

Early Detection of Chronic Kidney Disease (CKD)

Gregorio T. Obrador, MD, MPH

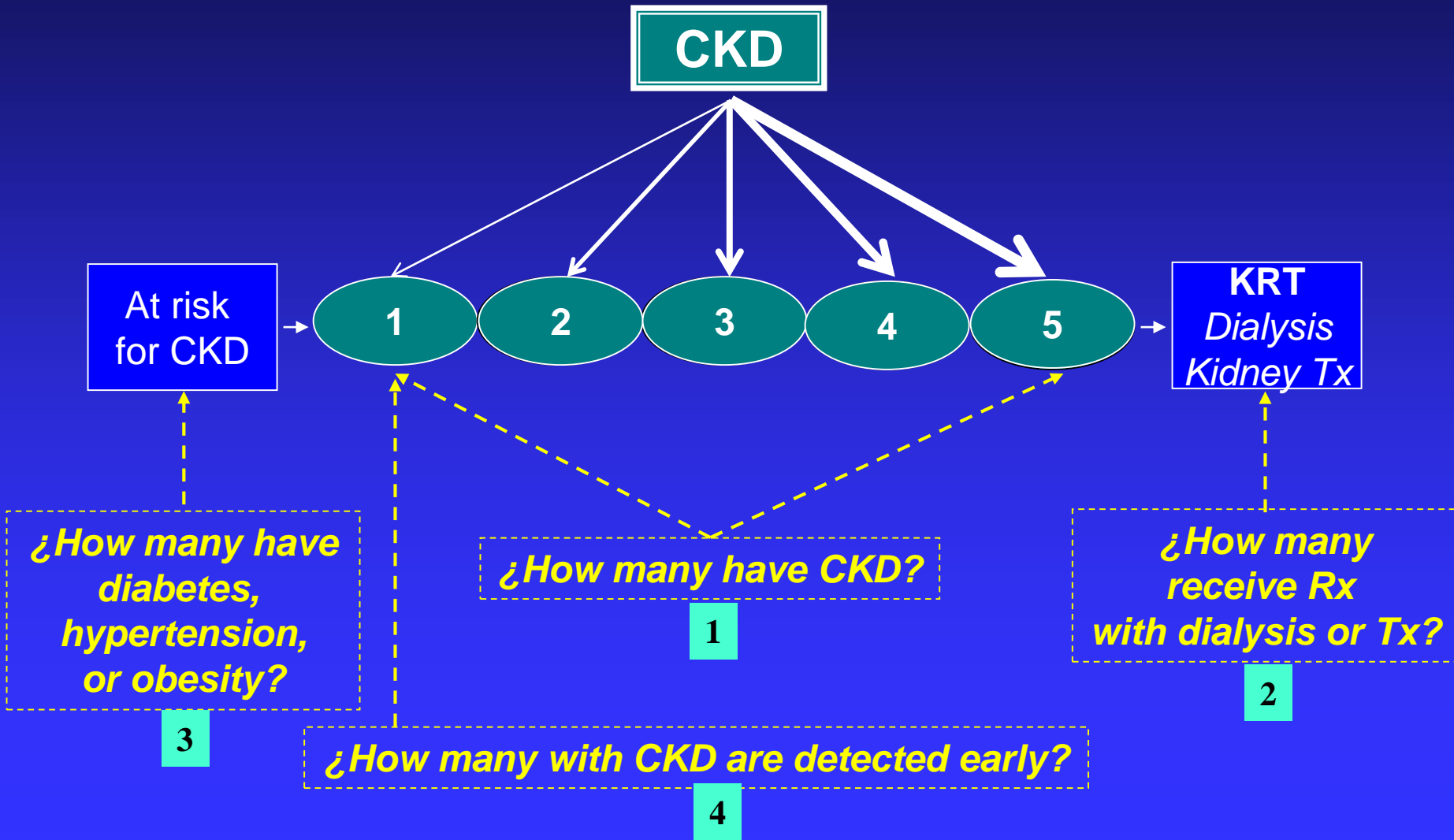
**Dean, Faculty of Health Sciences & School of Medicine
Universidad Panamericana, Mexico City**

**Adjunct Assistant Professor of Medicine, Tufts University School of
Medicine, Boston, MA**

Early Detection of CKD

- **Epidemiology of CKD in Mexico & CKD prevention**
- Kidney Early Evaluation (KEEP) Mexico Program
- Validation of PoCT measurement of SCr
- PoCT testing of albuminuria
- Conclusions

Epidemiology of CKD in Mexico



~9% of the Adult Population has CKD 3-5

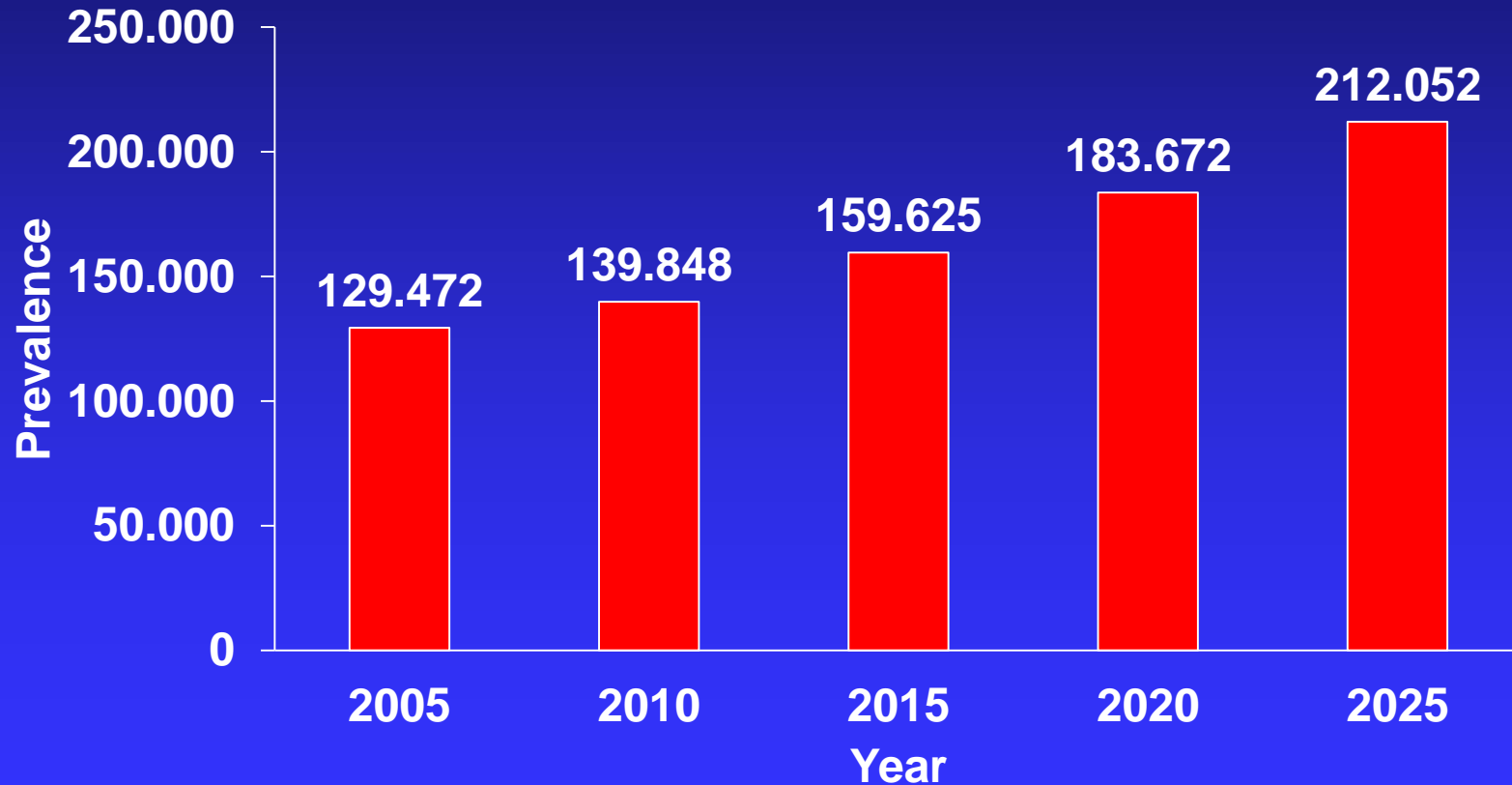
CKD 1	62.5%	626,034 pmp
CKD 2	29.0%	289,181 pmp
CKD 3	8.1%	80,788 pmp
CKD 4	0.3%	2,855 pmp
CKD 5	0.1%	1,142 pmp

Amato *et al*, *Kidney Int* 68:S11-S17, 2005.

Estimated Prevalence of CKD 5

	2005
Peritoneal dialysis	45,639
Hemodialysis	19,097
No access to KRT	65,006
<i>TOTAL</i>	129,742

Projections for CKD 5



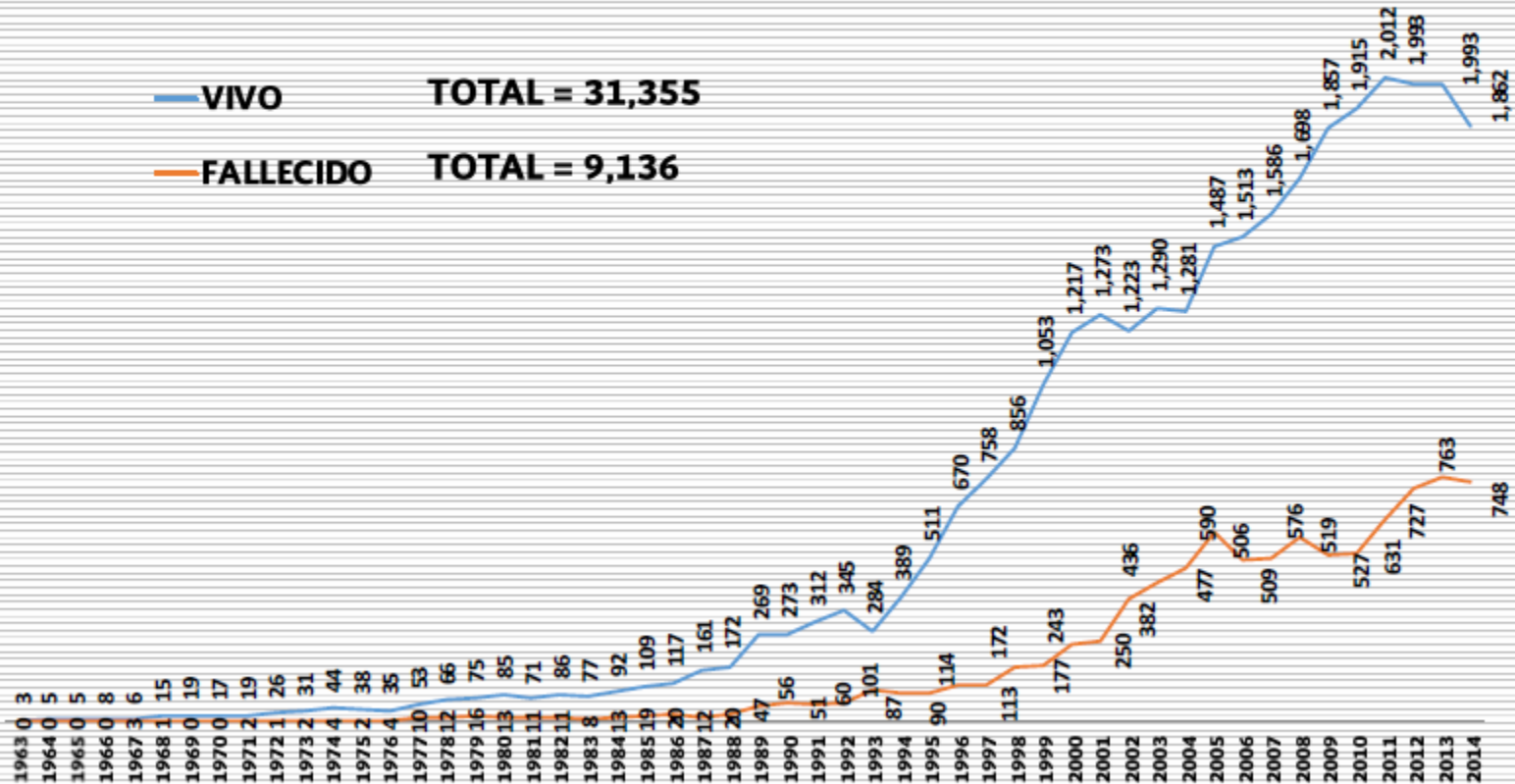
Dialysis Costs

Cuadro 17. Estimaciones de costos y precios anuales con tres sesiones por semana

Pacientes con necesidad de Terapia de Sustitución	Costos y precios estimados		
	Costos estimados en Unidades Públicas (\$158,964)	Costos estimados en Unidades Privadas (\$168,012)	Precio de contratación anual por paciente IMSS (\$168,480)
Pacientes en Hemodiálisis 19,097	\$3,035,735,508	\$3,208,525,164	\$3,217,462,560
Pacientes en Diálisis Peritoneal 45,639			
Pacientes sin tratamiento 65,006	\$10,333,613,784	\$10,921,788,072	\$10,952,210,880
Todos los Pacientes 129,472			

