrell's C-statistics for predicting 5-year risk of diabetes associated with prediabetes status at baseline

Prediabetes definition	Multiple adjusted*				
	N	HR (95% CI)†	I <sup>2</sup> (%)	C-statistics (95% CI)†	I <sup>2</sup> (%)
WHO-FPG‡	73 151	5.54 (4.31 to 7.12)	93.9	0.789 (0.772 to 0.807)	63.5
ADA-FPG‡	73 151	4.17 (3.36 to 5.17)	93.3	0.803 (0.787 to 0.819)	62.2
2hPG	12 846	3.78 (3.11 to 4.60)	66.4	0.793 (0.774 to 0.812)	0
ADA-HbA1c	19 375	7.81 (4.32 to 14.14)	94.9	0.811 (0.724 to 0.899)	97.9
IEC-HbA1c	19 375	8.36 (4.88 to 14.33)	93.9	0.802 (0.729 to 0.874)	96.2

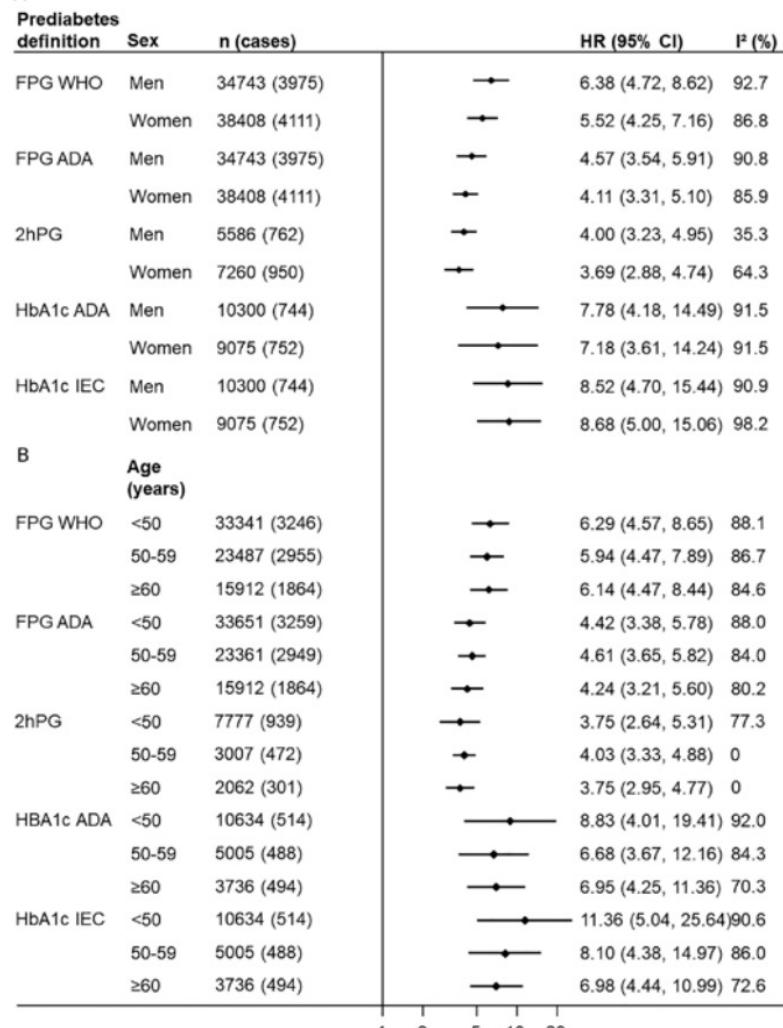
\*Age, sex, body mass index, systolic blood pressure, smoking and family history of diabetes.

†Normal (non-prediabetes or diabetes) was the reference group, see [table 1](#) for the respective definitions.

‡Family history of diabetes was not adjusted for MESA and Aichi.

ADA, American Diabetes Association; FPG, fasting plasma glucose; HbA1c, glycated hemoglobin; 2hPG, 2-hour postload plasma glucose;

IEC, International Expert Committee.



# Comparing different definitions of prediabetes with subsequent risk of diabetes: an individual participant data meta-analysis involving 76 513 individuals and 8208 cases of incident diabetes

**Table 2** Pooled HRs for incident diabetes association with prediabetes status at baseline and Harrell's C-statistics for predicting 5-year risk of diabetes associated with prediabetes status at baseline

Prediabetes definition	Multiple adjusted*				
	N	HR (95% CI)†	I <sup>2</sup> (%)	C-statistics (95% CI)†	I <sup>2</sup> (%)
WHO-FPG‡	73151	5.54 (4.31 to 7.12)	93.9	0.789 (0.772 to 0.807)	63.5
ADA-FPG‡	73151	4.17 (3.36 to 5.17)	93.3	0.803 (0.787 to 0.819)	62.2
2hPG	12846	3.78 (3.11 to 4.60)	66.4	0.793 (0.774 to 0.812)	0
ADA-HbA1c	19375	7.81 (4.32 to 14.14)	94.9	0.811 (0.724 to 0.899)	97.9
IEC-HbA1c	19375	8.36 (4.88 to 14.33)	93.9	0.802 (0.729 to 0.874)	96.2

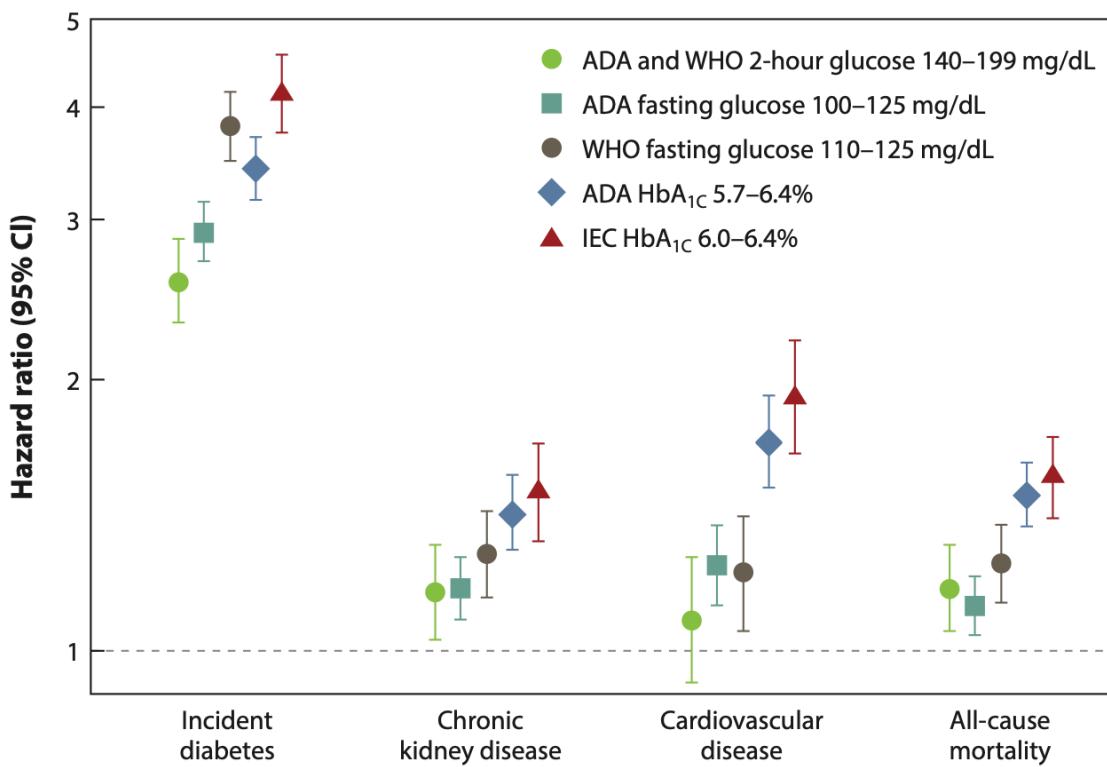
\*Age, sex, body mass index, systolic blood pressure, smoking and family history of diabetes.

