

Epidemiology of Diabetes Mellitus in Asia

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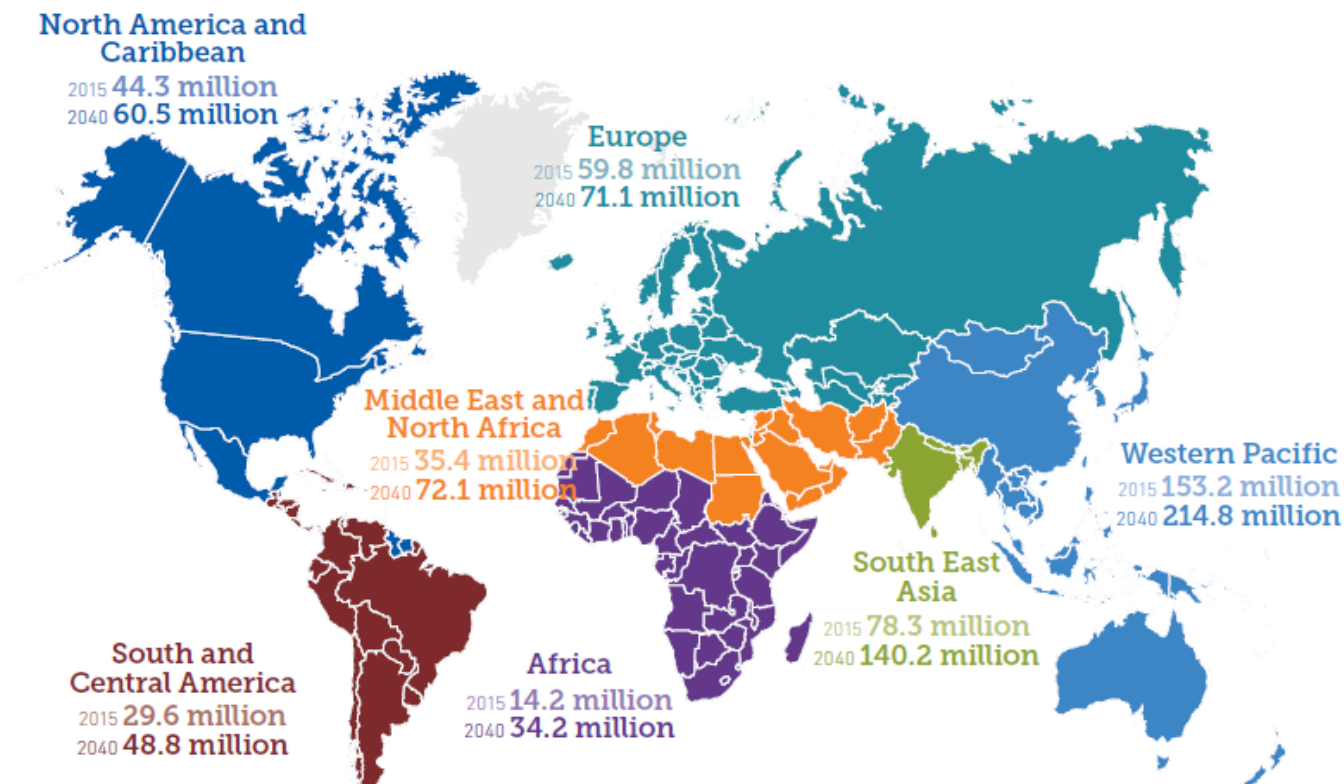
DIABETES

A GLOBAL epidemic out of control

Diabetes is a culture-social structural disease

IDF Diabetes Atlas, 7th edition

Estimated number of people with diabetes worldwide and per region in 2015 and 2040
(20-79 years)



World

2015 – 415 Million

266.0 M (64.3%)

Top 10 countries

Top ten countries/territories for number of people with diabetes (20-79 years), 2015 and 2040

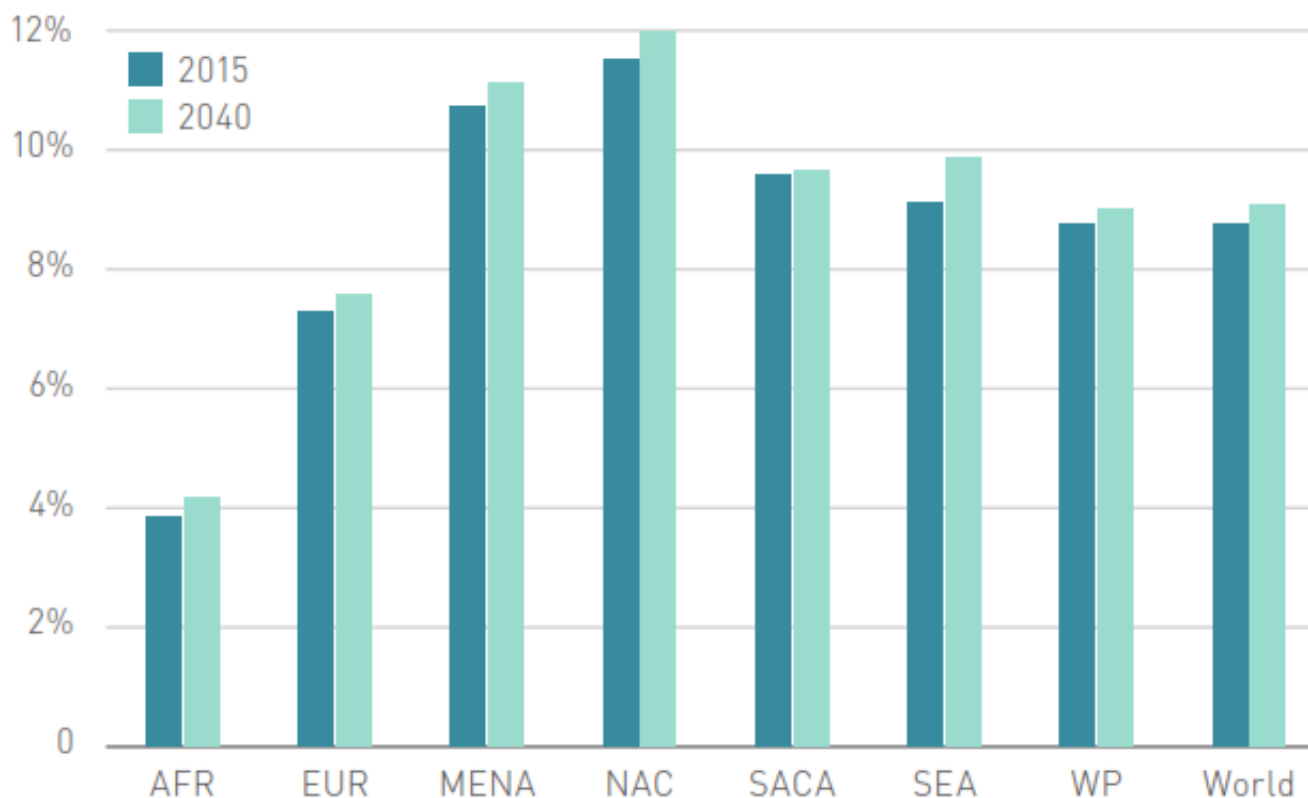
Rank	Country/territory	2015 Number of people with diabetes
1	China	109.6 million (99.6-133.4)
2	India	69.2 million (56.2-84.8)
3	United States of America	29.3 million (27.6-30.9)
4	Brazil	14.3 million (12.9-15.8)
5	Russian Federation	12.1 million (6.2-17.0)
6	Mexico	11.5 million (6.2-13.7)
7	Indonesia	10.0 million (8.7-10.9)
8	Egypt	7.8 million (3.8-9.0)
9	Japan	7.2 million (6.1-9.6)
10	Bangladesh	7.1 million (5.3-12.0)

178.8M=43%

Rank	Country/territory	2040 Number of people with diabetes
1	China	↑37.5% 150.7 million (138.0-179.4)
2	India	↑78.5% 123.5 million (99.1-150.3)
3	United States of America	35.1 million (33.0-37.2)
4	Brazil	23.3 million (21.0-25.9)
5	Mexico	20.6 million (11.4-24.7)
6	Indonesia	16.2 million (14.3-17.7)
7	Egypt	15.1 million (7.3-17.3)
8	Pakistan	14.4 million (10.6-20.4)
9	Bangladesh	13.6 million (10.7-24.6)
10	Russian Federation	12.4 million (6.4-17.1)

Diabetes prevalence by IDF region

IDF regions by age-adjusted comparative prevalence (%) of diabetes (20-79 years), 2015 and 2040

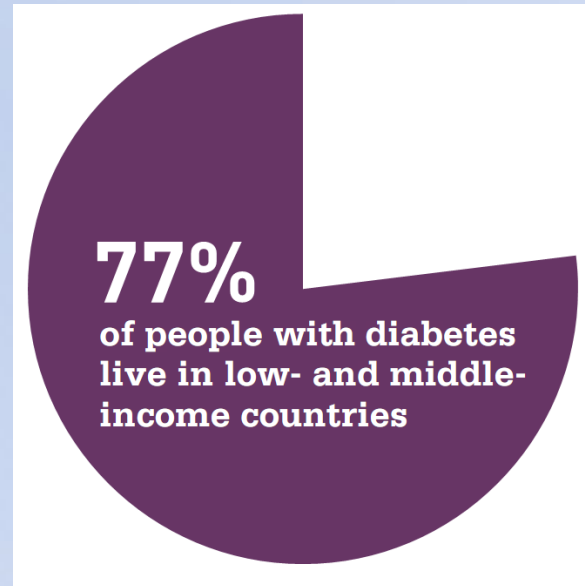


AFR – Africa region
EUR – European region
MENA – Middle East and North African region
WP – West Pacific region