Kidney Transplants in Mexico

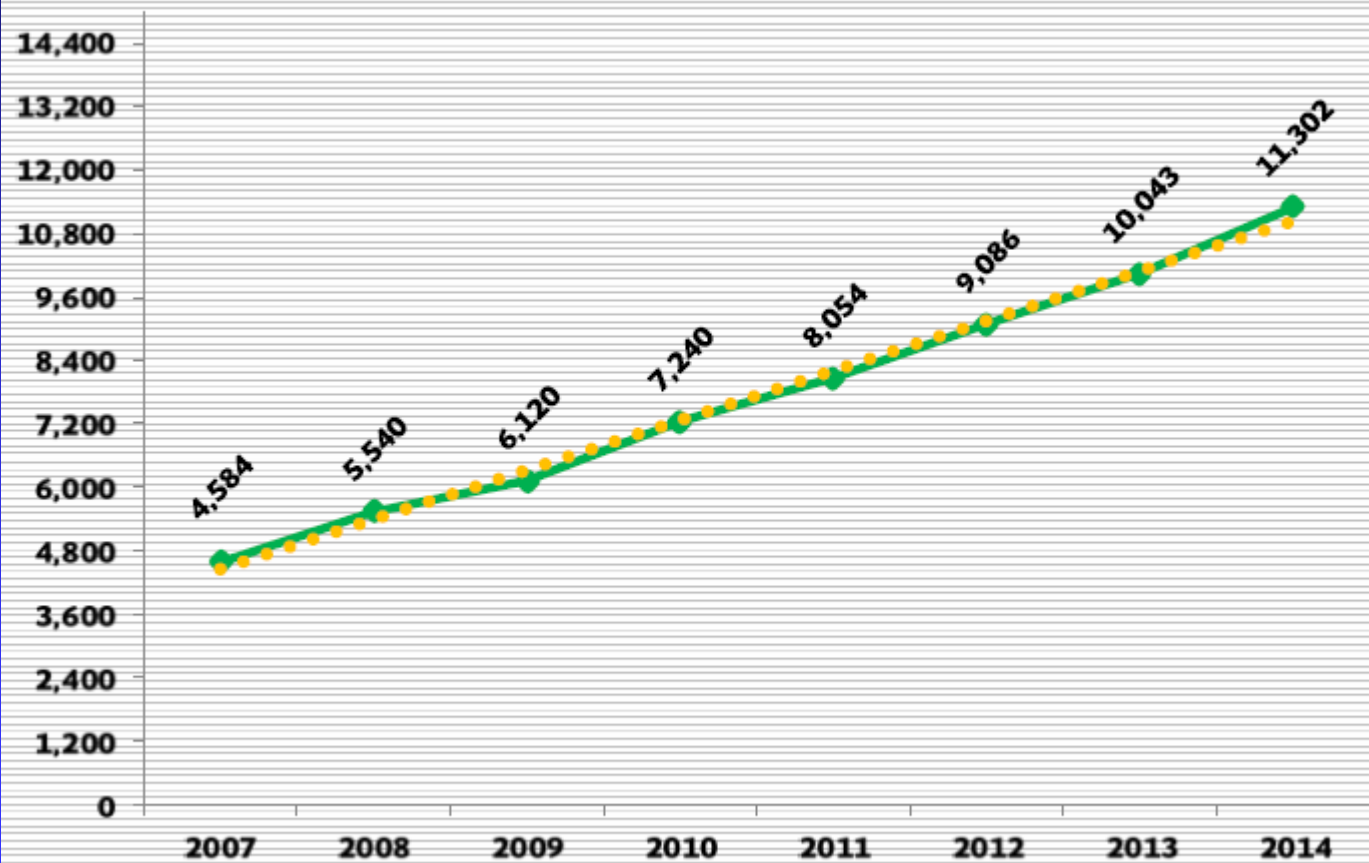
TRASPLANTE RENAL HISTÓRICO POR AÑO Y POR TIPO DE DONANTE



Fuente: Información al 31 de diciembre de 2014, consultada en el SIRNT.

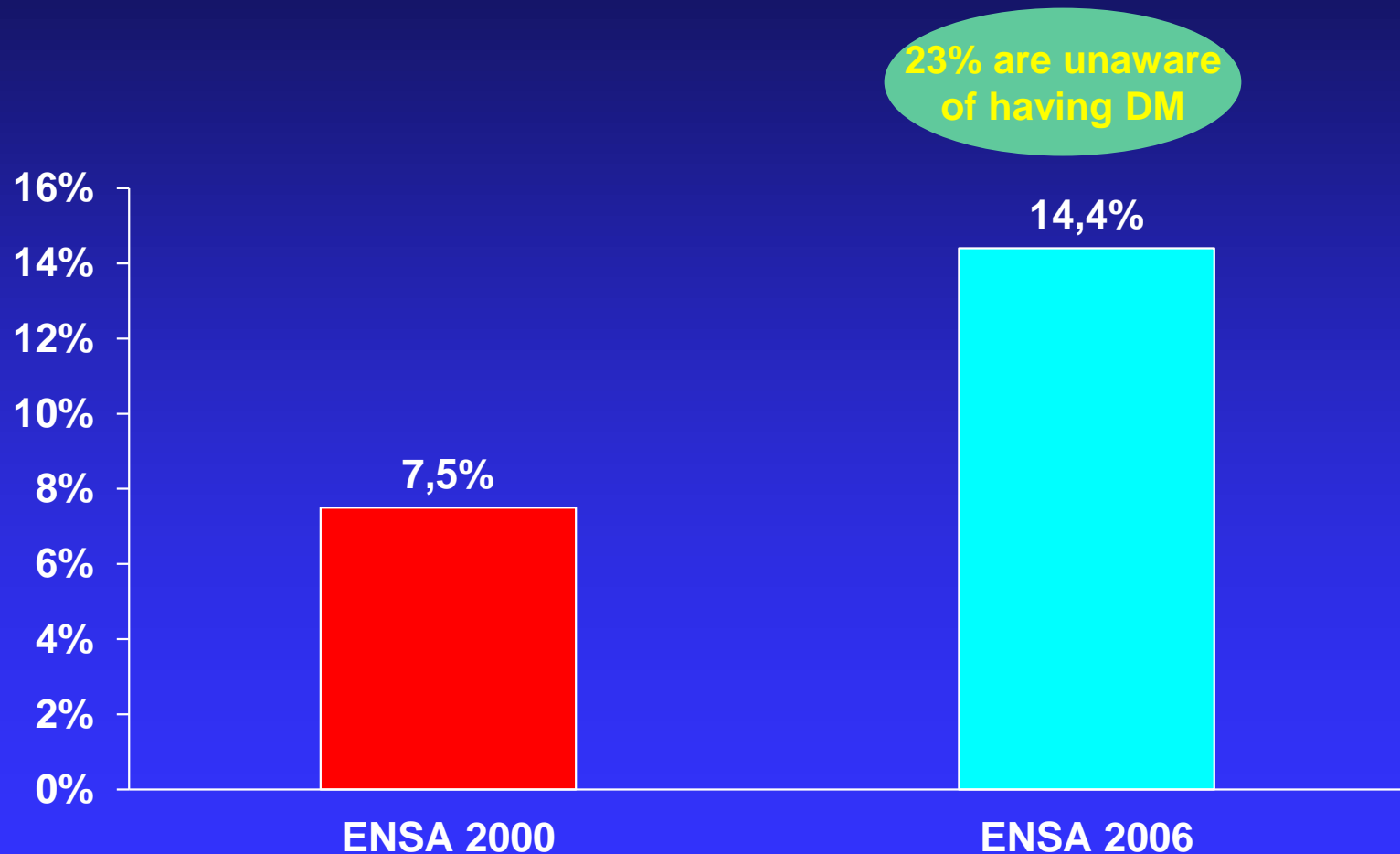
Waiting List for Kidney Transplantation

RECEPTORES EN ESPERA DE RIÑÓN AL 31 DE DICIEMBRE DE CADA AÑO

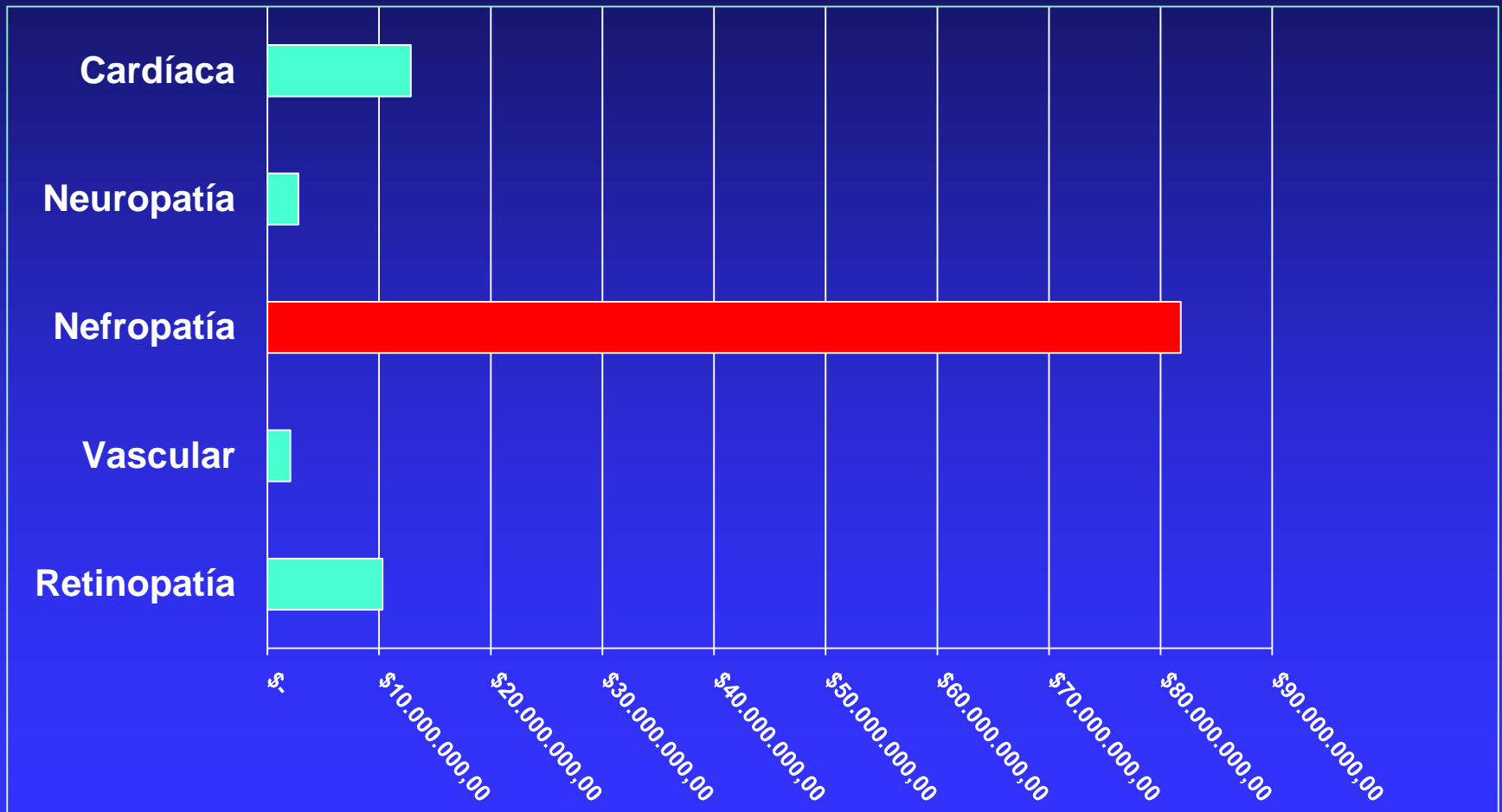


Fuente: Información al 31 de diciembre de 2014, consultada en el SIRNT.