†Normal (non-prediabetes or diabetes) was the reference group, see table 1 for the respective definitions.

‡Family history of diabetes was not adjusted for MESA and Aichi.

ADA, American Diabetes Association; FPG, fasting plasma glucose; HbA1c, glycated hemoglobin; 2hPG, 2-hour postload plasma glucose;

IEC, International Expert Committee.



**Figure 2**

Hazard ratios (95% confidence intervals) for the associations of different definitions of prediabetes with incident diabetes, chronic kidney disease, cardiovascular disease, and all-cause mortality in the community-based ARIC study. Abbreviations: ADA, American Diabetes Association; ARIC, Atherosclerosis Risk in Communities; CI, confidence interval; IEC, International Expert Committee; WHO, World Health Organization. Figure based on data from Reference 110.

# VARIABILIDAD

**Table 2 – Glucose tolerance classification at first and second visit; [n (row percent)]**

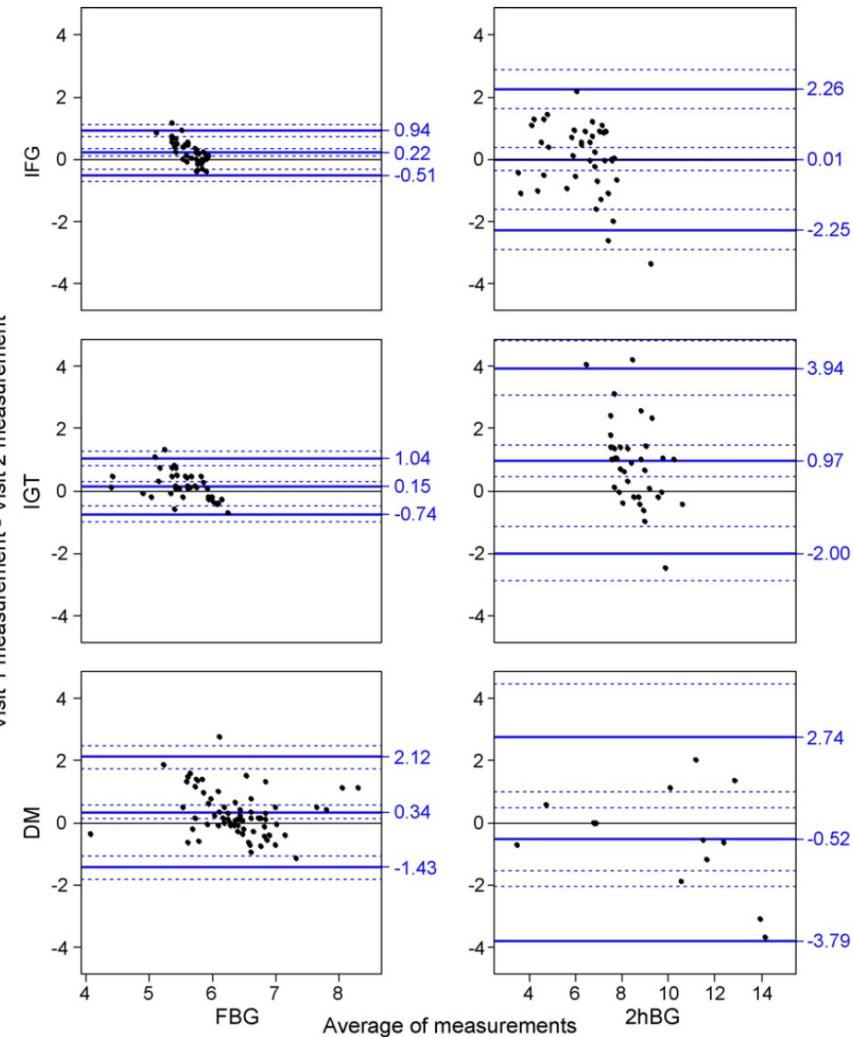
Visit <sub>1</sub>	Visit <sub>2</sub>				Total
	NGT	IFG	IGT	Diabetes	
IFG	15 (35.7)	20 (47.6)	6 (14.3)	1 (2.4)	42
IGT	9 (22.5)	6 (15.0)	16 (40.0)	9 (22.5)	40
Diabetes	6 (8.5)	4 (5.6)	7 (9.9)	54 (76.1)	71
Total	30 (19.6)	30 (19.6)	29 (19.0)	64 (41.8)	153

# VARIABILIDAD

**Table 2 – Glucose tolerance classification at first and second visit; [n (row percent)]**

Visit <sub>1</sub>	Visit <sub>2</sub>				Total
	NGT	IFG	IGT	Diabetes	
IFG	15 (35.7)	20 (47.6)	6 (14.3)	1 (2.4)	42
IGT	9 (22.5)	6 (15.0)	16 (40.0)	9 (22.5)	40
Diabetes	6 (8.5)	4 (5.6)	7 (9.9)	54 (76.1)	71
Total	30 (19.6)	30 (19.6)	29 (19.0)	64 (41.8)	153

Rasmussen S. Diabetes Res Clin Pract 2008 Apr;80(1):146-52.