NAC – North American and Caribbean region
SACA – South and Central American region
SEA – South East Asia region

... and the costs to society are high and escalating

Diabetes is a human and economic burden



4.9 million **deaths**

Intersects with all
dimensions of
development

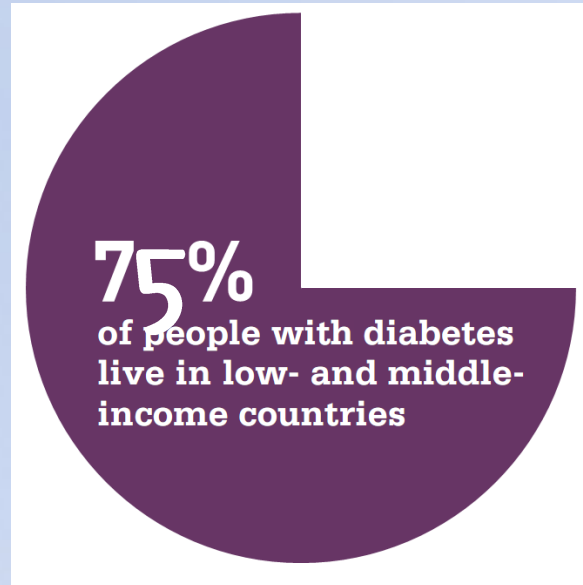
11% worldwide
expenditure

... and the costs to society are high and escalating

Diabetes is a human and economic burden



5 million deaths

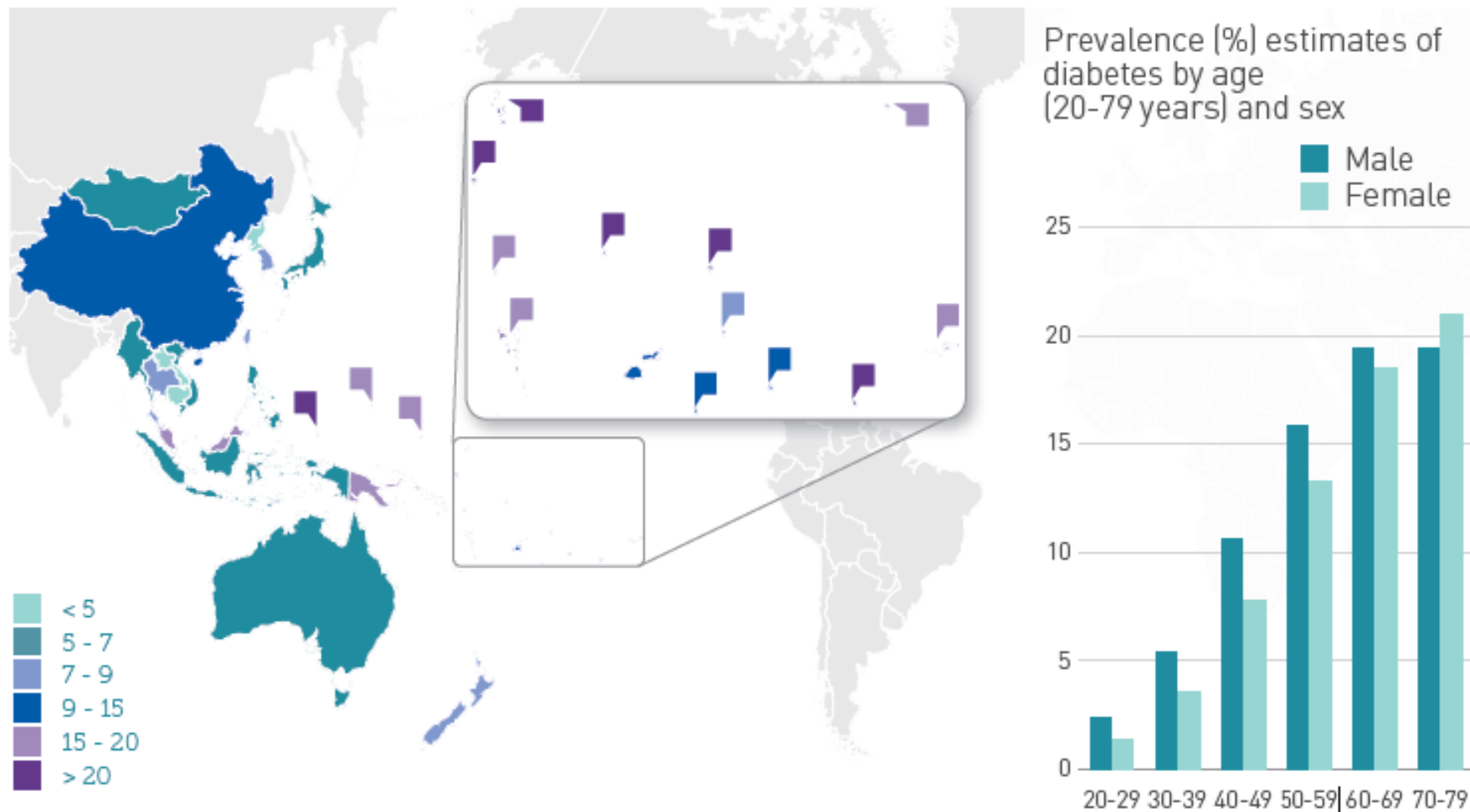


Intersects with all
dimensions of
development



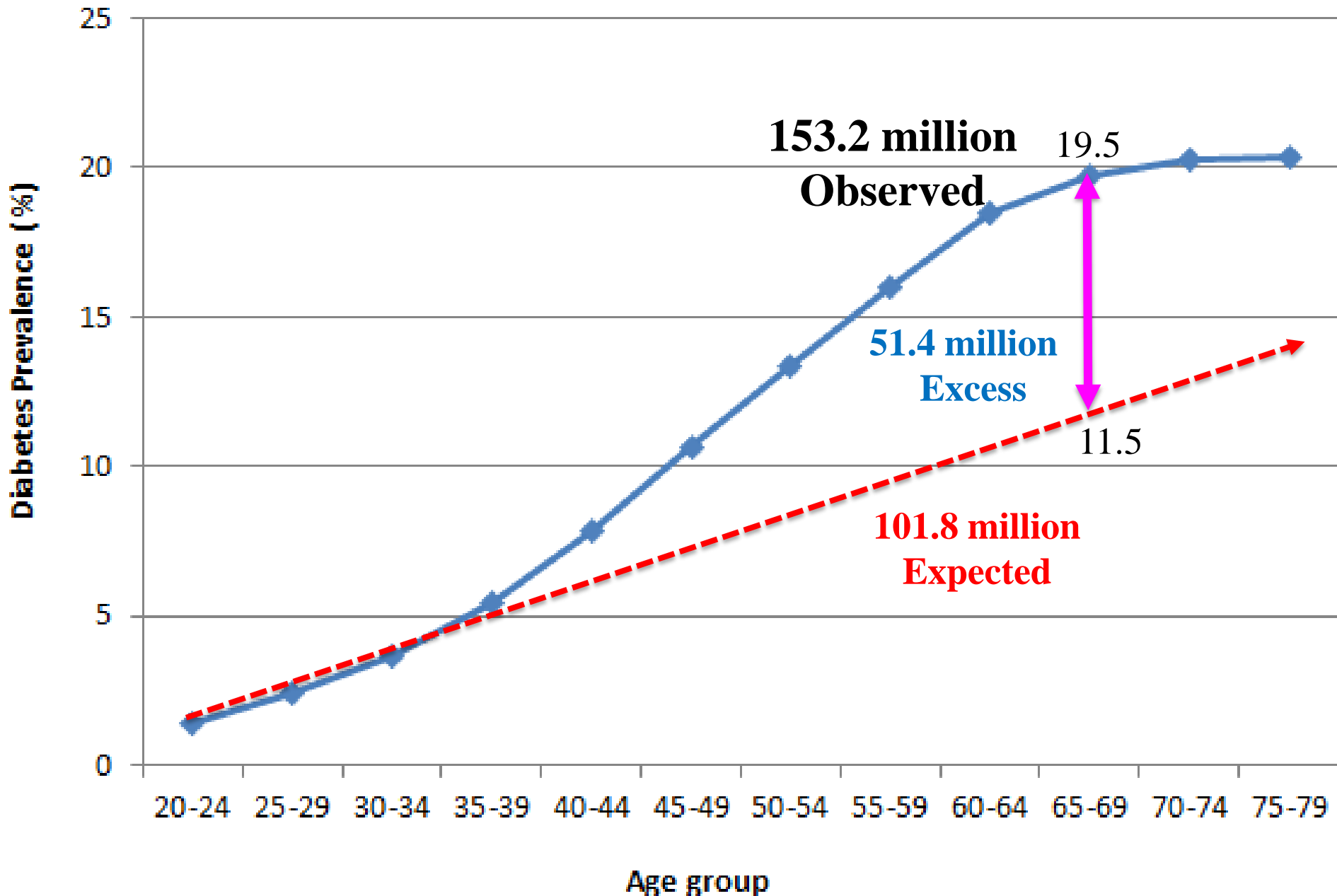
12% worldwide
expenditure

Map 4.7 Prevalence* (%) estimates of diabetes (20-79 years), 2015

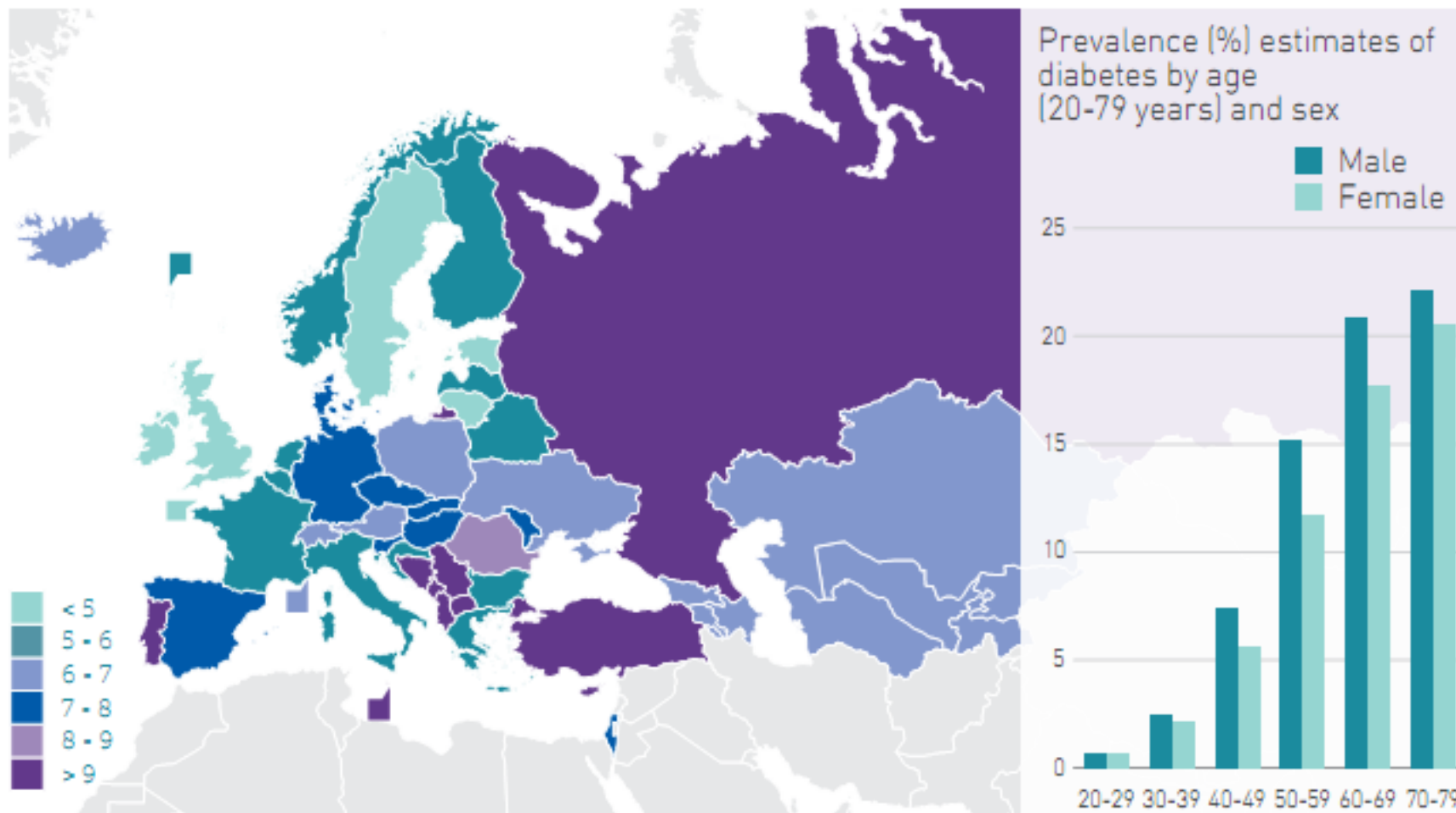


* comparative prevalence

The prevalence of diabetes by age in the International Diabetes Federation Western Pacific Region