Diabetes Prevalence Has Doubled

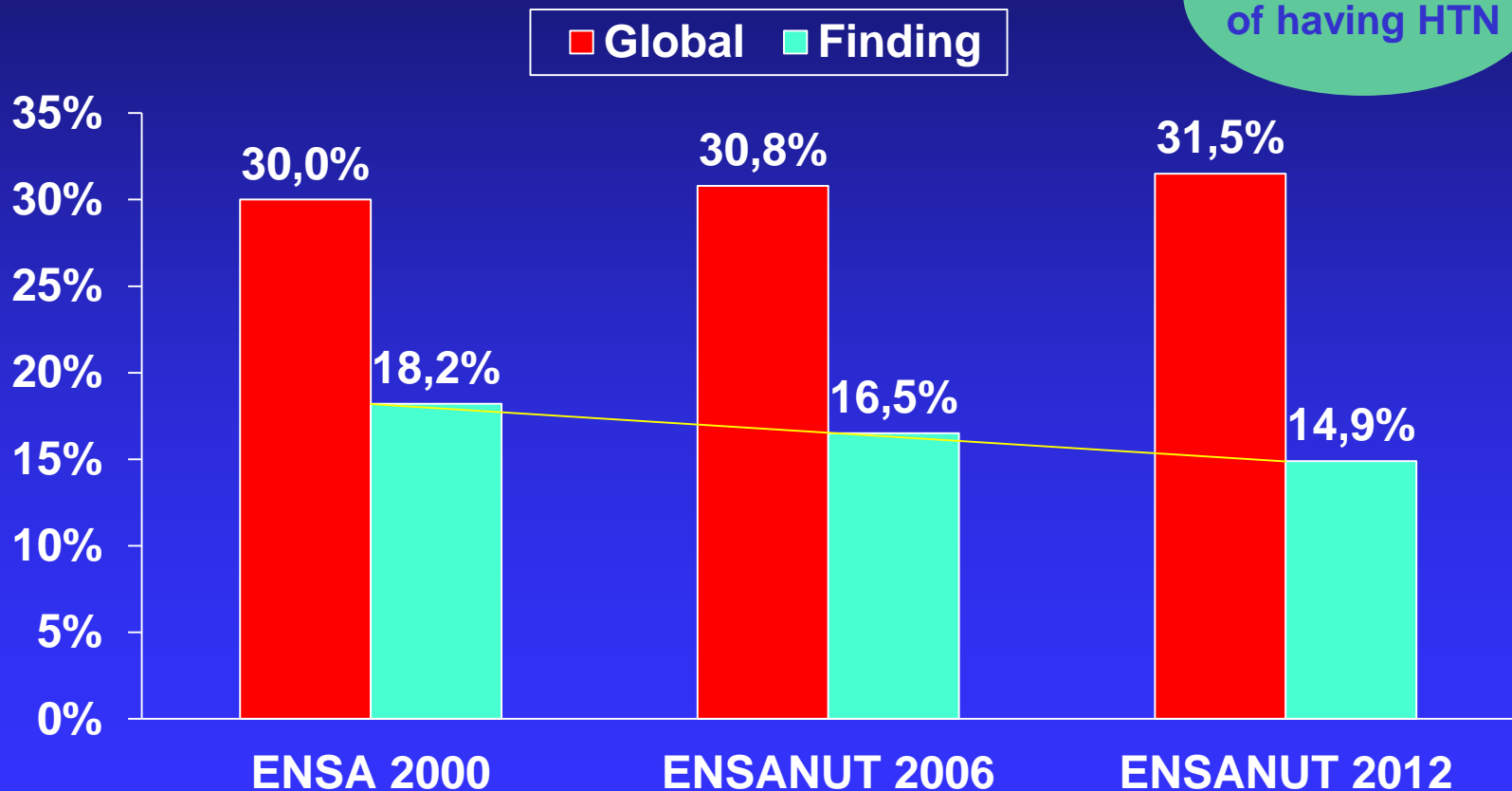


Nephropathy is the Most Expensive Complication of Diabetes



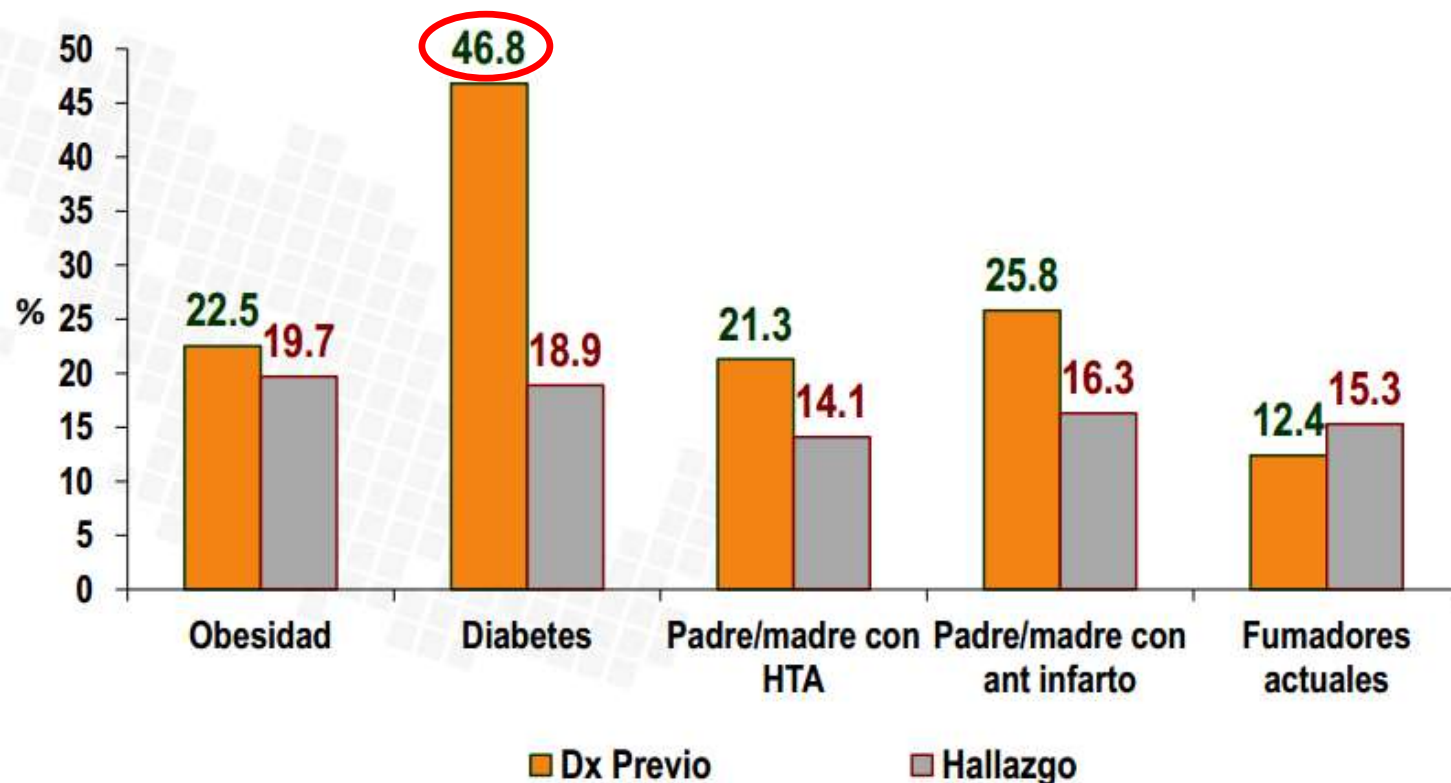
Hypertension Prevalence

47% were unaware of having HTN

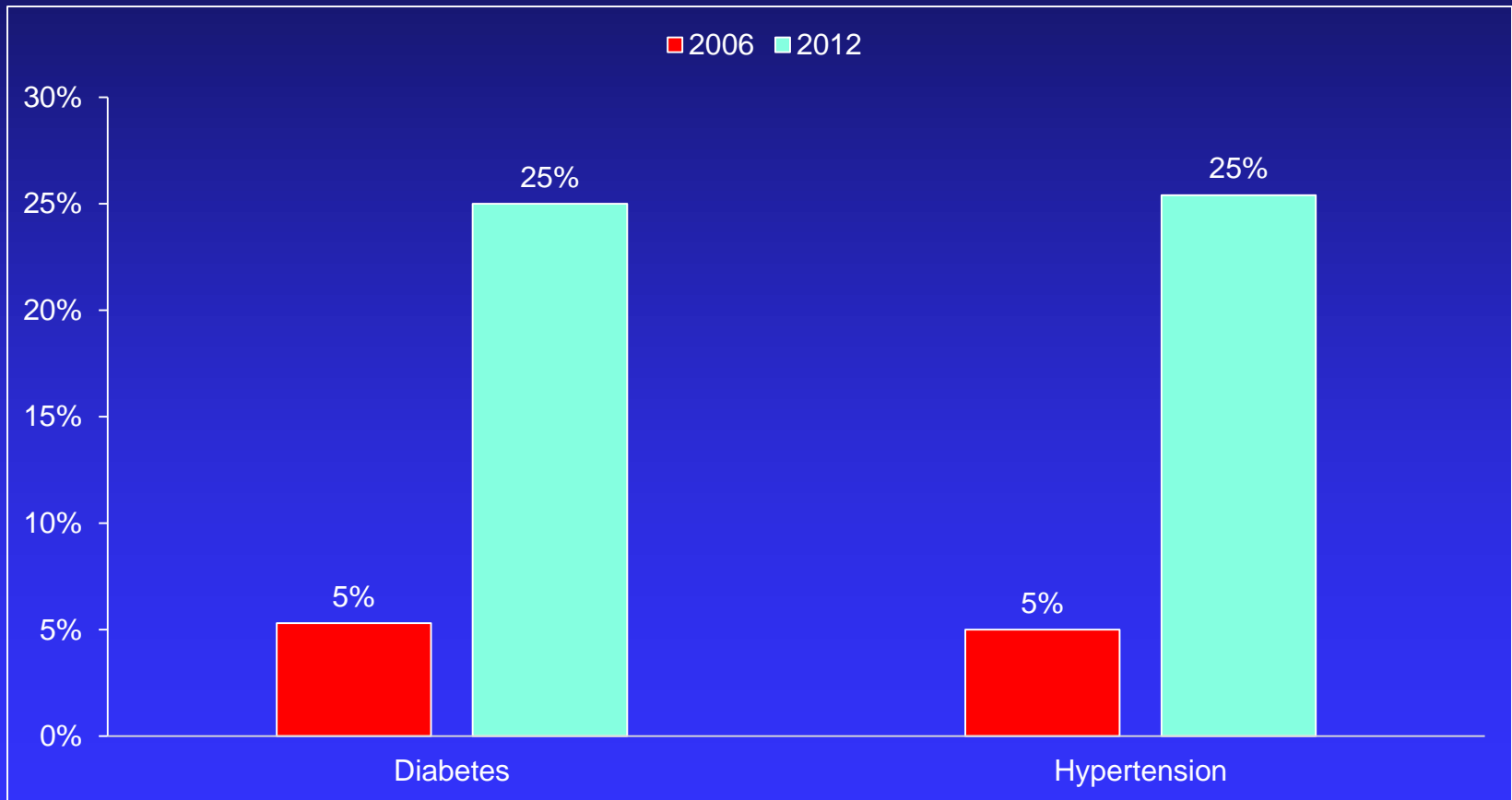


Almost Half of Diabetic Patients Also Have Hypertension

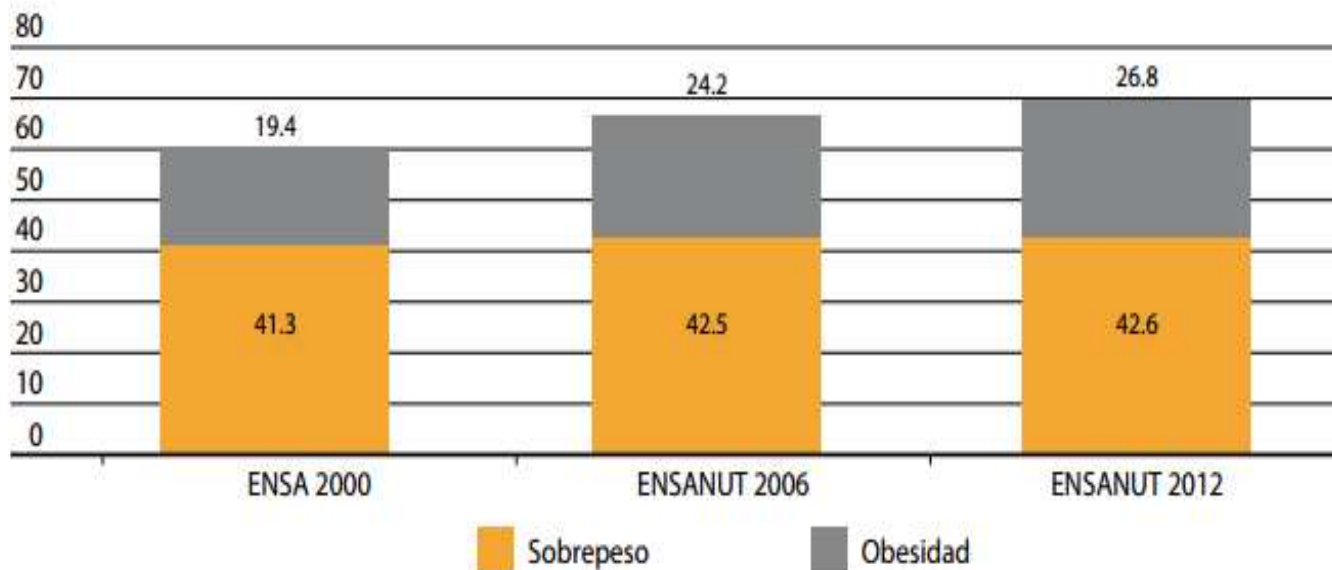
Prevalencia de hipertensión en población con otras comorbilidades/características. ENSANUT 2012



Diabetes & Hypertension Control Has Improved Over Time



#1 in Adult and Childhood Overweight & Obesity

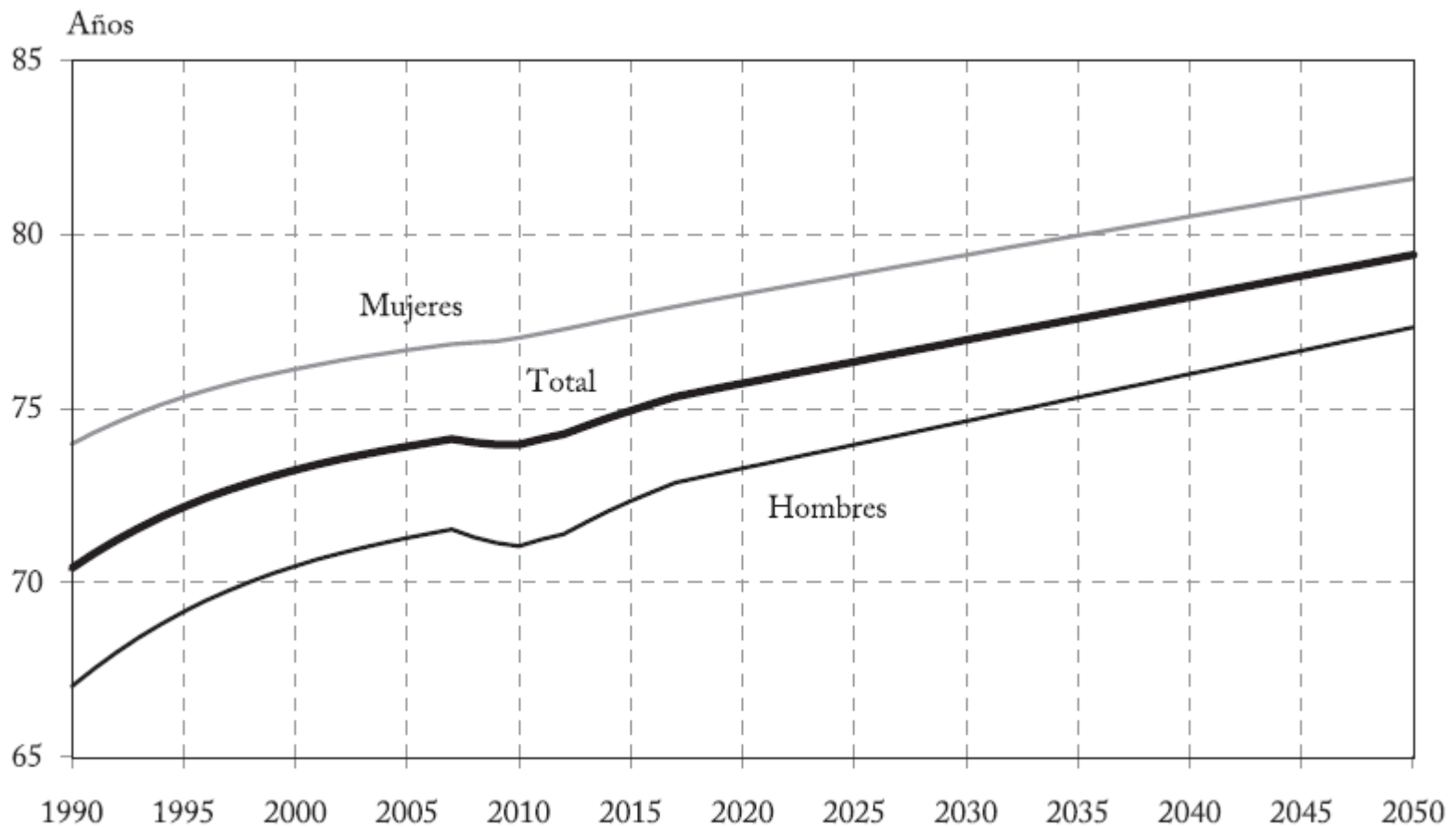


■ **Figura 10.6**

Comparación de las prevalencias de sobrepeso y obesidad en hombres mayores de 20 años de edad, participantes en la ENSA 2000, ENSANUT 2006 y ENSANUT 2012. México, ENSANUT 2012

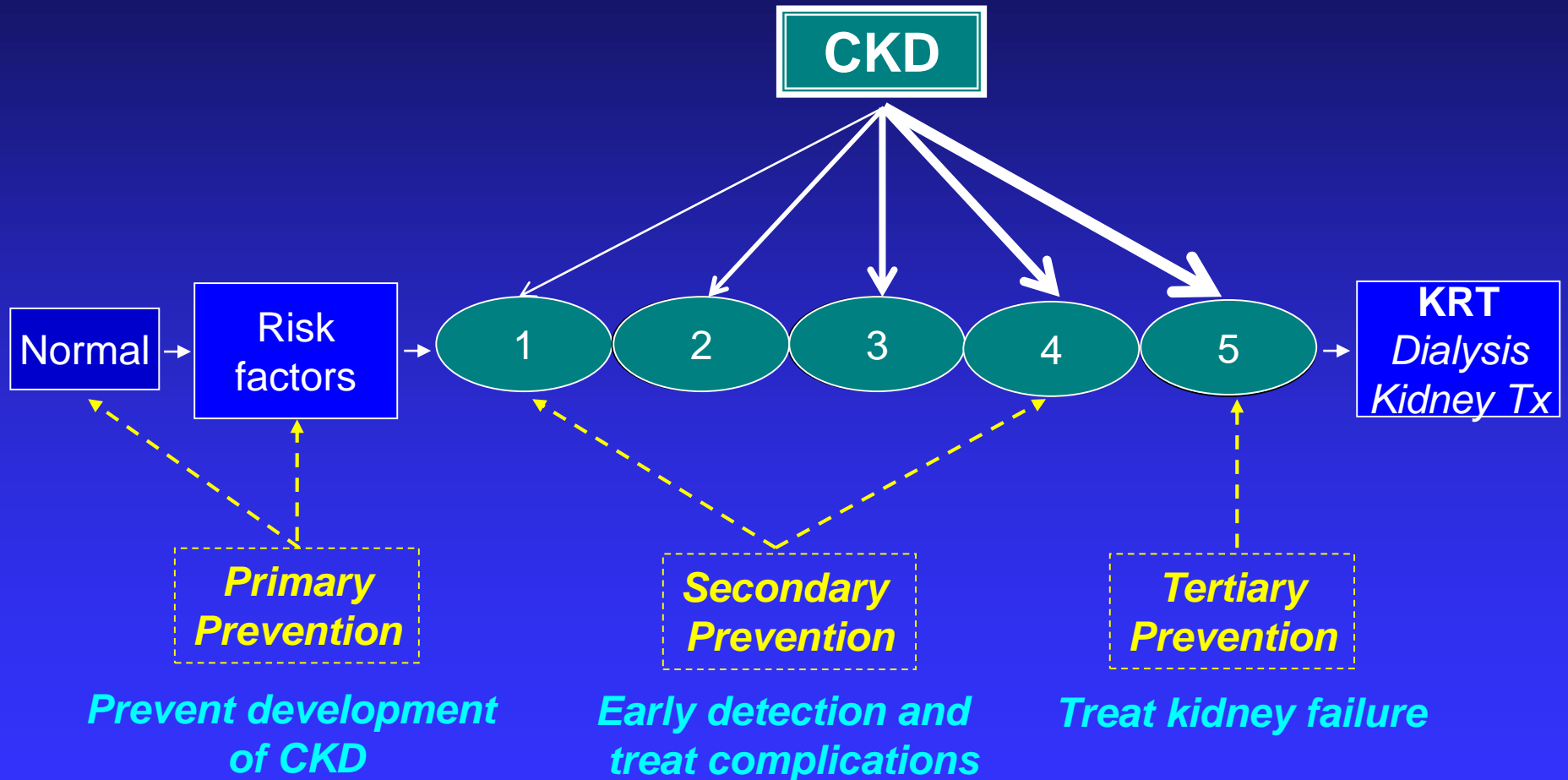
Aging of the Population

Life Expectancy Projections



Fuente: Estimaciones del CONAPO con base en la Conciliación demográfica 1990-2010 y Proyecciones de población 2010-2050.

CKD Prevention



Early Detection of CKD

- **Epidemiology of CKD in Mexico & CKD prevention**
- **Kidney Early Evaluation (KEEP) Mexico Program**
- Validation of PoCT measurement of SCr
- PoCT testing of albuminuria
- Conclusions

Justification of CKD Screening

- CKD is **frequent**
- It is associated with **high morbidity, mortality and cost**
- It can be **diagnosed** with simple and unexpensive tests
- Early detection allows for implementation of **interventions** that have been shown to slow progression to end-stage kidney disease

Kidney Early Evaluation Program

KEEP Mexico

- It is a **CKD screening and educational program** aimed at individuals at **high risk** for CKD, including those with diabetes, hypertension, and/or family history of DM/HTN/CKD