## Reversion from prediabetes to normoglycaemia and risk of cardiovascular disease and mortality: the Whitehall II cohort study

Dorte Vistisen<sup>1</sup> · Mika Kivimäki<sup>2</sup> · Leigh Perreault<sup>3</sup> · Adam Hulman<sup>4,5,6</sup> · Daniel R. Witte<sup>4,5,6</sup> · Eric J. Brunner<sup>2</sup> · Adam Tabák<sup>2,7</sup> · Marit E. Jørgensen<sup>1,8</sup> · Kristine Færch<sup>1</sup>

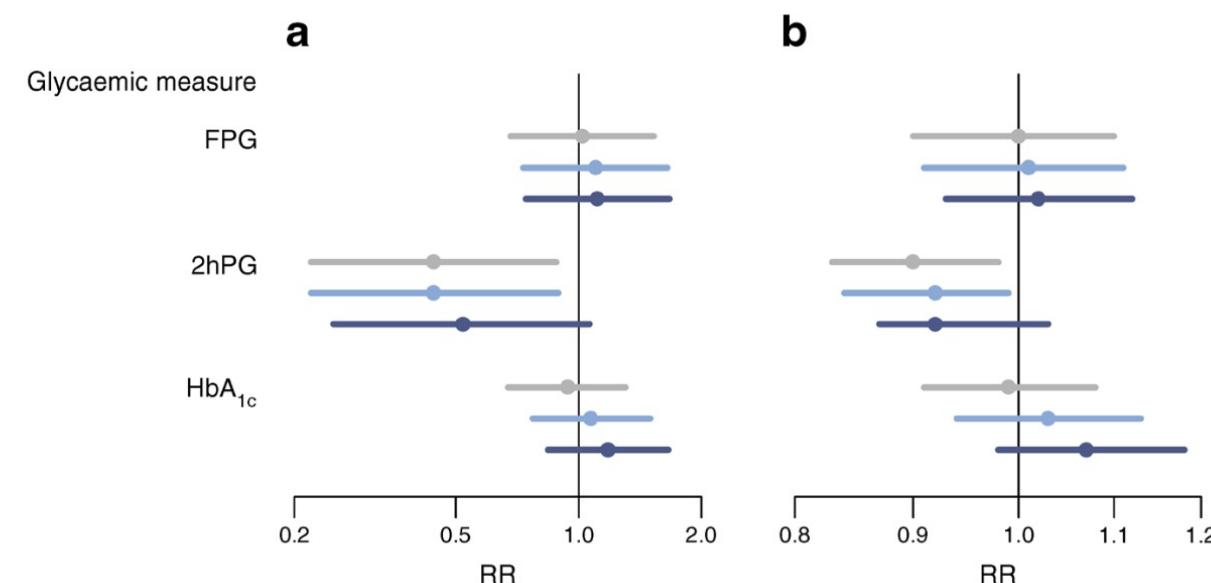
- Alteración de la glucemia en ayunas (IFG):
  - 820 participantes: 45% regresión a normogucemia, 14% progresión a diabetes
- Intolerancia a la glucosa (IGT):
  - 324 participantes: 37% regresión a normogucemia, 23% progresión a diabetes
- Glucemia Intermedia (Hb glicosilada):
  - 1709 participantes: 17% regresión a normogucemia, 14% progresión a diabetes

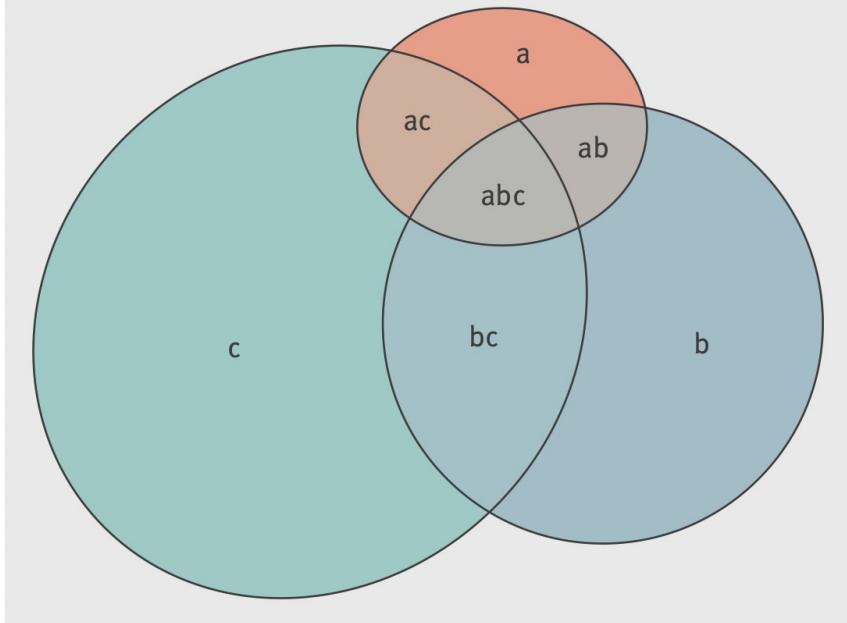


## Reversion from prediabetes to normoglycaemia and risk of cardiovascular disease and mortality: the Whitehall II cohort study

Dorte Vistisen<sup>1</sup> · Mika Kivimäki<sup>2</sup> · Leigh Perreault<sup>3</sup> · Adam Hulman<sup>4,5,6</sup> · Daniel R. Witte<sup>4,5,6</sup> · Eric J. Brunner<sup>2</sup> · Adam Tabák<sup>2,7</sup> · Marit E. Jørgensen<sup>1,8</sup> · Kristine Færch<sup>1</sup>

**Fig. 1** Rate ratios (RRs) of an event (CVD or death) for reverting from prediabetes to normoglycaemia vs not reverting (a) or for decreasing 1 SD in glycaemic measure over 5 years from phase 7 to phase 9 (b). Grey: unadjusted RR; light blue: adjusting for age and sex; dark blue: further adjusting for previous CVD. The RR for 1 SD decrease (b) is further adjusted for baseline glycaemia in all the analyses. The x-axis is on a natural logarithmic scale



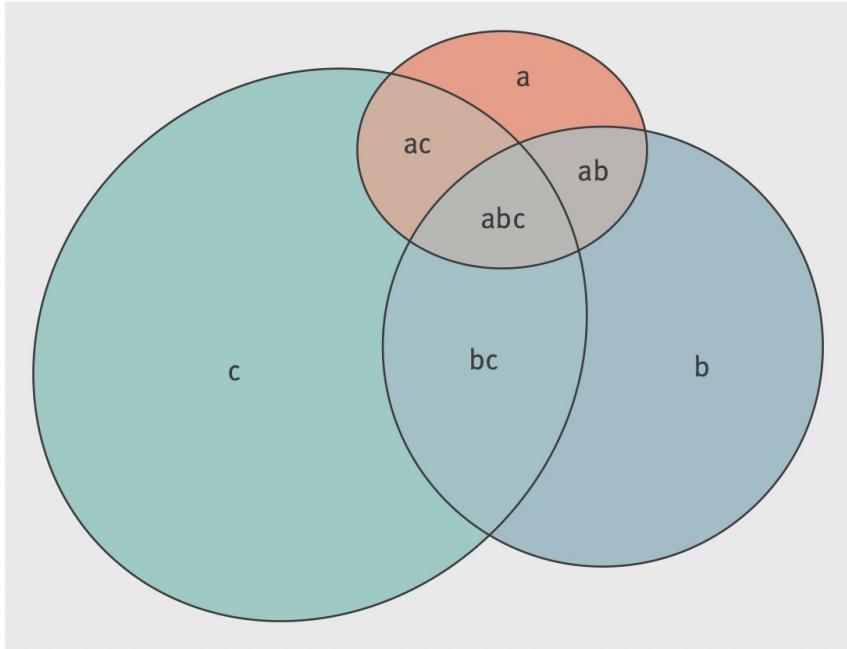


**Fig 4 | Prevalence of pre-diabetes by diagnostic test with IEC and WHO criteria, showing overlap with all three tests.**  
Prevalence of pre-diabetes was 27%. Of those with abnormal results, a=4.7% isolated IFG; b=24.4% isolated IGT; c=47.8% isolated HbA<sub>1c</sub>; ab=2.9% IFG+IGT; ac=4.1% IFG+HbA<sub>1c</sub>; bc=12.2% IGT+HbA<sub>1c</sub>; abc=3.9% IGT+IFG+HbA<sub>1c</sub>; d (area outside ellipse)=72% (normal result)