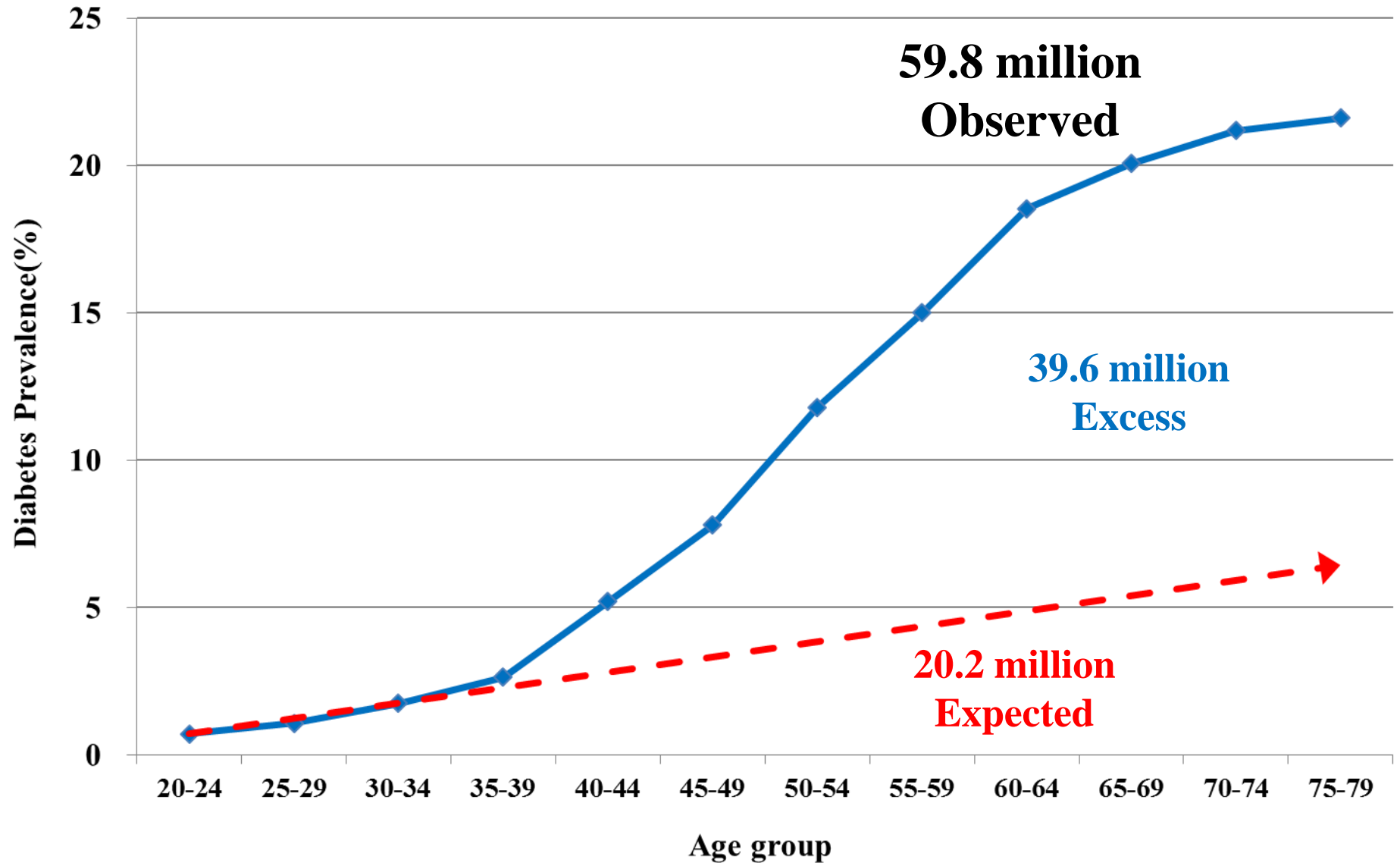


Map 4.2 Prevalence* (%) estimates of diabetes (20-79 years), 2015



* comparative prevalence

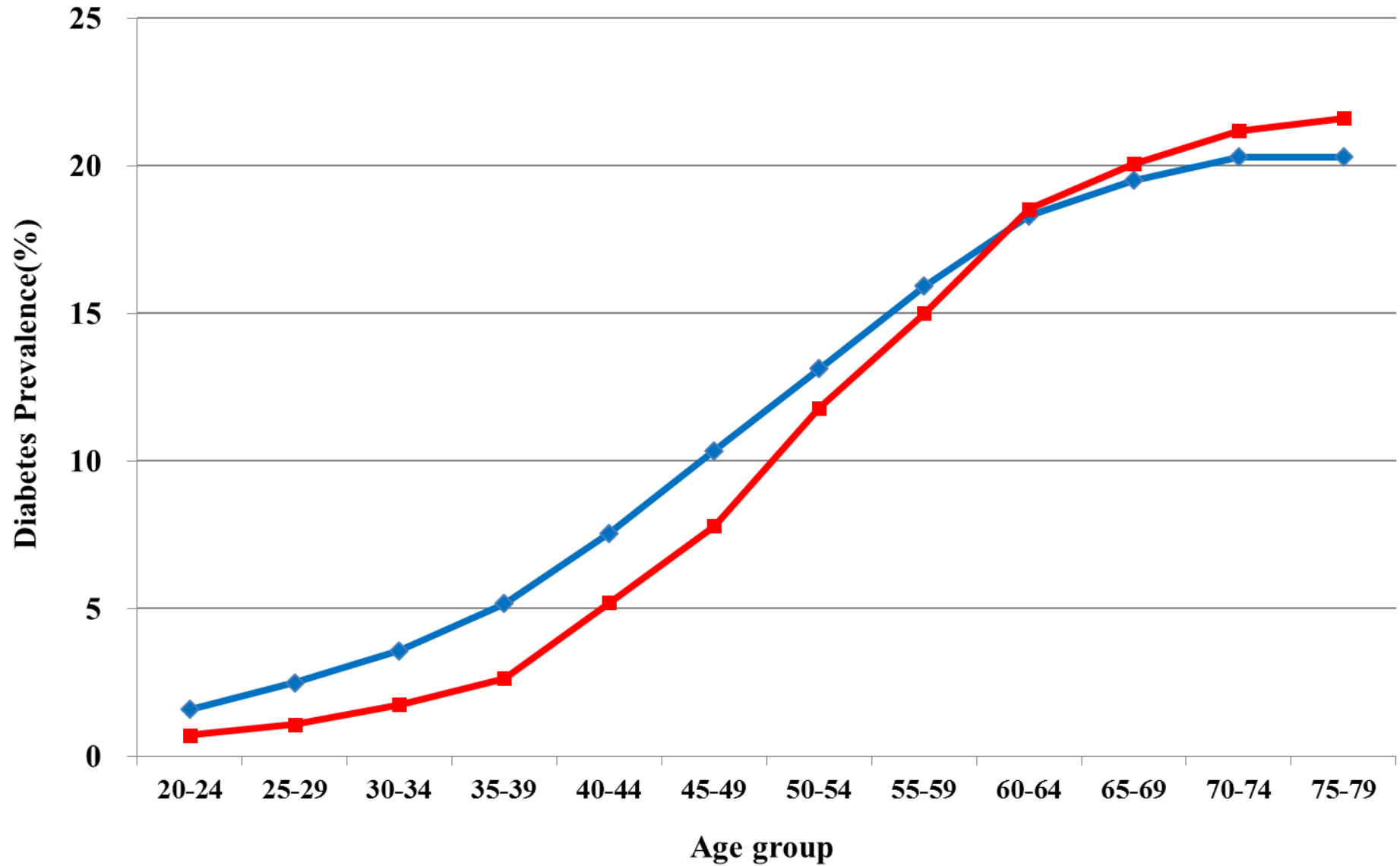
The prevalence of diabetes by age in the International Diabetes Federation Europe



The prevalence of diabetes by age in the International Diabetes Federation



WPR VS EUR





One in **two** adults with
diabetes is **undiagnosed**

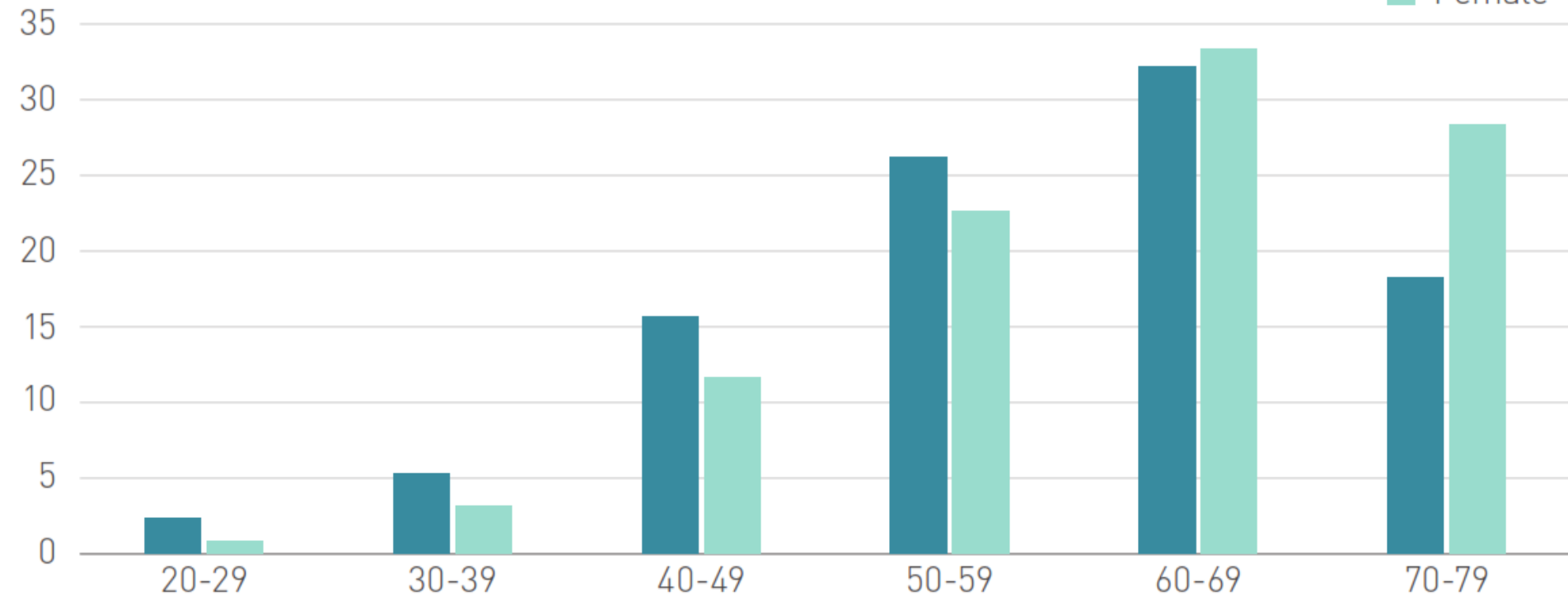
Proportion and number of people (20-79 years) living with diabetes who are undiagnosed, 2015

IDF region	Proportion undiagnosed	Number of undiagnosed people with diabetes
Africa	66.7%	9.5 million