- It was developed by the US **National Kidney Foundation** in early 2000 and currently is used in **Japan and Australia**.
- In **2008** the **Mexican Kidney Foundation** adapted KEEP for use in Mexico
- A **pilot** began in Mexico City and Guadalajara, Jalisco



KEEP Mexico



Publications of KEEP Mexico

original article

<http://www.kidney-international.org>

© 2010 International Society of Nephrology

Prevalence of chronic kidney disease in the Kidney Early Evaluation Program (KEEP) México and comparison with KEEP US

Gregorio T. Obrador¹, Guillermo García-García², Antonio R. Villa¹, Ximena Rubilar¹, Nadia Olvera³, Evangelina Ferreira³, Margarita Virgen¹, José Alfonso Gutiérrez-Padilla⁴, Melissa Plascencia-Alonso⁴, Martha Mendoza-García⁴ and Salvador Plascencia-Pérez⁴

¹Universidad Panamericana School of Medicine, México City, México; ²Division of Nephrology, Hospital Civil de Guadalajara, University of Guadalajara Health Sciences Center, Guadalajara, México; ³Mexican Kidney Foundation, México City, México and ⁴Fundación Hospitales Civiles de Guadalajara, Guadalajara, México

Kidney Int 77: S2-S8, 2010



ELSEVIER

Archives of Medical Research 44 (2013) 650–654

ORIGINAL ARTICLE

Longitudinal Analysis of Participants in The KEEP Mexico's Chronic Kidney Disease Screening Program

Gregorio T. Obrador,^a Antonio R. Villa,^a Nadia Olvera,^b Verónica Gutiérrez,^b Daniela Contreras,^a and Rebeca Reyes^b

^aUniversidad Panamericana School of Medicine, Mexico City, Mexico

^bMexican Kidney Foundation, Mexico City, Mexico

Received for publication August 22, 2013; accepted October 10, 2013 (ARCMED-D-13-00465).