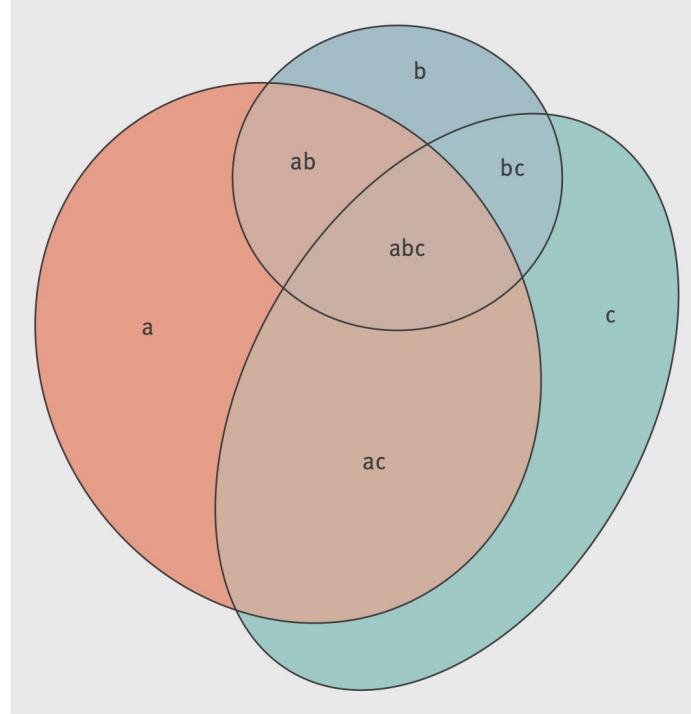


## Efficacy and effectiveness of screen and treat policies in prevention of type 2 diabetes: systematic review and meta-analysis of screening tests and interventions

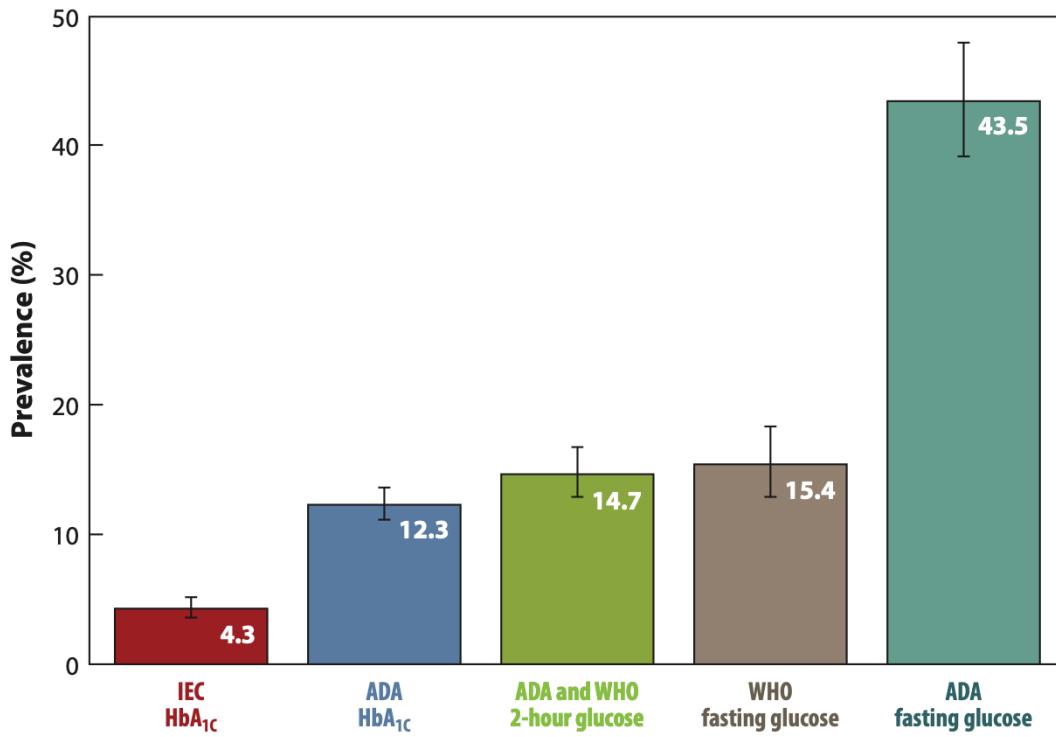
Eleanor Barry,<sup>1</sup> Samantha Roberts,<sup>1</sup> Jason Oke,<sup>1</sup> Shanti Vijayaraghavan,<sup>2</sup> Rebecca Normansell,<sup>3</sup> Trisha Greenhalgh<sup>1</sup>



**Fig 4 | Prevalence of pre-diabetes by diagnostic test with IEC and WHO criteria, showing overlap with all three tests.** Prevalence of pre-diabetes was 27%. Of those with abnormal results, a=4.7% isolated IFG; b=24.4% isolated IGT; c=47.8% isolated HbA<sub>1c</sub>; ab=2.9% IFG+IGT; ac=4.1% IFG+HbA<sub>1c</sub>; bc=12.2% IGT+HbA<sub>1c</sub>; abc=3.9% IGT+IFG+HbA<sub>1c</sub>; d (area outside ellipse)=72% (normal result)



**Fig 5 | Prevalence of pre-diabetes by diagnostic test with ADA criteria for all tests.** Prevalence of pre-diabetes was 54%. Of those with abnormal results, a=25.4% isolated IFG; b=6% isolated IGT; c=22.4% isolated HbA<sub>1c</sub>; ab=7.2% IFG+IGT; ac=26.7% IFG+HbA<sub>1c</sub>; bc=3.6% IGT+HbA<sub>1c</sub>; abc=8.7% IGT+IFG+HbA<sub>1c</sub>; d (area outside ellipse)=46% (normal result)



**Figure 1**

Prevalence of prediabetes in US adults aged 20 or older according to clinical definitions of prediabetes. Definitions of prediabetes: International Expert Committee (IEC) HbA<sub>1c</sub> 6.0–6.4%; American Diabetes Association (ADA) HbA<sub>1c</sub> 5.7–6.4%; ADA and World Health Organization (WHO) 2-h glucose 140–199 mg/dl; WHO fasting glucose 110–125 mg/dl; ADA fasting glucose 100–125 mg/dl. Data from National Health and Nutrition Examination Survey (NHANES) 2015–2016.