Europe	39.3%	23.5 million
Middle East and North Africa	40.6%	14.4 million
North America and Caribbean	29.9%	13.3 million
South and Central America	39.0%	11.5 million
South-East Asia	52.1%	40.8 million
Western Pacific	52.1%	79.8 million
World	46.5%	192.8 million

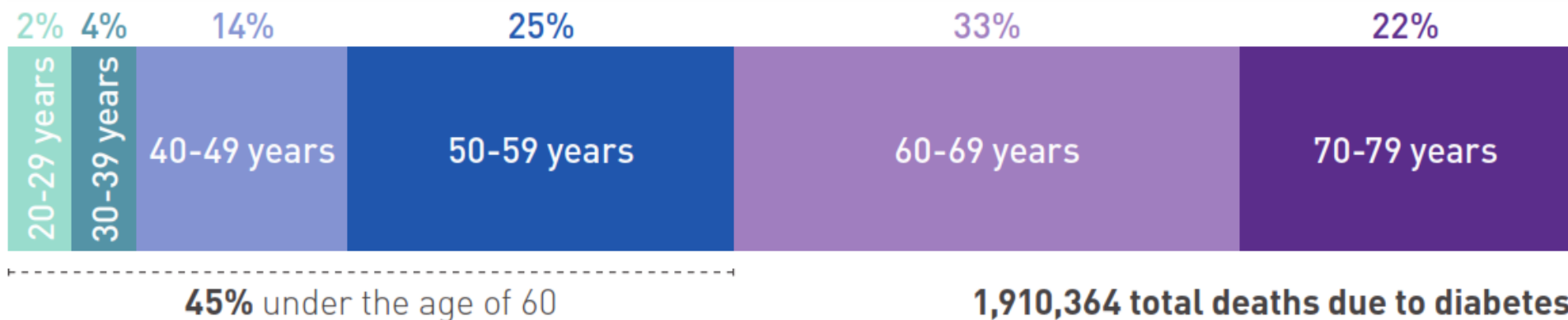
Western Pacific

Percentage of all-cause mortality due to diabetes by age (20-79 years) and sex

Male
Female



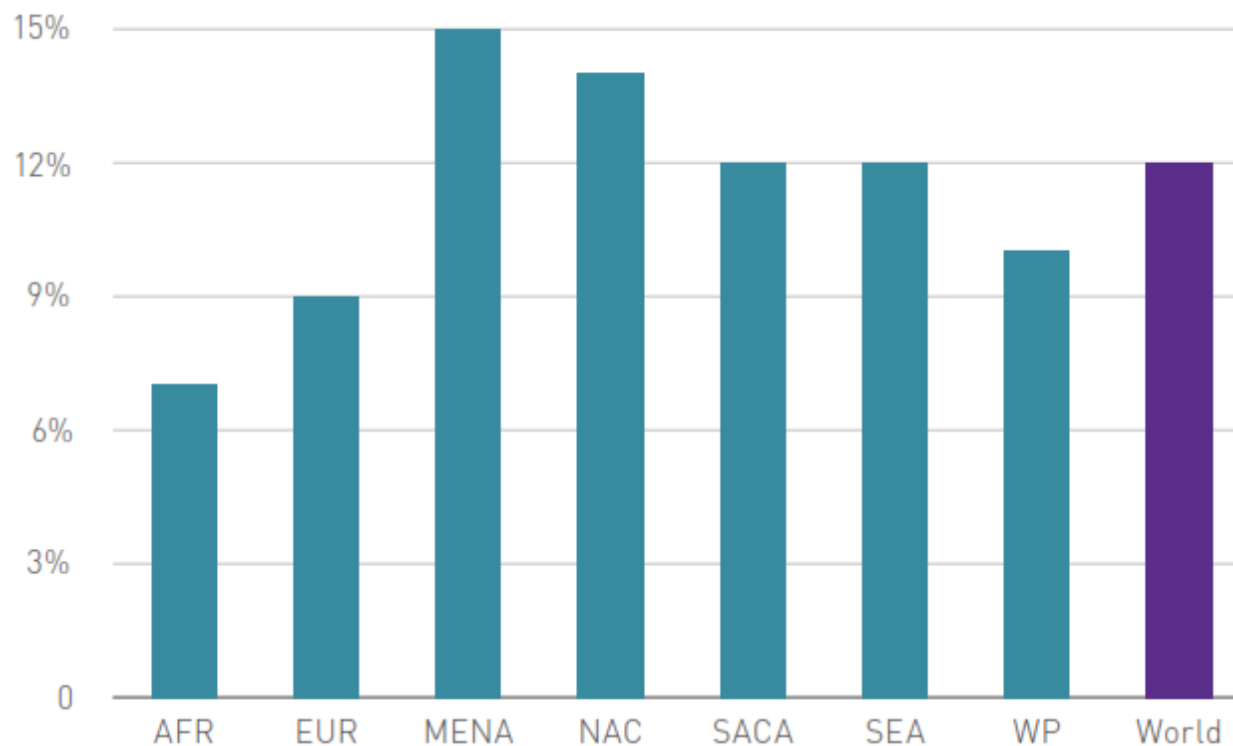
Death due to diabetes by age





**12% of global
health
expenditure is
spent on
diabetes**

Proportion of total health expenditure estimated to be spent on diabetes (20-79 years), R=2*, 2015