Archives of Medical Research 44:650-54, 2013

Archives
of Medical
Research

AJKD

Position Statement



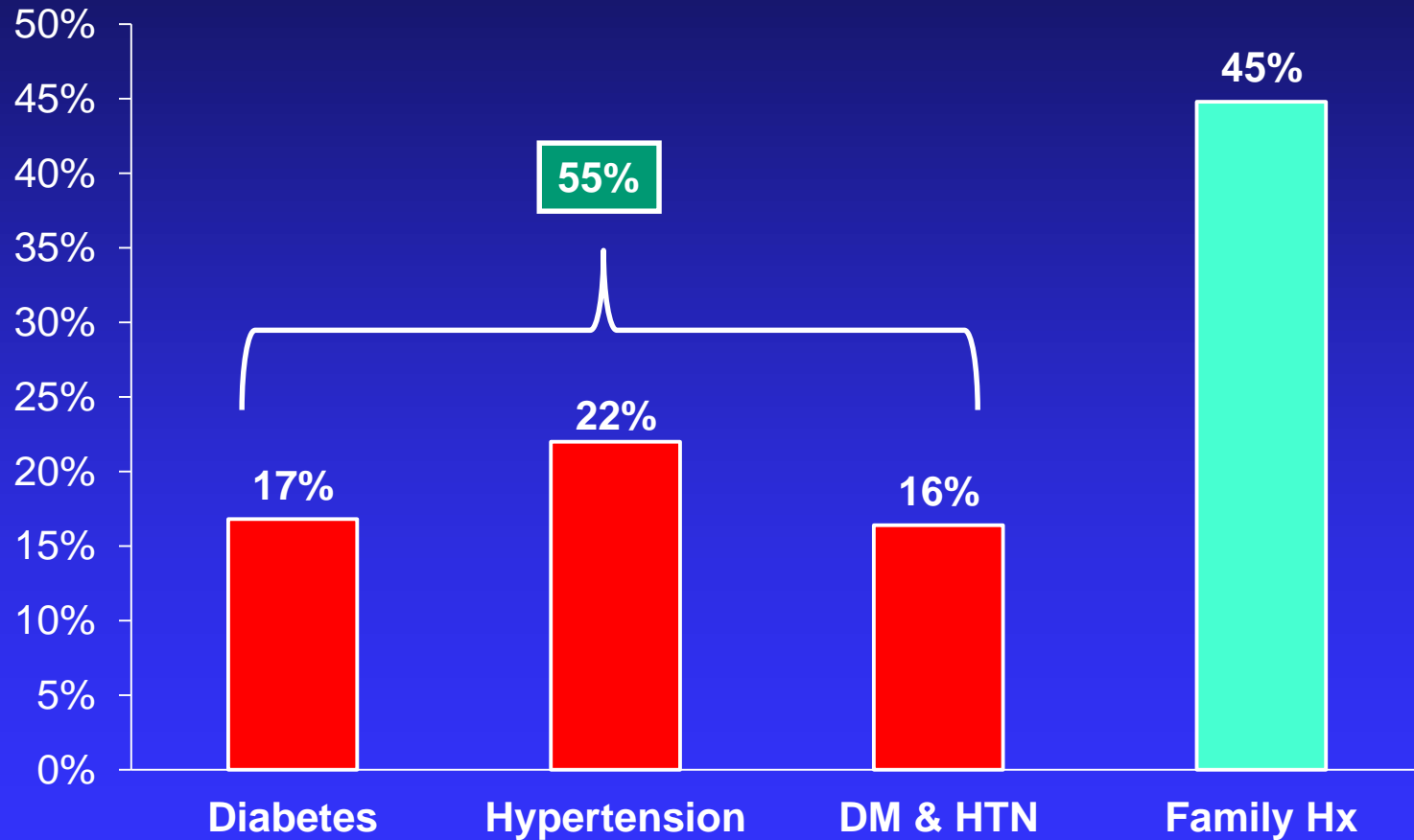
National Kidney
Foundation*

Establishing the Global Kidney Disease Prevention Network (KDPN): A Position Statement From the National Kidney Foundation

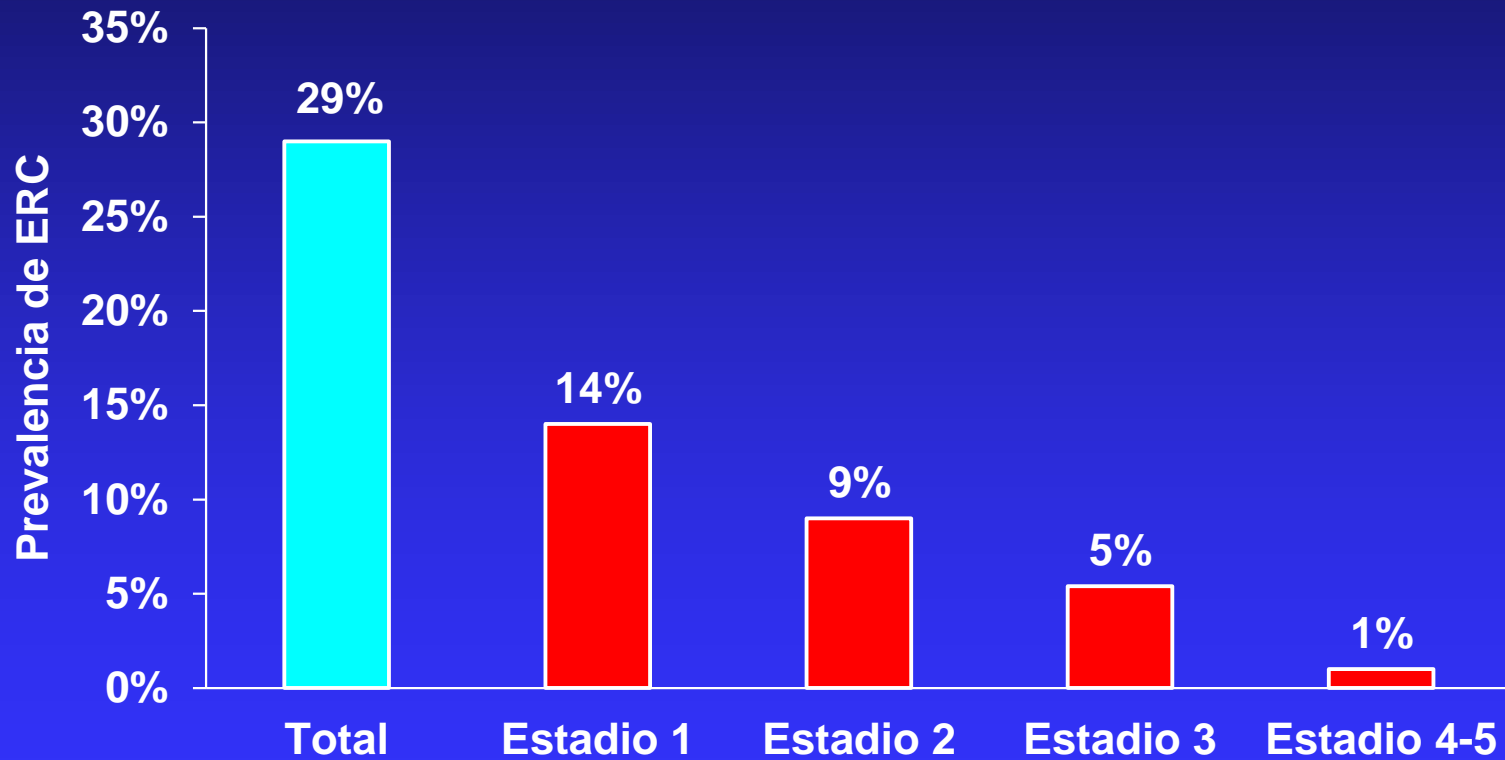
Gregorio T. Obrador, MD, MPH,¹ Mitra Mahdavi-Mazdeh, MD,² and
Allan J. Collins, MD,³ on behalf of the Global Kidney Disease Prevention Network*

Am J Kidney Dis 57(3): 361-370, 2011

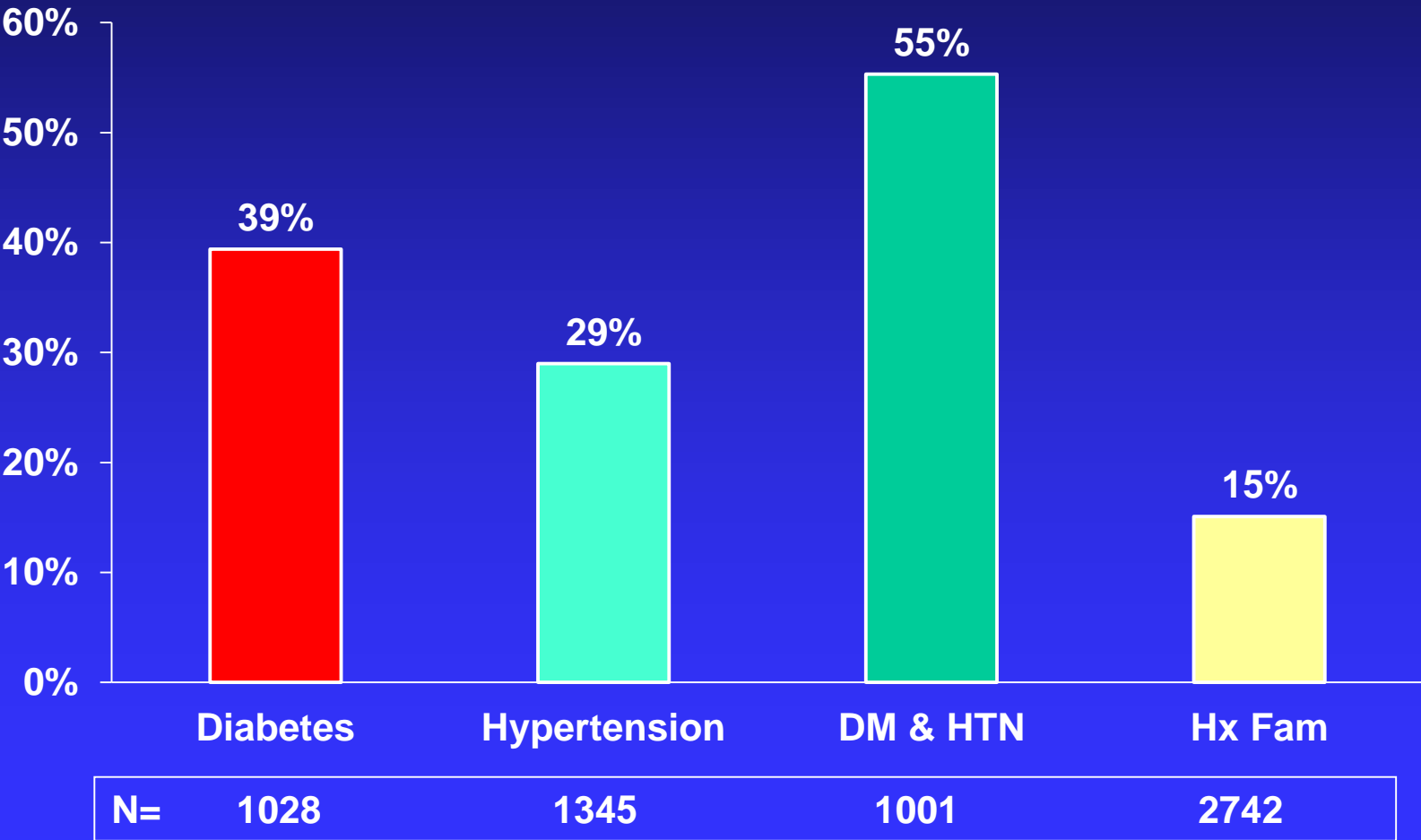
Risk Factors for CKD (N = 6116)