# DIABETES PREVENTION PROGRAM (USA) 2002

## The New England Journal of Medicine

---

Copyright © 2002 by the Massachusetts Medical Society

---

VOLUME 346

FEBRUARY 7, 2002

NUMBER 6

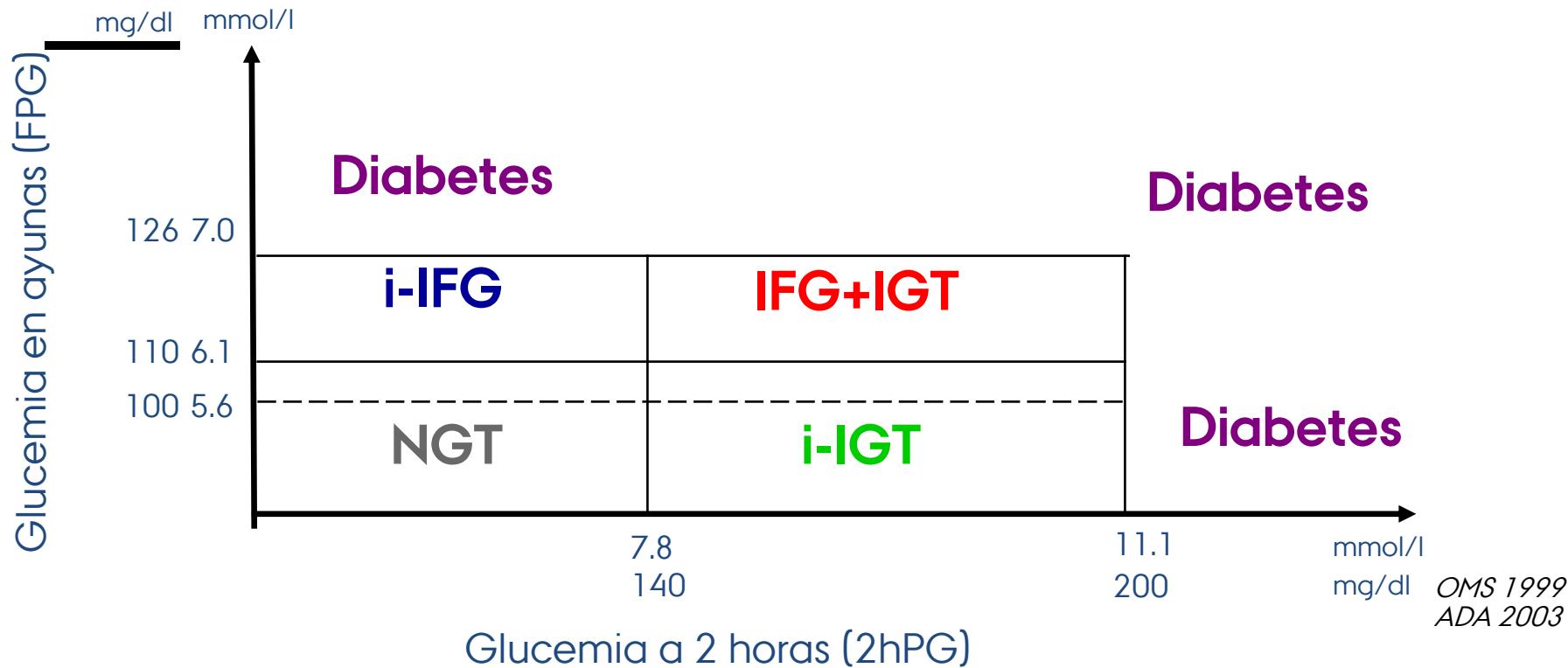
---



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

DIABETES PREVENTION PROGRAM RESEARCH GROUP\*

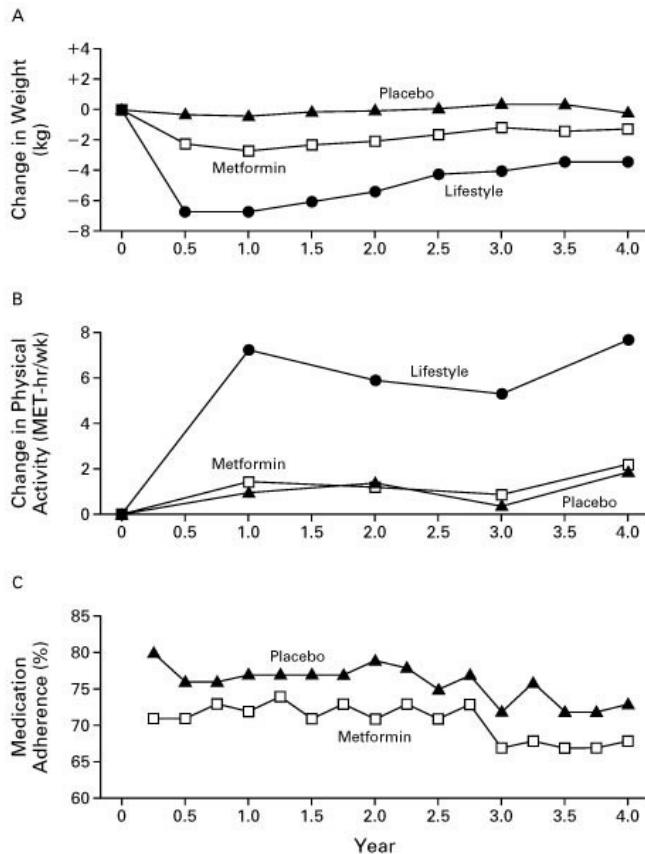
# MATRIZ DIAGNÓSTICA (OMS 1999)



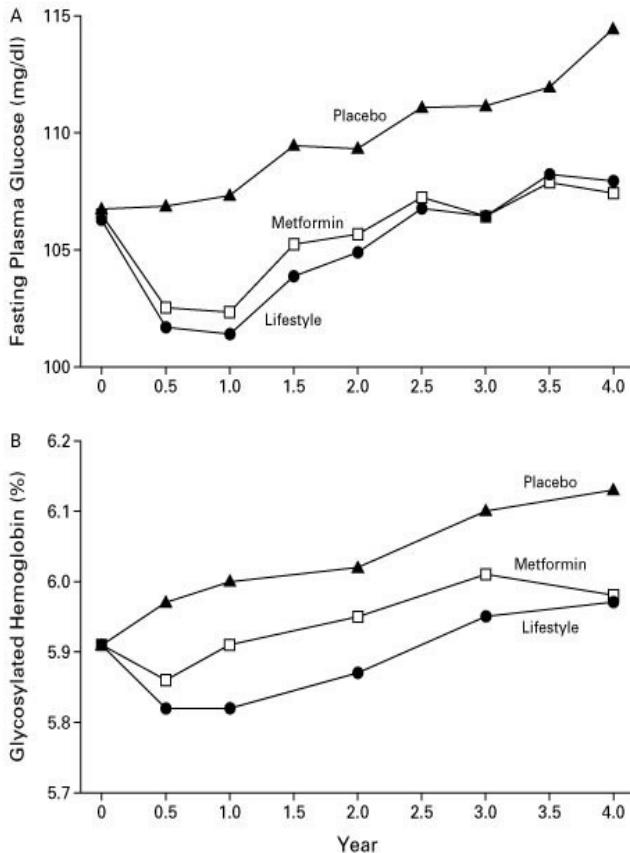
IFG: alteración de la glucemia en ayunas