*The R=2 estimates assume that healthcare expenditures for people with diabetes are on average two-fold higher than people without diabetes

AFR – Africa region

EUR – European region

MENA – Middle East and North African region

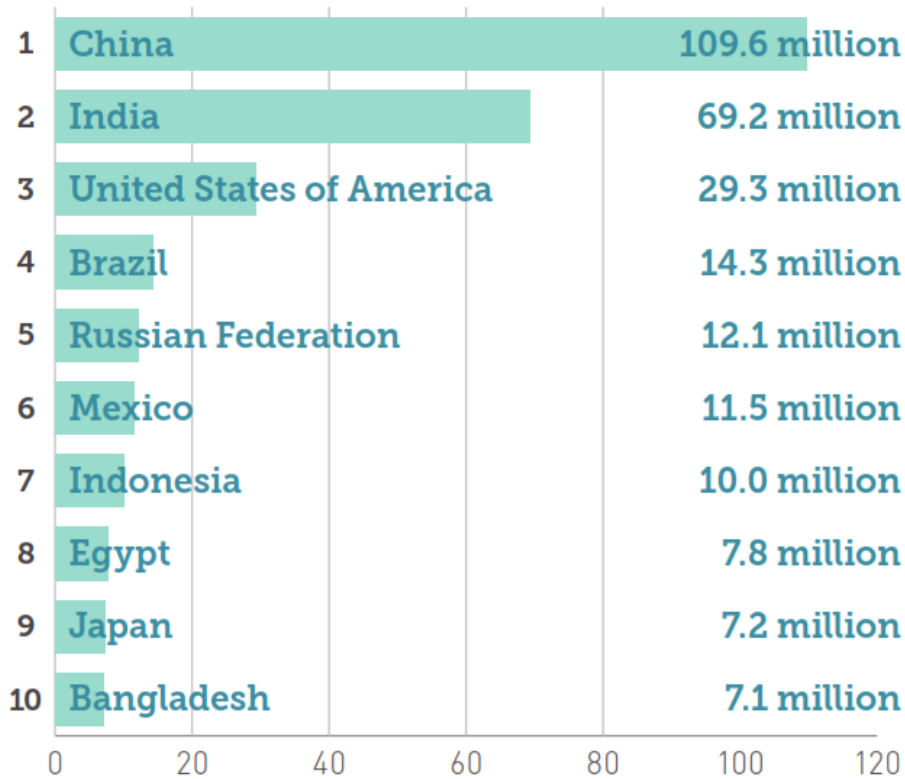
WP – West Pacific region

NAC – North American and Caribbean region

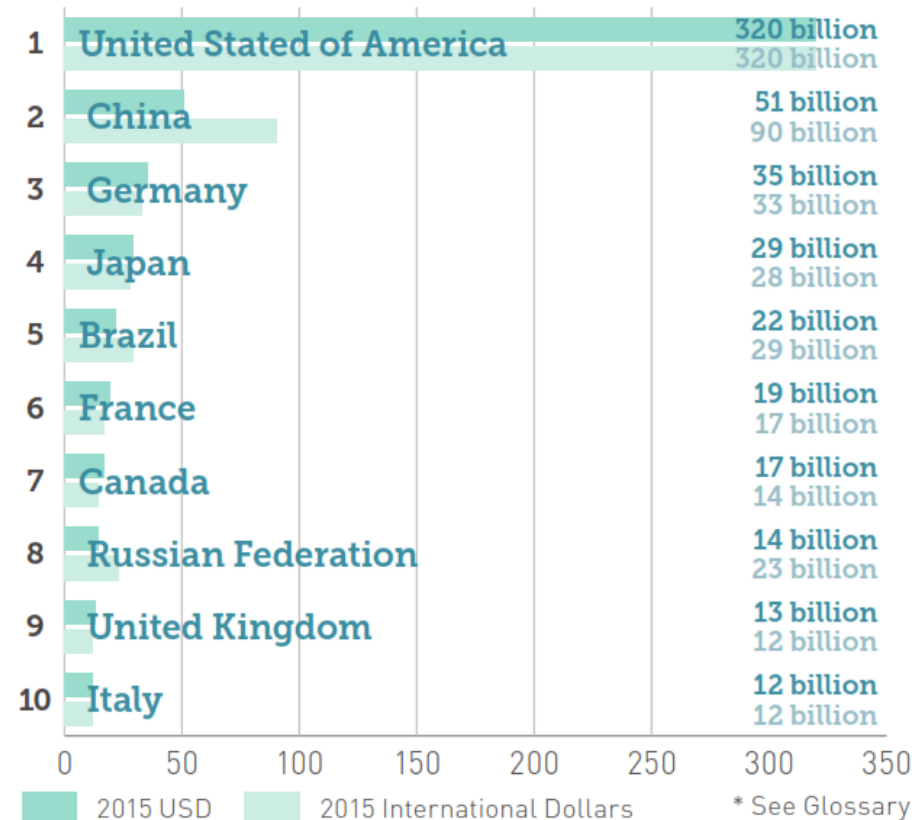
SACA – South and Central American region

SEA – South East Asia region

Top ten countries/territories for number of adults with diabetes



Top ten countries/territories for diabetes-related health expenditure (R=2*)



**Identification of high risk population
using the risk factors**

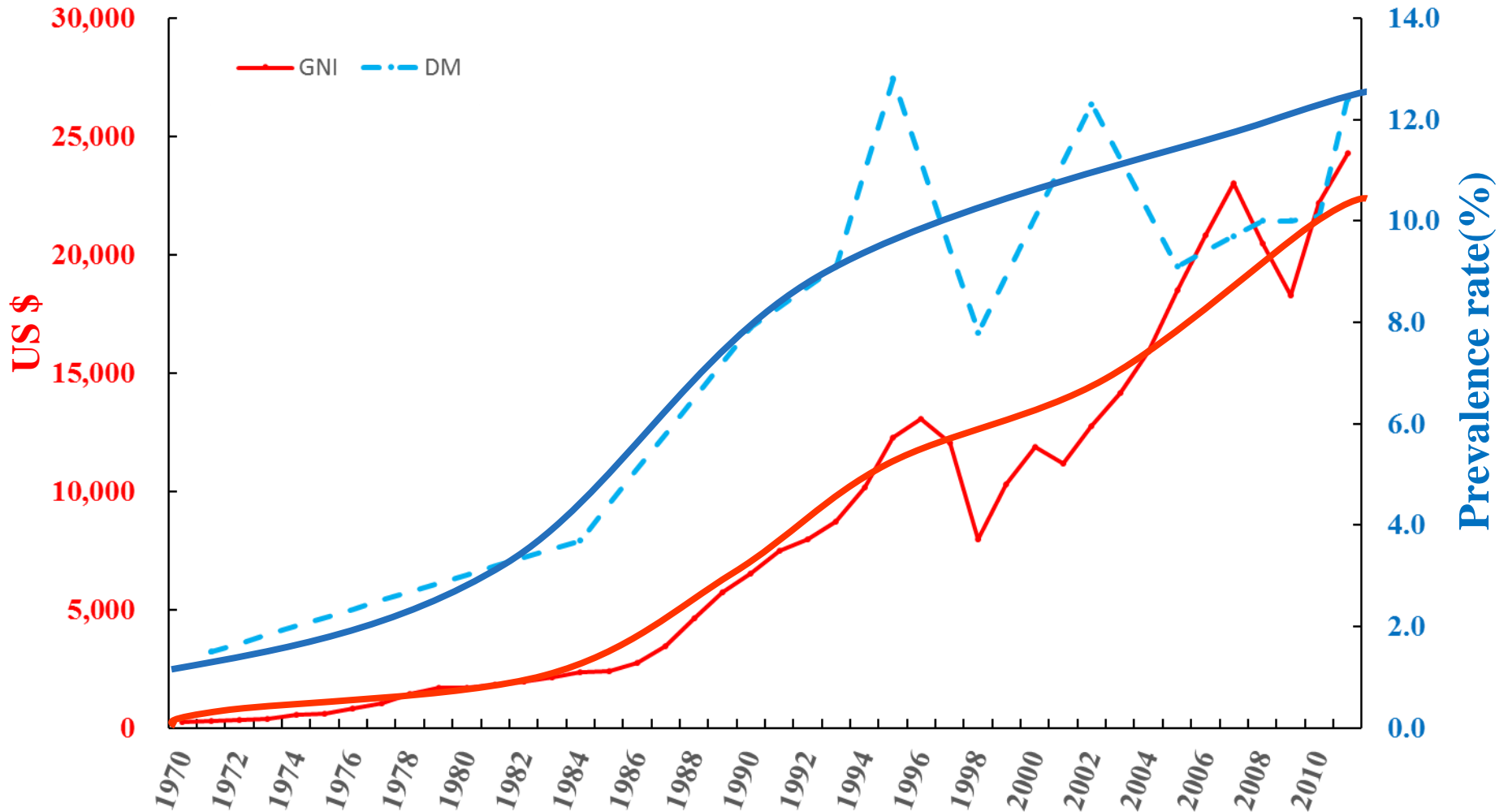
Cox Proportional Hazard Analysis of T2DM:at 14 yrs FU