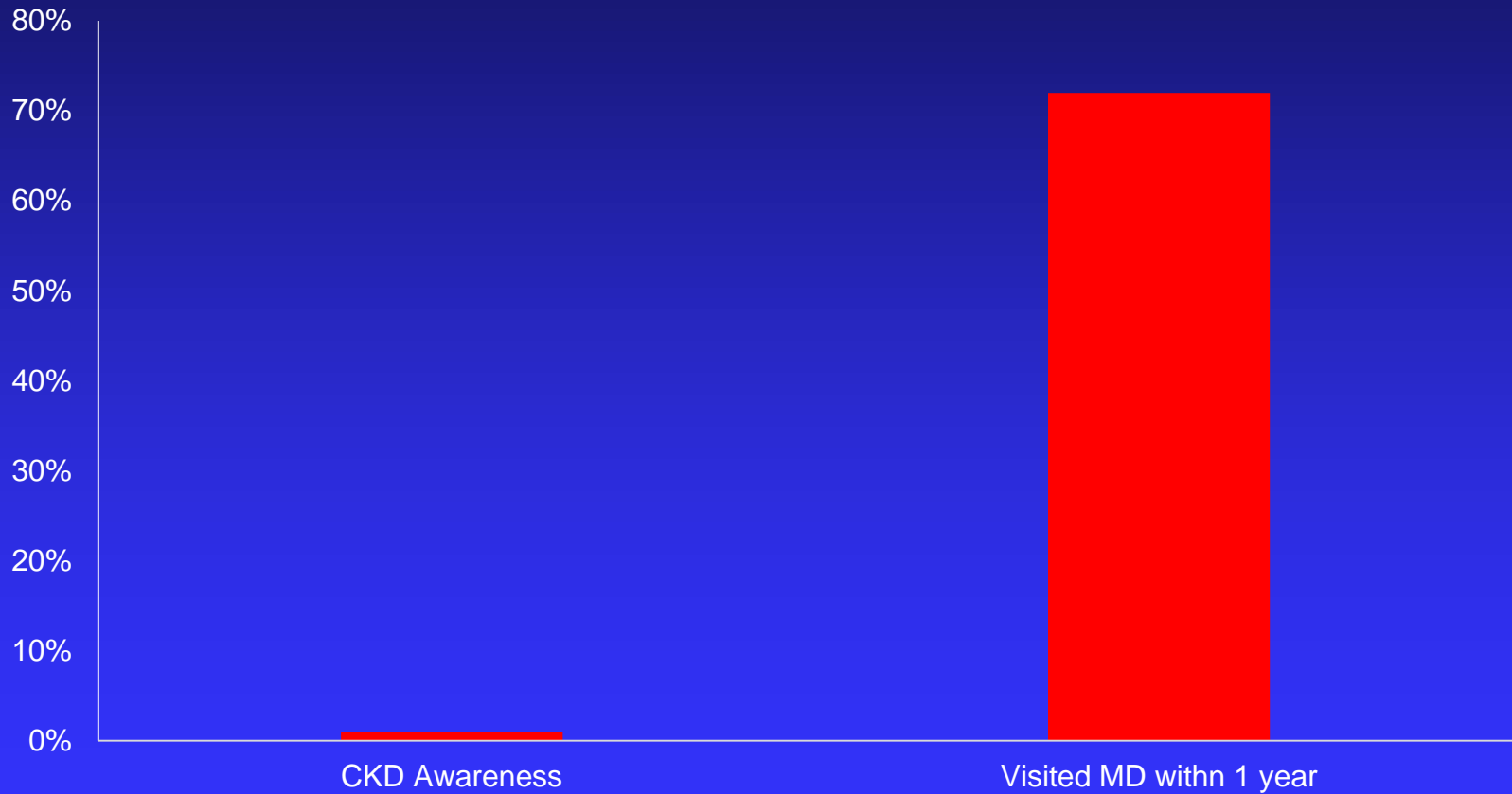
CKD Prevalence



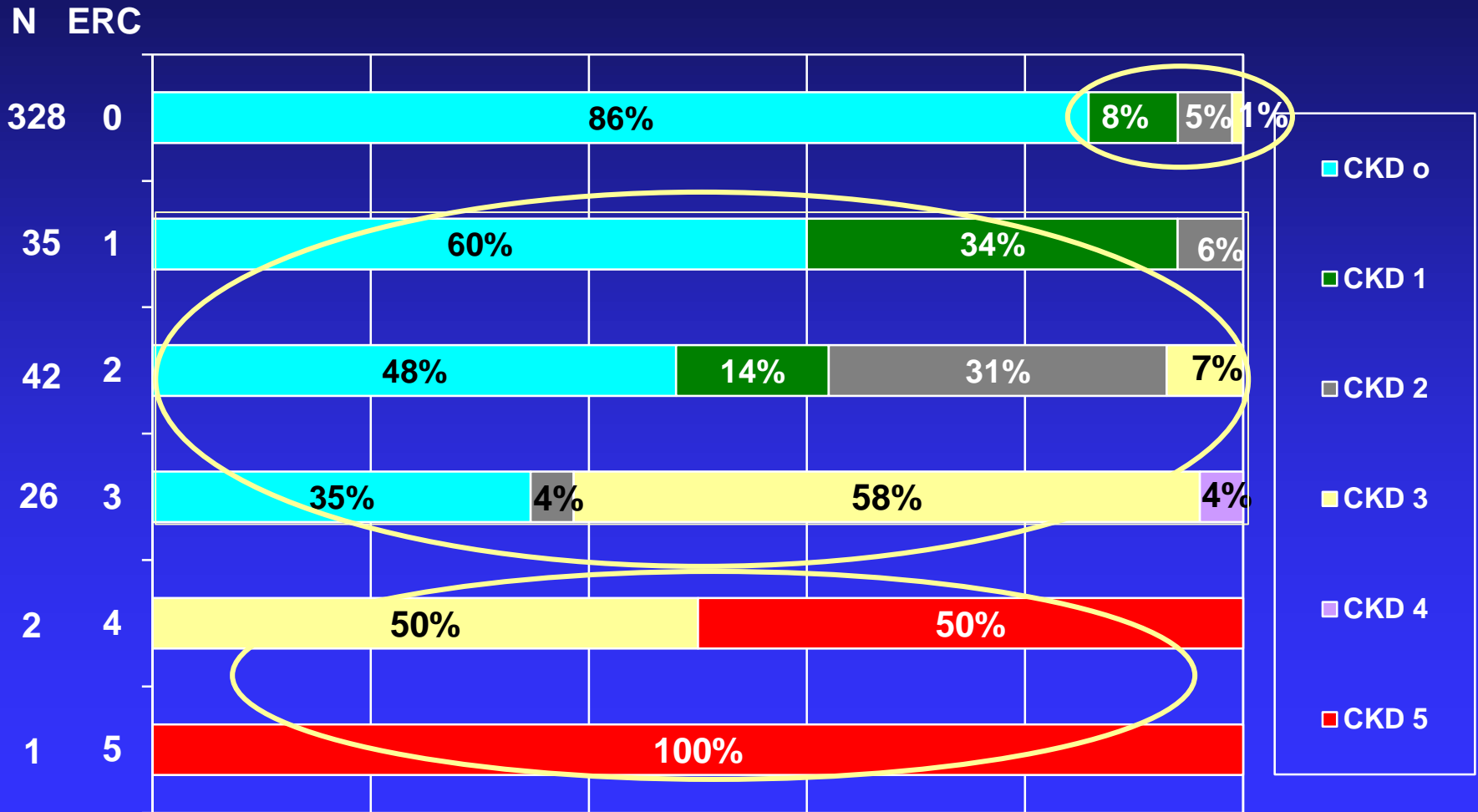
CKD Prevalence by Risk Factor



Prior Medical Care & CKD Awareness



Transitions in CKD Stage (N= 434)



Demonstration Project

Jalisco State

- The objective was to adapt the KEEP methodology to perform massive and rapid screening of approximately 10,000 subjects with diabetes
- Collaboration between the Mexican Kidney Foundation and the Federal and Jalisco State Secretariat of Health
- Financed by the Popular Insurance of the Secretariat of Health

Serum Creatinine Measurement Challenges

- Most Mexican laboratories don't measure serum creatinine by methods traceable to IDMS
- There are significant differences in quality among laboratories
- Use of a central lab would be expensive and logistically complicated

Early Detection of CKD

- **Epidemiology of CKD in Mexico & CKD prevention**
- **Kidney Early Evaluation (KEEP) Mexico Program**
- **Validation of PoCT measurement of SCr**
- PoCT testing of albuminuria
- Conclusions

ORIGINAL ARTICLE

Innovative Use of Point-of-Care Testing for Chronic Kidney Disease Screening

Anne K. Shephard, BSc (Hons), Mark D.S. Shephard, PhD,* Heather J. Halls, MSc,* Olivia Corso, BSc,†
and Timothy H. Mathew, MBBS, FRACP†*

Point of Care 2011;10:98-101.

Point of Care Testing (PoCT) of Serum Creatinine with i-STAT

ADVANTAGES

- Easy to use
 - ◆ Capillary or venous blood
 - ◆ Results in 2-4 minutes
 - ◆ 2-hour training
- Immediate on-site results facilitate clinical decision making and logistics of the program

DISADVANTAGES

- More expensive than to measure SCr in a standard lab
- Validity of SCr measurement in the Mexican population?

Comparison of SCr Measurement (and eGFR) by i-STAT and IDMS (N = 257)

	Serum Creatinine mg/dL
CrS with i-STAT	
Capillary blood	0.82 ± 0.44
Venous blood	0.88 ± 0.42
CrS with IDMS	0.79 ± 0.39

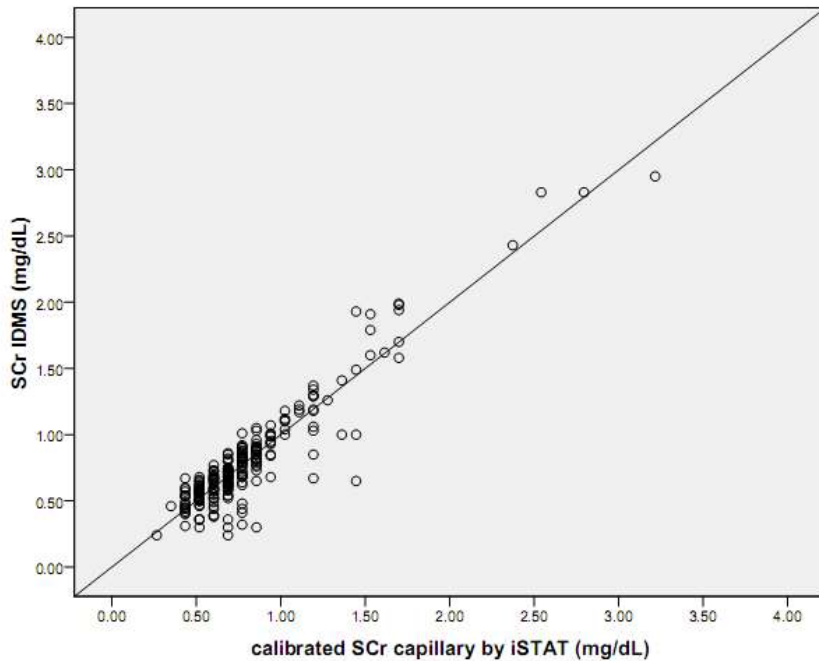
	Serum Creatinine mg/dL	eGFR (mL/min/1.73 m ²)
CrS with i-STAT		
Calibrated capillary	0.79 ± 0.37	94.00 ± 24.62
Calibrated venous	0.79 ± 0.36	93.90 ± 24.41
CrS with IDMS	0.79 ± 0.39	94.70 ± 25.54