IGT: intolerancia a la glucosa

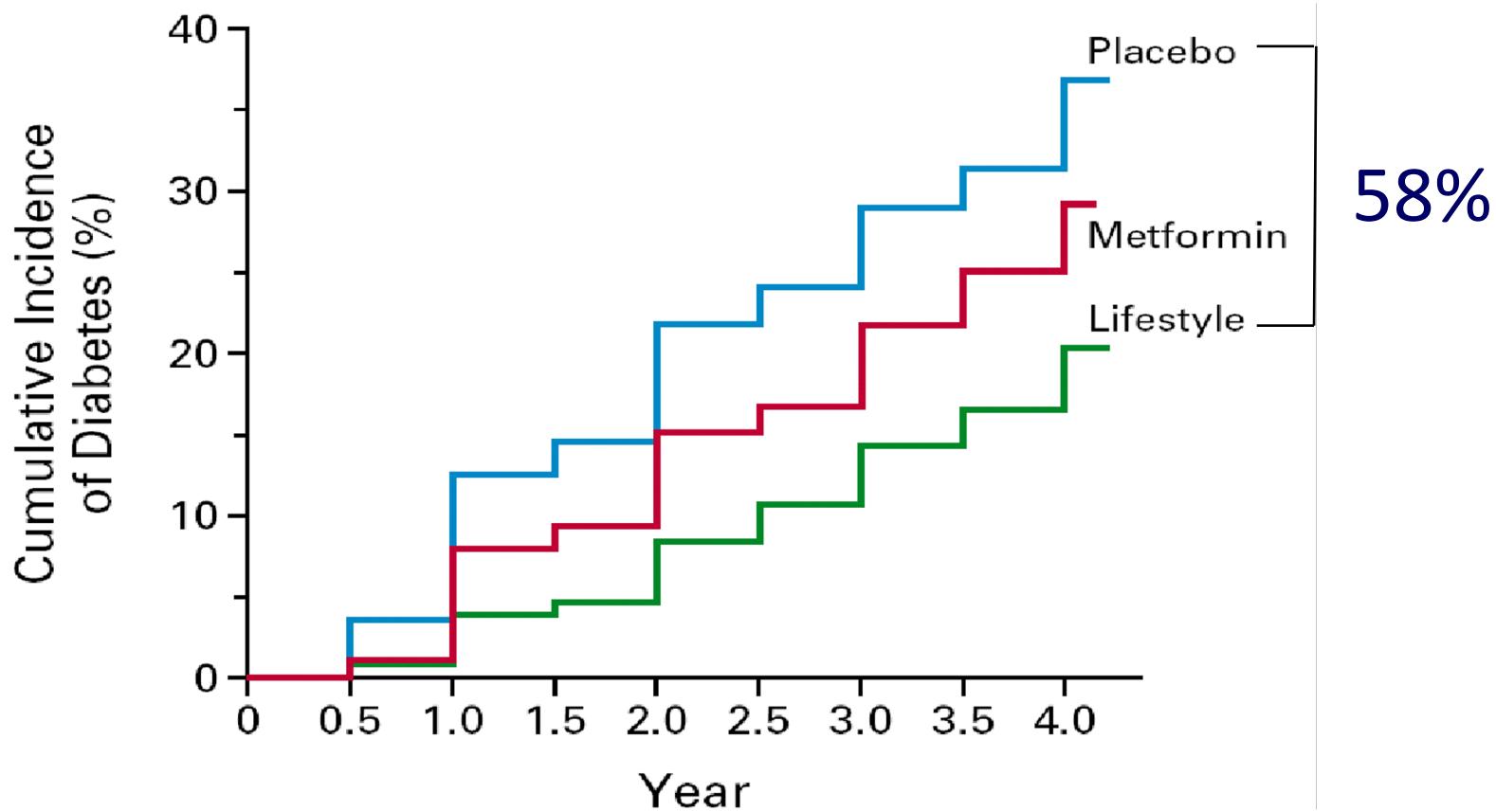
# DIABETES PREVENTION PROGRAM (USA) 2002



# DIABETES PREVENTION PROGRAM (USA) 2002



# DIABETES PREVENTION PROGRAM (USA) 2002



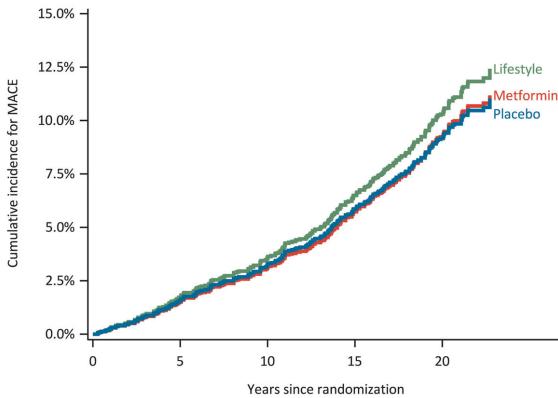
**Table 1** Randomized, clinical trials that aimed to prevent diabetes by lifestyle modification.

Study <sup>a</sup>	Number of patients by treatment group	BMI of participants (kg/m <sup>2</sup> )	Duration of intervention (years)	Lifestyle goals	Weight loss achieved at 1 year (kg)	Cumulative incidence of T2DM in controls	Risk reduction (95% CI)
Pan et al. (1997) <sup>13</sup>	130 diet 141 exercise 126 diet and exercise 133 control	26	6	Weight loss + maintenance of a healthy diet ± exercise	NR	68% (15.7% per year)	Diet 31% (NR) Exercise 46% (NR) Both 42% (NR)
Tuomilehto et al. (2001) <sup>14</sup>	265 active 257 control	31	4	5% weight loss on low-fat, high-fiber diet + 30 min exercise per day	4.2	23% (6% per year)	58% (30–70%)
DPP Research Group (2002) <sup>19</sup>	1,079 active 1,082 control	34	2.8	7% weight loss + 150 min exercise per week	7	28.9% at 3 years	58% (48–66%)
Kosaka et al. (2005) <sup>22b</sup>	356 active 102 control	24	4	Reduction in BMI to ≤22 kg/m <sup>2</sup> by 30–40 min exercise per day	2.5	9.3% (assessed by FPG >7.8 mmol/l)	67.4% (NR)
Ramachandran et al. (2006) <sup>23</sup>	133 active 136 control	26	3	Weight maintenance by diet low in refined carbohydrates and fat + 30 min exercise per day	0	55%	28.5% (20–37%)