Variables	β	p-value	RR(95% C.I.)
Mets	0.438	<0.001	1.55(1.28~1.87)
Urban	0.698	<0.001	2.01(1.70~2.38)
NGT		Reference	
IFG	1.213	<0.001	3.36(2.35~4.81)
IGT	1.537	<0.001	4.65(3.95~5.48)
IFG+IGT	2.335	<0.001	10.33(6.99~15.26)
Normal		Reference	
Pre hypertension	0.266	0.004	1.30(1.09~1.57)
HTN stage1	0.120	0.386	1.13(0.86~1.48)
HTN stage2	0.582	<0.001	1.79(1.40~2.29)
Non-smoker		Reference	
Ex-smoker	0.219	0.038	1.24(1.01~1.53)
Current smoker	0.578	<0.001	1.78(1.49~2.14)
Family History of DM	0.384	0.001	1.47(1.18~1.83)
Physical stress signs	0.483	0.011	1.62(1.12~2.35)
Age	0.025	<0.001	
HbA1c	1.803	<0.001	
Composite Insulin Sensitivity Index	-0.013	0.011	
Insulinogenic index	-0.001	0.017	
ALT	0.007	<0.001	

Adjusted for sex , alcohol drinking, exercise,, Quicki index, WBC, RBC

Trend of T2DM in Korea

Economy vs. Prevalence



Diabetes in urban and rural environments

Diabetes in **urban** areas



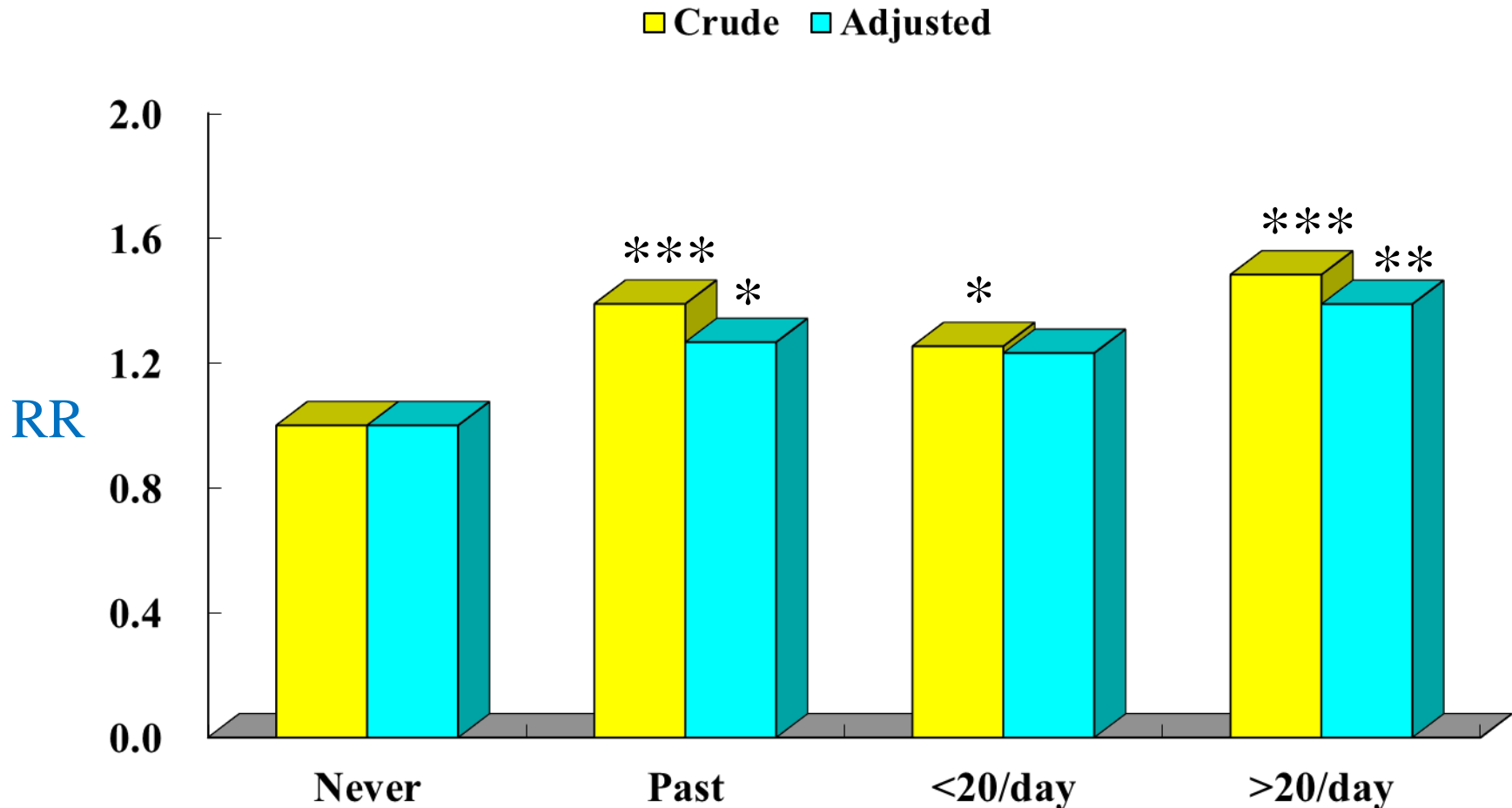
65% 2015 269.7 million
74.5% 2040 477.9 million

Diabetes in **rural** areas



2015 145.1 million
2040 163.9 million

Baseline Smoking Status and T2DM Status during 12 yrs of Follow-up



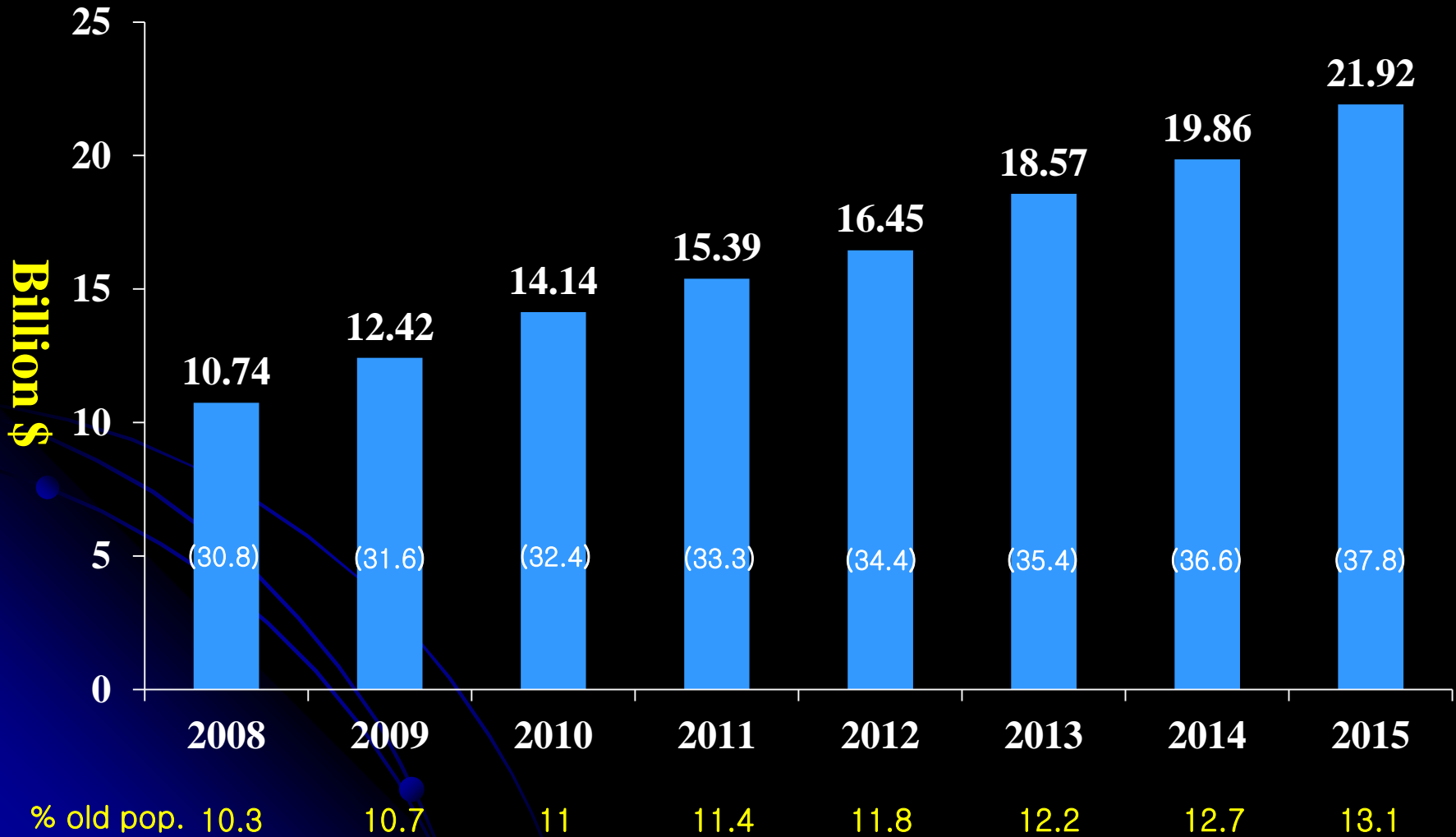
<0.05, **<0.01, ***<0.001;

Adjusted for Sex, Fam Hx DM, Residence, Exer., Alcoh, age, SBP, WC, WBC, RBC, T.Chol, HDL, Tg, ALT, HbA1c, Beta cell function, HOMA-IR, Quicki index

Cho NH et al. Clin Endocrinol. 2009 Nov;71(5):679-85.