Pearson Correlation

Calibrated i-STAT SCr and IDMS SCr

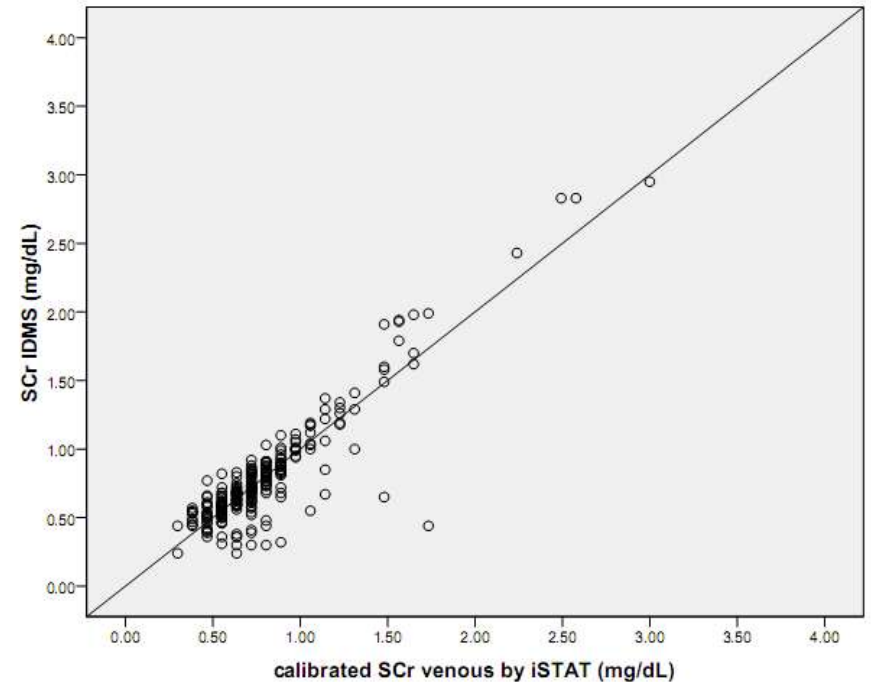
Capillary blood

Correlation	P
0.93	<0.0001



Venous blood

Correlation	P
0.90	<0.0001



Comparison of CKD Stages

i-STAT SCr (Capillary) versus IDMS SCr

		SCr-IDMS					Total
		0	1	2	3	4	
SCr i-STAT	0	154	0	0	0	0	154
	1	0	53	5	0	0	58
	2	0	4	13	3	0	20
	3	1	0	3	15	2	21
	4	0	0	0	0	4	4
Total		155	57	21	18	6	257

Gamma Coefficient = 0.99, $p < 0.0001$

Kappa = 0.88, $p < 0.0001$

Sensitivity, Specificity, PPV, NPV for SCr-iSTAT (Capillary Blood)

	Cases (CKD1-5)	No cases	Total
Positive	102	1	103
Negative	0	154	154
Total	102	155	257

	Valor
Sensitivity	100%
Specificity	99%
PPV	99%
NPV	100%

Demonstration Project

Jalisco State



Inauguration

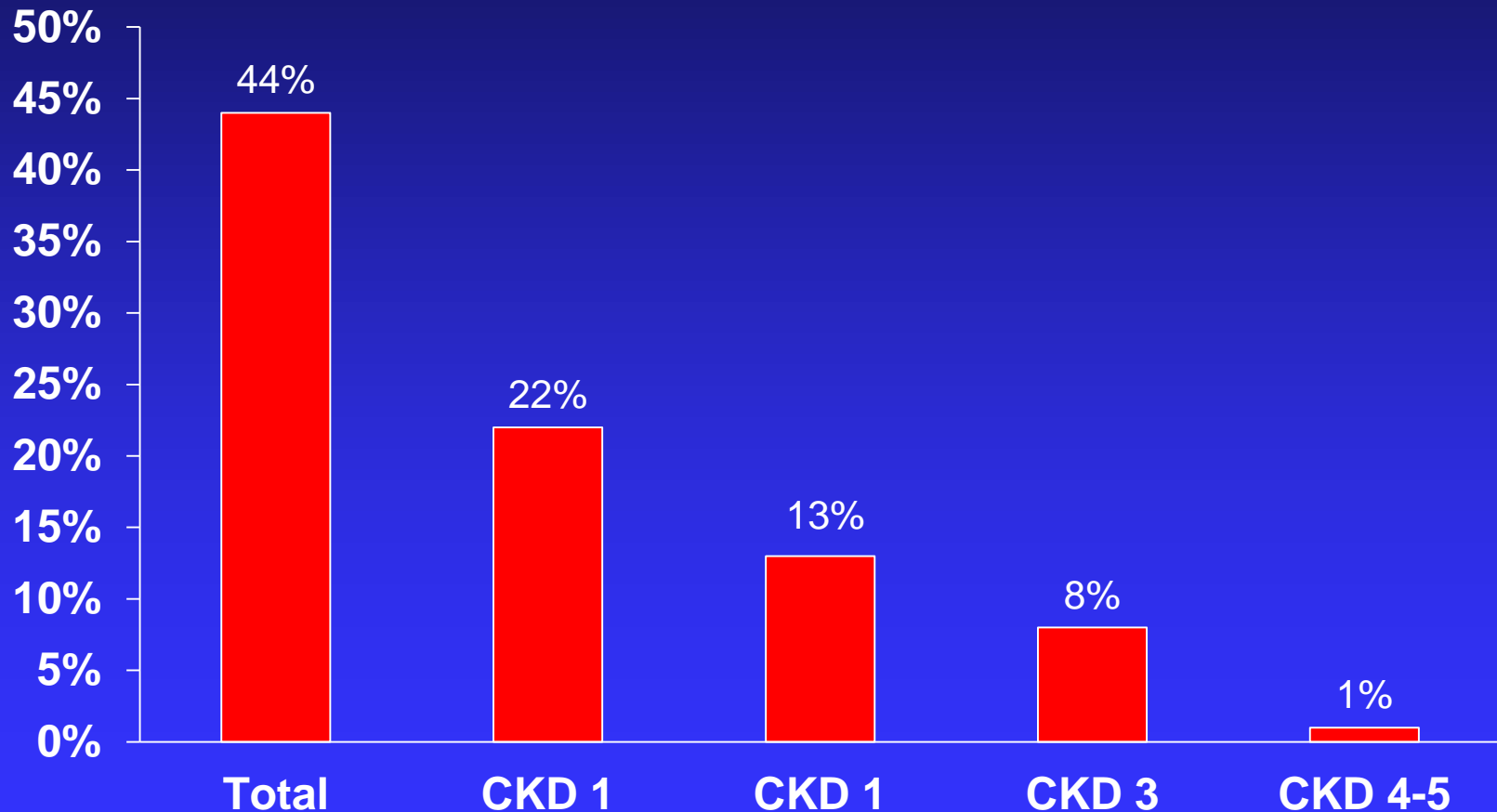


Education

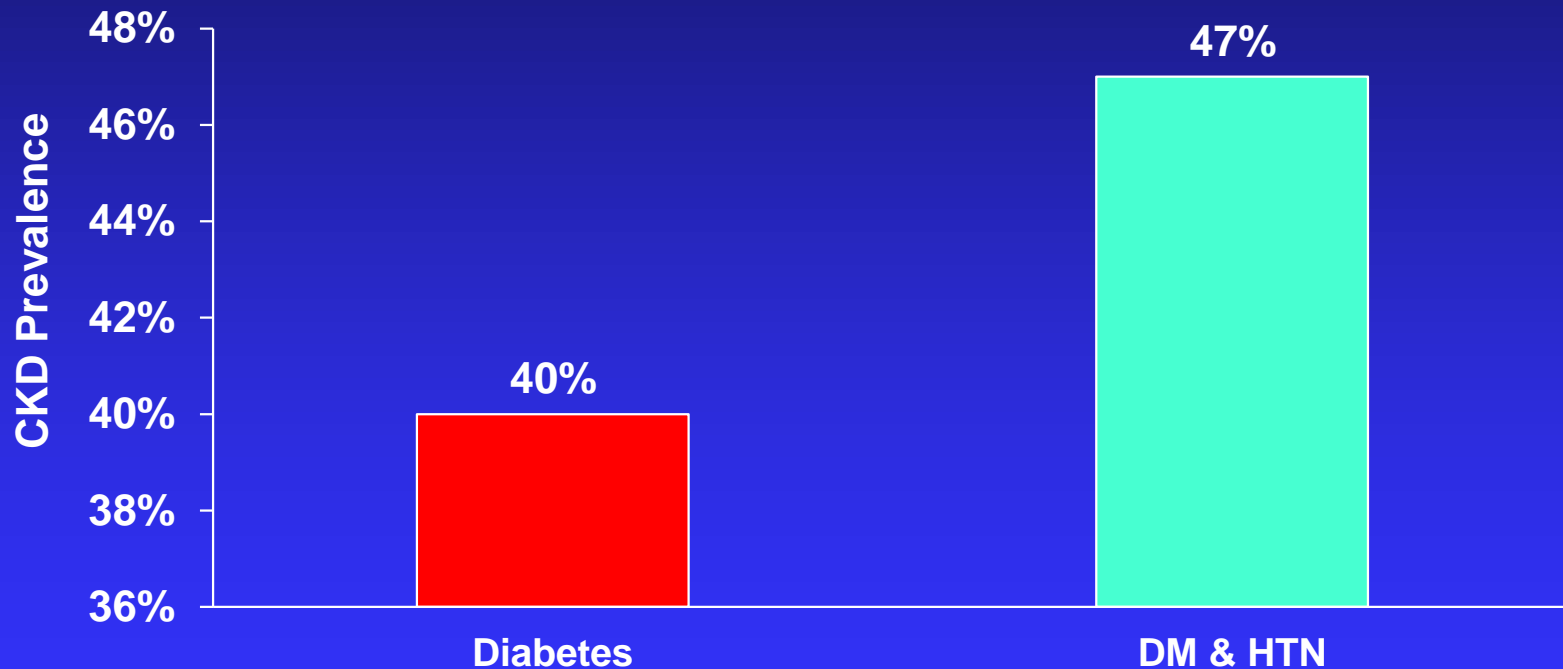


Training

Probable CKD Prevalence



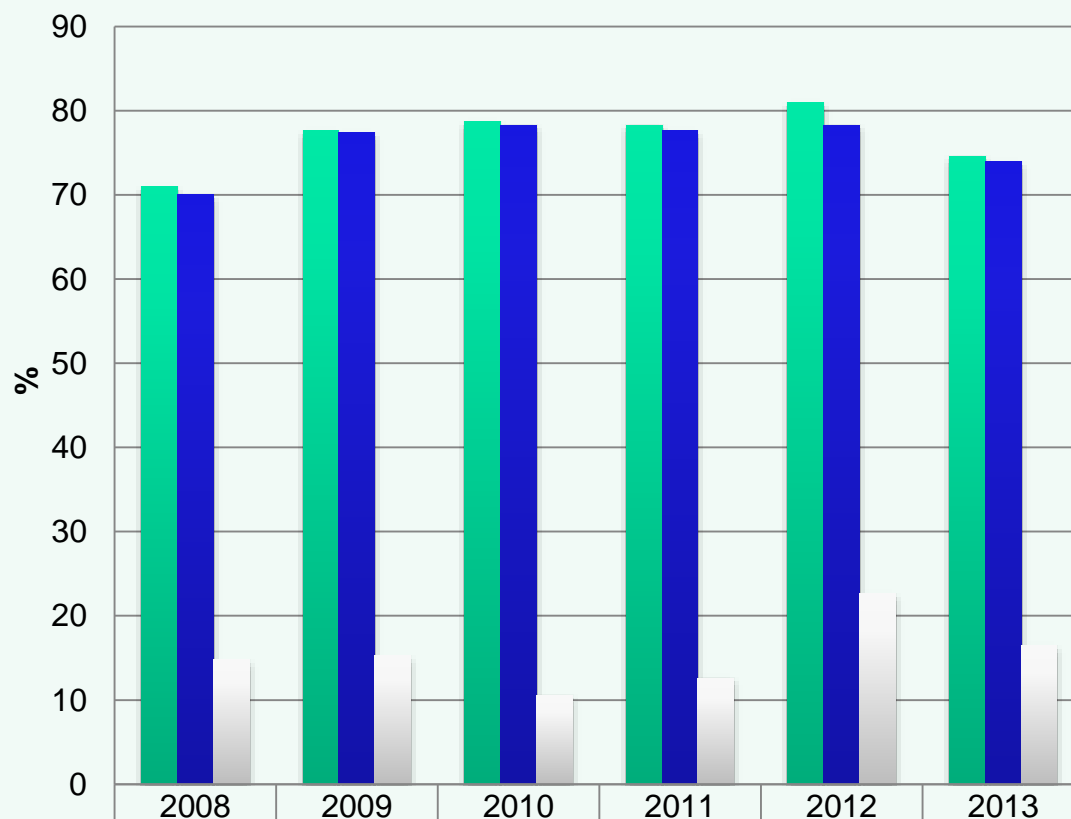
Probable CKD Prevalence by Risk Factor



Early Detection of CKD

- **Epidemiology of CKD in Mexico & CKD prevention**
- **Kidney Early Evaluation (KEEP) Mexico Program**
- **Validation of PoCT measurement of SCr**
- **PoCT testing of albuminuria**
- **Conclusions**