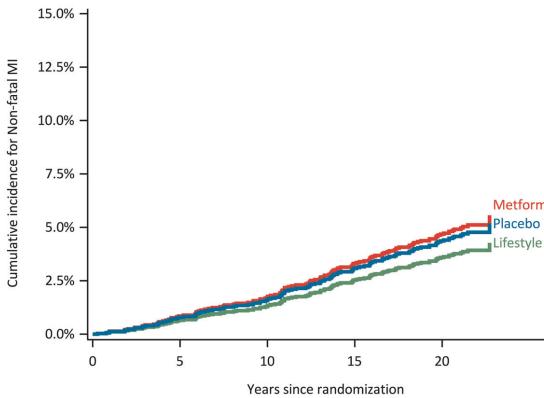
<sup>a</sup>All study populations had impaired glucose tolerance. <sup>b</sup>In this study, the oral glucose tolerance test used 100 g glucose and modified criteria for impaired glucose tolerance. Abbreviations: DPP, Diabetes Prevention Program; FPG, fasting plasma glucose; IGT, impaired glucose tolerance; NR, not reported; T2DM, type 2 diabetes mellitus.

# SEGUIMIENTO DEL DPP A LARGO PLAZO

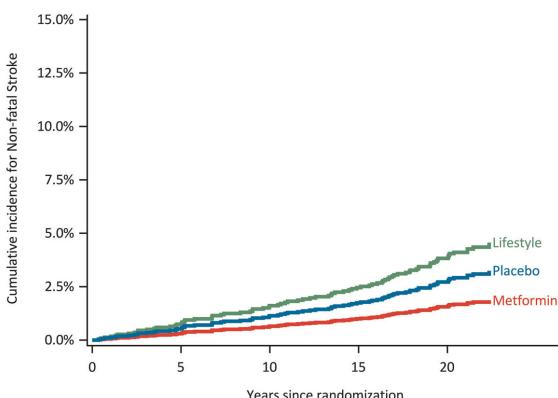
A Total Major Adverse Cardiovascular Events



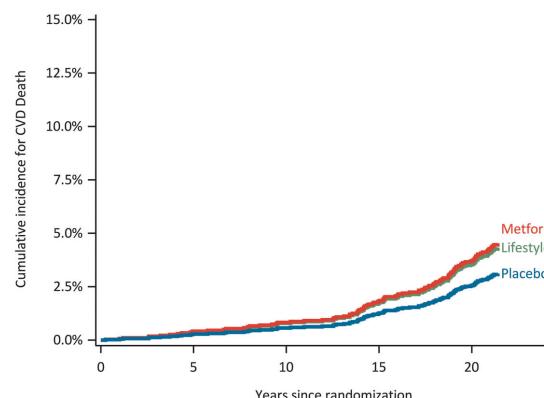
B Non-fatal Myocardial Infarction



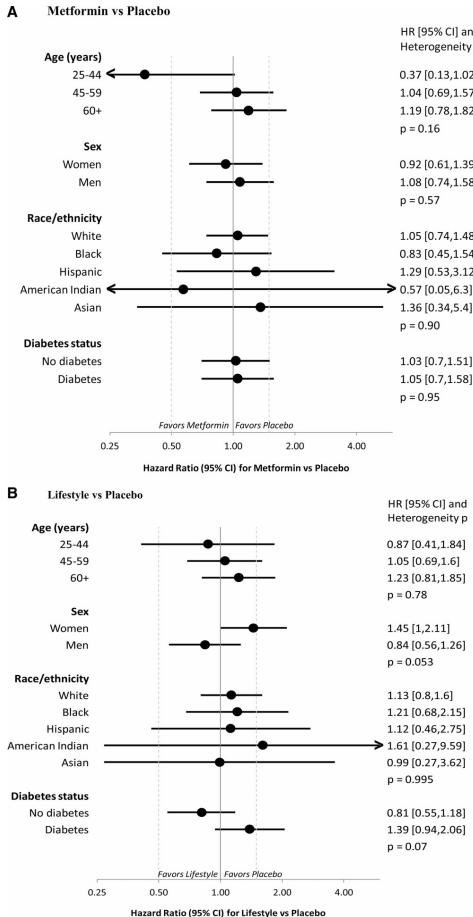
C Non-fatal Stroke



D Cardiovascular Death



# SEGUIMIENTO DEL DPP A LARGO PLAZO

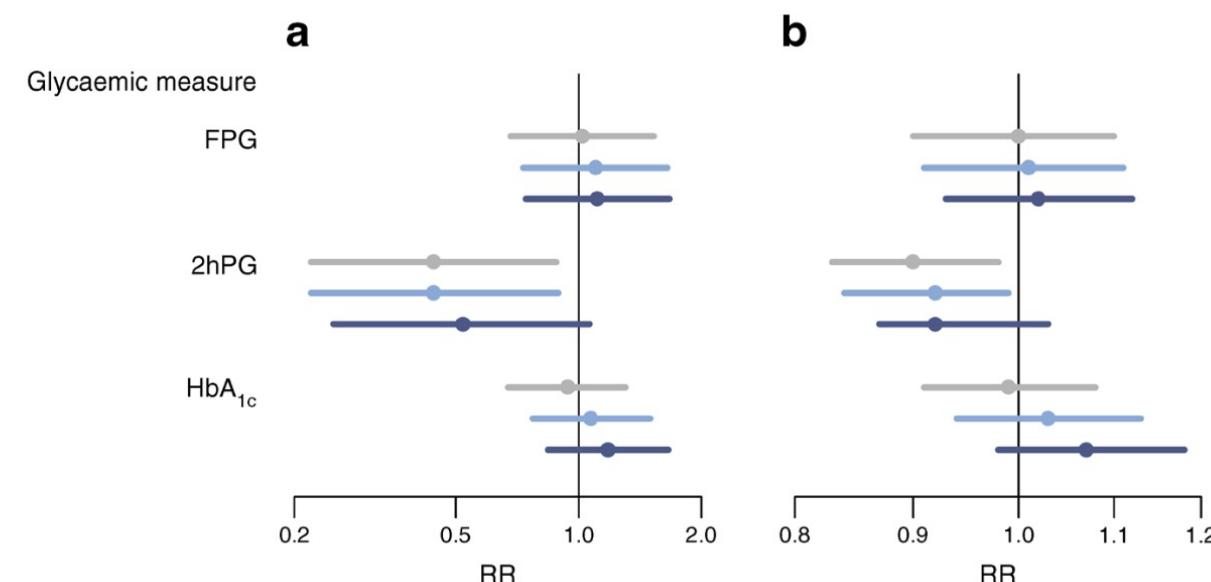




## Reversion from prediabetes to normoglycaemia and risk of cardiovascular disease and mortality: the Whitehall II cohort study

Dorte Vistisen<sup>1</sup> · Mika Kivimäki<sup>2</sup> · Leigh Perreault<sup>3</sup> · Adam Hulman<sup>4,5,6</sup> · Daniel R. Witte<sup>4,5,6</sup> · Eric J. Brunner<sup>2</sup> · Adam Tabák<sup>2,7</sup> · Marit E. Jørgensen<sup>1,8</sup> · Kristine Færch<sup>1</sup>