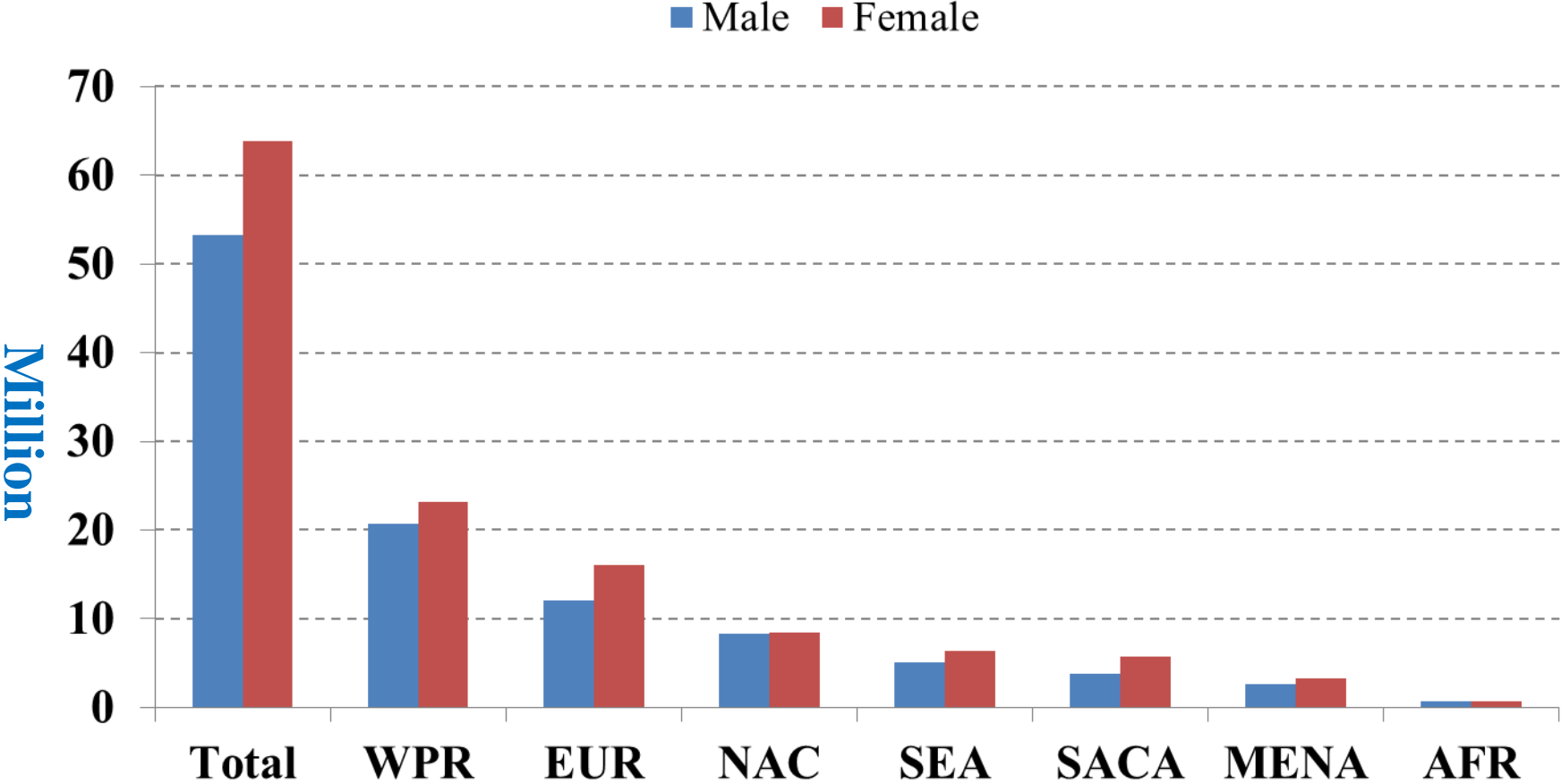
Diabetes in Old population

Medical Expenses in age ≥ 65 yrs



Frequency of Diabetes in Older population

65+ yrs



Multiple Logistics Analysis of Old population

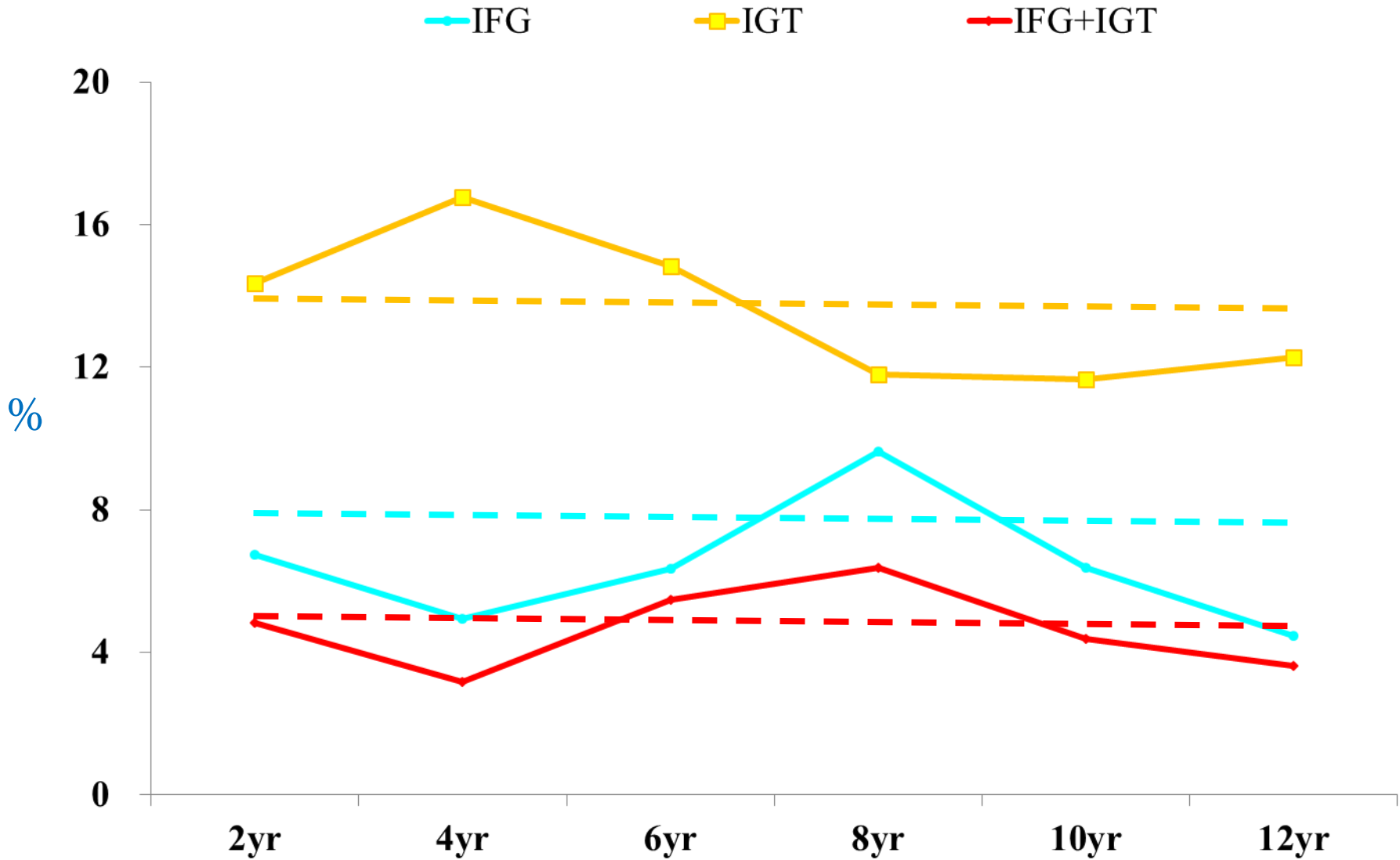
variables	β	p-value	OR(95% C.I.)
≥ 65 yr	0.687	<0.001	1.99(1.65~2.39)
Male	0.471	0.012	1.60(1.11~2.31)
Urban	1.200	<0.001	3.32(2.73~4.03)
Non-Smoker		Reference	
Past Smoker	0.298	0.027	1.35(1.03~1.76)
Current Smoker	0.054	0.725	1.06(0.78~1.43)
Family Hx DM	0.531	<0.001	1.70(1.40~2.07)
Waist	-0.012	0.046	
ASM/Wt	-0.056	0.007	
sBP	0.011	<0.001	
HbA1c	2.313	<0.001	
HOMA-IR	0.604	<0.001	
β -cell function	-0.015	<0.001	
T.Chol	--0.010	<0.001	
Tg	0.001	0.020	
Constant	-12.675	<0.001	