Pacientes con datos para obtener tamizaje de ERC



	2008	2009	2010	2011	2012	2013
■ Ambas mediciones (proteinuria/TFG)	71	77,7	78,7	78,3	81	74,6
■ EGO + TFG	70	77,4	78,3	77,7	78,3	74
■ Microalbuminuria + TFG	14,8	15,3	10,6	12,6	22,6	16,5

Meta-analysis of PoC Tests to Detect Albuminuria

Parameter	Meta-analysis			
	Clnitek‡			DCA‡ (All Operators)
	All Operators	Laboratory Operator	Clinical Operator	
Sensitivity, %	76 (63–86)	83 (70–91)	67 (45–83)	96 (78–99)
Specificity, %	93 (84–97)	91 (80–96)	96 (78–99)	98 (93–99)
LR+	11.0 (4.9–24.4)	9.1 (4.2–19.6)	15.1 (2.8–82.0)	44.7 (13.6–147.4)
LR–	0.26 (0.16–0.40)	0.19 (0.11–0.32)	0.34 (0.19–0.62)	0.04 (0.01–0.25)

McTaggart *et al.* Diagnostic accuracy of point-of-care tests for detecting albuminuria. A systematic review and meta-analysis. *Ann Intern Med* 160:550-57, 2014.

Comparison of PoC Tests for Detecting Albuminuria

- Adult pts with DM
- HCSAE PEMEX
- Exclusion of possible false +
- Sample size ~ 150

24-hour urine albumin

Clinitek Status

1st morning urine sample

Random urine sample

DCA

1st morning urine sample

**Urinalysis
Micraltest**

Results

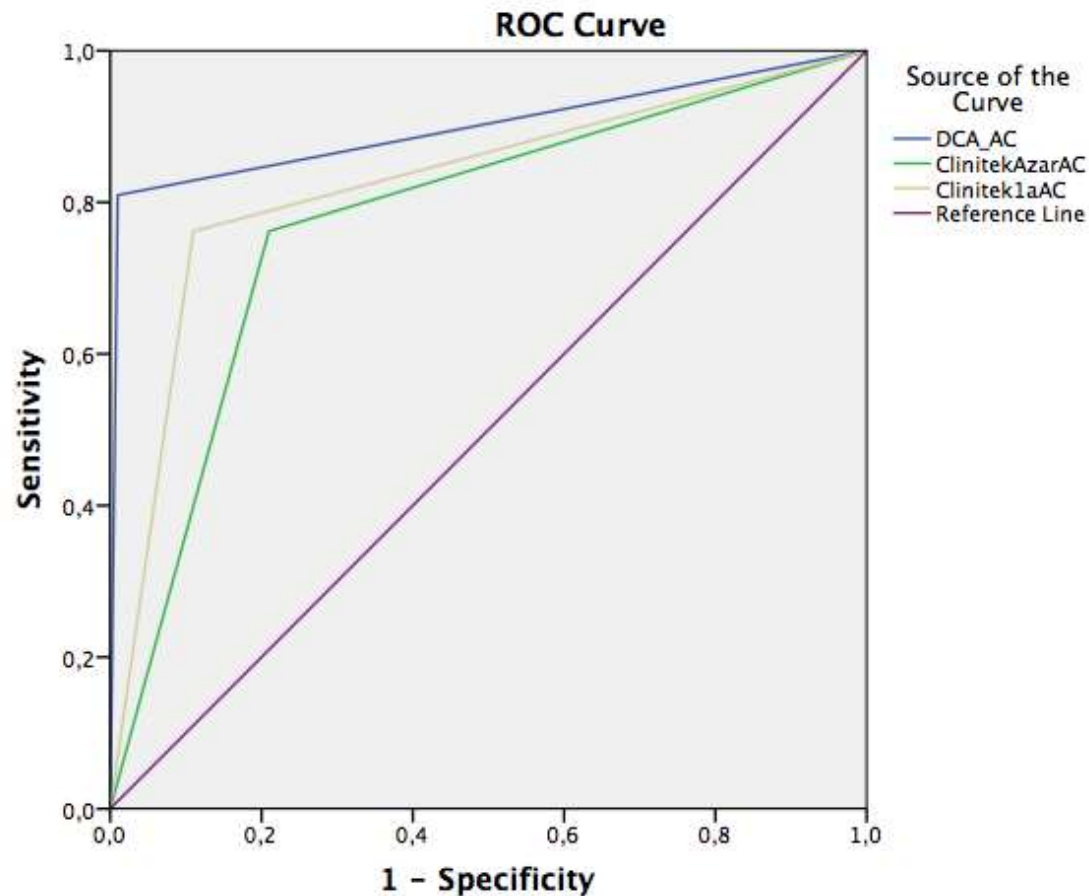
Patient Characteristics (N = 121)

Mean age (years)	65 (34-88)
Female (%)	68%
Mean duration of diabetes (years)	10.2
Hypertension (%)	58%
Mean duration of hypertension (years)	14
Overweight & obesity (%)	44% / 39%
Hypercholesterolemia (%)	56%
Mean duration of hyperlipidemia (years)	6.3
Previous CKD diagnosis	3%

Results

	Clinitek Status		DCA
	Random urine	1 st morning urine	1 st morning urine
Sensitivity	76%	76%	81%
Specificity	79%	89% *	99%
PPV	43%	59%	94%
NPV	94%	94%	96%
RV+	2.3	6.9	81
RV-	0.14	0.27	0.19
Accuracy	79%	87%	96%

ROC & Area Under the Curve

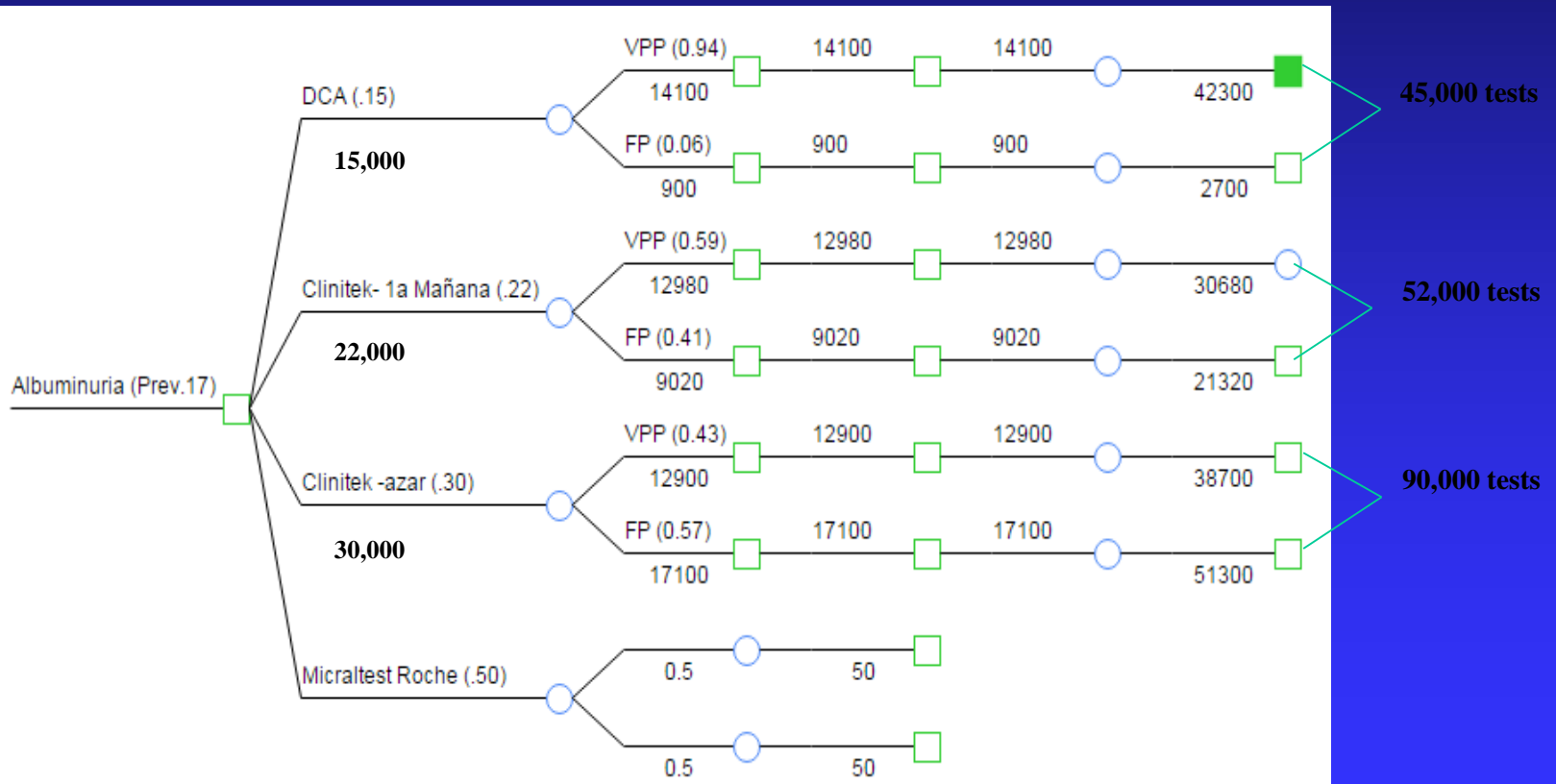


Test	Area under the curve
DCA	0.90
Clinitek 1 st morning urine	0.82
Clinitek Random urine	0.77

Results

	Clinitek Status		DCA	Micral Test (cutoff<20)	Micral Test (cutoff \geq 20)
	Orina al azar	1 ^a de la mañana	1 ^a de la mañana	1 st morning urine	1 st morning urine
Sensitivity	78%	78%	78%	61%	91%
Specificity	80%	89%	100%	97%	65%
False +	20%	11%	0%	3%	35%
False -	22%	22%	22%	39%	9%
PPV	47%	62%	100%	82%	38%
VPN	94%	95%	95%	79%	97%
LR +	3.9	7.1	∞	20.3	2.6
LR -	0.27	0.25	0.22	0.40	0.40
Accuracy	80%	87%	96%	90%	70%

Decision Tree



Early Detection of CKD

- **Epidemiology of CKD in Mexico & CKD prevention**
- **Kidney Early Evaluation (KEEP) Mexico Program**
- **Validation of PoCT measurement of SCr**
- **PoCT testing of albuminuria**
- **Conclusions**

Conclusiones

- CKD is frequent and is associated with high morbidity, mortality and cost
- High prevalence of risk factors for CKD in Mexico
- KEEP Mexico is an effective CKD screening program
- PoC tests for measuring SCr and for detecting albuminuria are useful in CKD screening programs
- Further studies are needed to determine the best CKD screening strategies