**Fig. 1** Rate ratios (RRs) of an event (CVD or death) for reverting from prediabetes to normoglycaemia vs not reverting (a) or for decreasing 1 SD in glycaemic measure over 5 years from phase 7 to phase 9 (b). Grey: unadjusted RR; light blue: adjusting for age and sex; dark blue: further adjusting for previous CVD. The RR for 1 SD decrease (b) is further adjusted for baseline glycaemia in all the analyses. The x-axis is on a natural logarithmic scale





## “Prediabetes”: Are There Problems With This Label? Yes, the Label Creates Further Problems!

*Diabetes Care* 2016;39:1468–1471 | DOI: 10.2337/dc15-2113

John S. Yudkin



## “Prediabetes”: Are There Problems With This Label? No, We Need Heightened Awareness of This Condition!

*Diabetes Care* 2016;39:1472–1477 | DOI: 10.2337/dc16-1143

William T. Cefalu

Yudkin JS. *Diabetes Care* 2016;39:1468–1471.  
Cefalu WT. *Diabetes Care* 2016;39:1472–1477

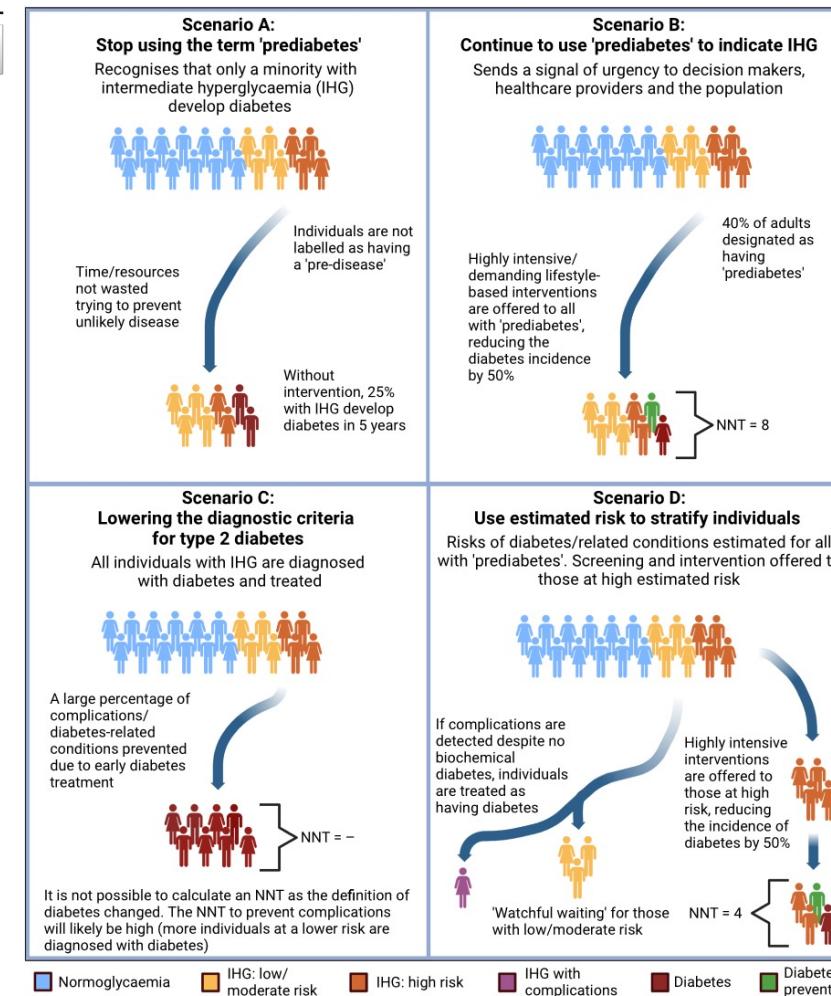


## The prediabetes conundrum: striking the balance between risk and resources

Martin B. Blond<sup>1</sup> • Kristine Færch<sup>1,2</sup> • Christian Herder<sup>3,4,5</sup> • Dan Ziegler<sup>3</sup> • Coen D. A. Stehouwer<sup>6,7</sup>

- Existe necesidad de prevención
- Personas con prediabetes tienen mayor riesgo de diabetes y sus complicaciones
- Pero existe alta heterogeneidad en riesgo

¿Como encontramos el equilibrio entre sub y sobretratamiento?



# RESUMEN

- ▶ El concepto de prediabetes tiene diferentes definiciones y cada una tiene ventajas y desventajas
- ▶ Hay debate sobre su utilidad
- ▶ Posee valor pronostico, pero:
  - › ¿Es el mejor pronosticador?
- ▶ Diferente importancia de acuerdo a:
  - › Nivel individual
  - › Nivel poblacional

# GRACIAS

---

Daniel R. Witte

**Steno Diabetes Center Aarhus**

Aarhus University Hospital

Palle Juul-Jensens Boulevard 11, Entrance A

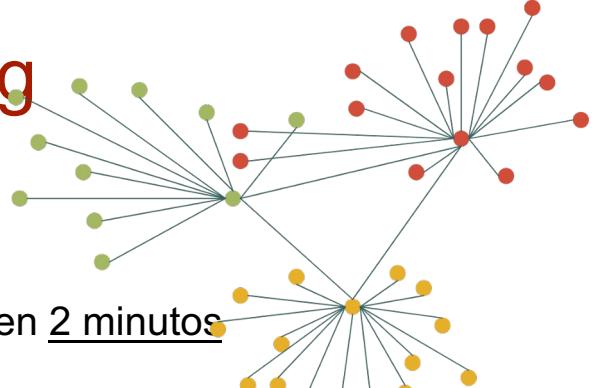
8200 Aarhus N

Denmark

[www.stenoaarhus.dk](http://www.stenoaarhus.dk)

[daniel.witte@ph.au.dk](mailto:daniel.witte@ph.au.dk)

# Actividad de Networking



Grupos de 5 personas con diferentes nacionalidades

## 1. Ronda de presentaciones. Cada participante se va a presentar en 2 minutos

Nombre/país de residencia/afiliación. Intereses académicos o proyectos de investigación que realizan actualmente

## 2. Discusión grupal. Prediabetes (10 minutos)

Prediabetes es una condición que requiere el uso de una prueba diagnóstica en sangre para su identificación. La discusión debe centrarse en el tipo de pruebas con las que se puede identificar prediabetes (glucosa en ayuno, prueba de tolerancia oral a la glucosa 2hr, hemoglobina glucosilada), y cuál de las pruebas es la que más frecuentemente se utiliza en la práctica. Otro punto a discutir es la transición hacia el uso de hemoglobina glucosilada como prueba diagnóstica de prediabetes

## 3. Discusión plenaria. Cada grupo menciona las puntos más relevantes de su discusión en pleno (7 minutos)