Adjusted for alcohol drinking, exercise, ALT, QuicKi index, HDL

Diabetes in High risk population

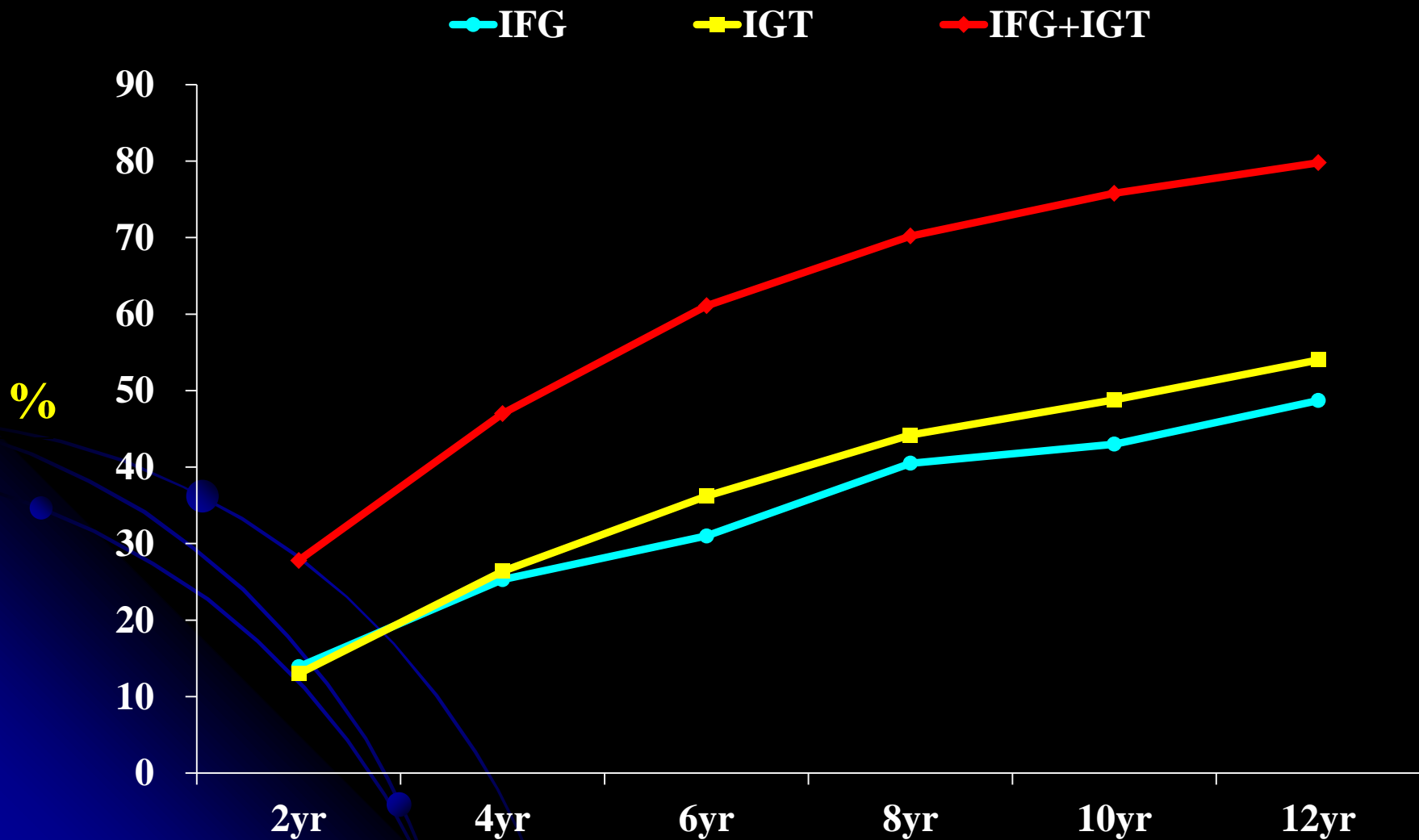
Status of pre-diabetes

12 yrs follow-up

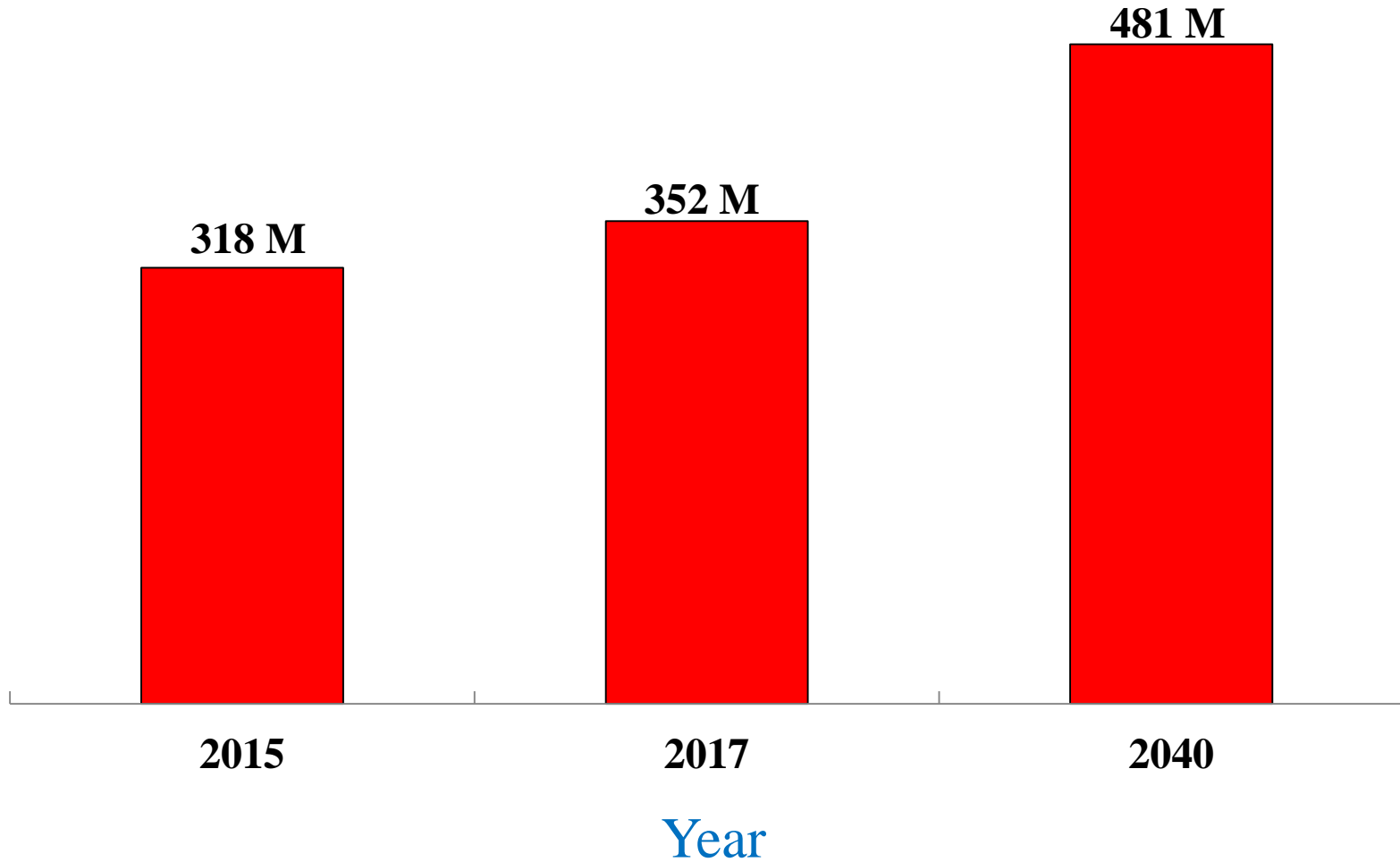


Cumulative Incidence of T2DM

12 yrs follow-up



Trend of IGT



Cox Proportional Hazard Analysis of PreDM

Variables	β	p-value	RR(95% C.I.)
Urban	0.447	<0.001	1.56(1.31~1.86)
SBP	0.011	<0.001	
Waist Circumference	0.018	<0.001	
T.chol	-0.003	0.004	
Family History of DM	0.384	0.001	1.41(1.14~1.74)
WBC	0.069	0.001	
HbA1c	1.221	<0.001	
Composite Insulin Sensitivity Index	-0.204	0.021	
Insulinogenic index	-0.147	<0.001	
ALT	0.005	<0.001	

Adjusted for Age, sex , alcohol drinking, exercise, smoking, Tg, HDL, CRP, Creatinine , Stress

Summary/Conclusion

- **No disease has impacted human life stronger than Diabetes, and Diabetes Epidemic is more serious in Asia than any part of the world.**
- **Costs are greater than any other diseases.**
- **Diabetes is currently unstoppable, but utilization of risk factors for undiagnosed cases and identification in high risk populations accompanied with early management may be the solution and the best way to stop the diabetes Tsunami in Asia.**

Thank you for your attention!
Many thanks to Center for Clinical Epidemiology, Ajou University Medical Center staff

