

The health burden of diabetes in Latin America and the Caribbean: estimates of diabetes-free life expectancy and the effects of diabetes on healthy life expectancy

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Demographic context

- Life expectancy at birth in Latin America has increased from 52 years to near 72 years in the last fifty years and further increases are expected in the next decades (CELADE 2004);
 - Percentage of those aged 65 and over is expected to rise from the current 5.5% to 10% in 2025 (CELADE 2004).
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Do increases in
life expectancy
imply better
health for this
larger surviving
aging
population?

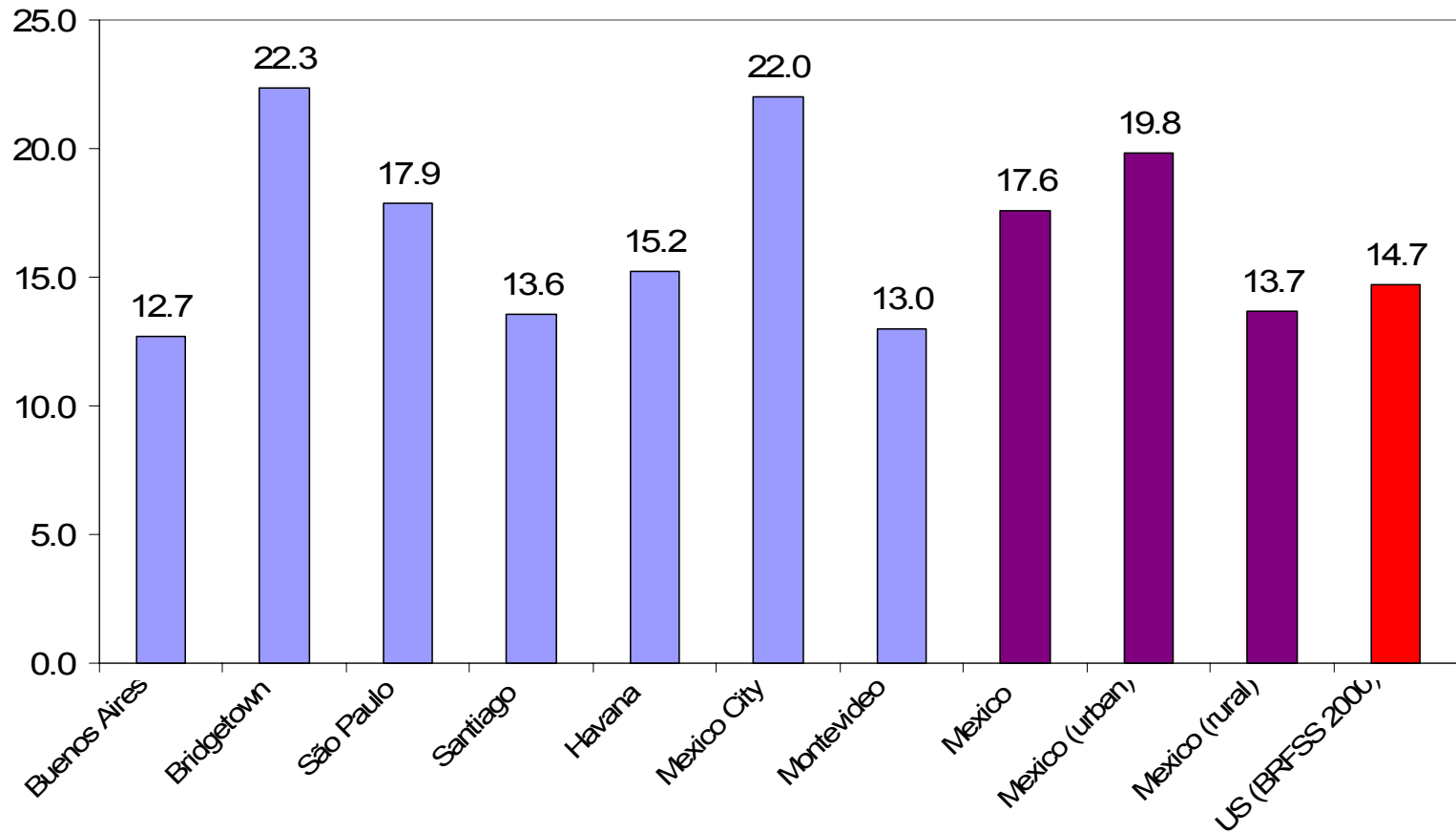
Context: epidemiological and nutritional transitions are in progress

- In the last decades, a considerable part of Latin American and Caribbean population has changed diet and lifestyles (mainly through lack of exercise) and those changes have influenced the prevalence of diabetes.
 - Diabetes prevalence is on rise - in 1995, the prevalence rate was estimated to be 5.7% and it is expected to reach 8.1% in 2025 – a 42% increase (King et al. 1998).
 - There is some evidence that obesity is also on the rise in Latin America and the Caribbean.
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Diabetes prevalence among elders in Latin America and the Caribbean

- Diabetes prevalence in Latin America and the Caribbean is relatively high.
 - Most of the cases are of type 2 diabetes (~90 to 95%).
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Prevalence of self-reported diabetes among elders (60+) in Latin America and the Caribbean



Note: Estimates are not age standardized.

US data from Mokdad et al 2001

Diabetes and disability

- Diabetes has been shown to be strongly associated with physical limitation and functional disability. In general, individuals with diabetes are about two to three times more likely to have disability than those without (Gregg et al. 2000, Valderrama-Gama et al. 2002, Bruce et al. 2003, Ryerson et al. 2003, Maty et al. 2004).
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Diabetes and disability

- Those with diabetes are also more likely to become functionally disabled (Gregg et al. 2002). Gregg et al. (2002) report a yearly incidence of 9.8% among women with diabetes and 4.8% among non-diabetics. After controlling for comorbidities and potential confounders, diabetes was still associated with an increase of 42% in the risk of any incident disability in elderly women (Gregg et al. 2002).
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The effects of diabetes on life expectancy and healthy life expectancy

- Bélanger et al. (2002) find that disability-free life expectancy at age 45 is 14.1 years lower for women with diabetes than for those without the disease. Among men, diabetes reduces disability-free life expectancy in 10.7 years. Diabetes also had a strong effect reducing total life expectancy of women in Canada – total life expectancy at age 45 is reduced in 13 years among women. However, the effects are much smaller among men. The authors conclude that diabetes imposes a bigger burden on total life expectancy among women, but diabetes-related disabilities are probably similar among both sexes.
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The effects of diabetes on life expectancy and healthy life expectancy

- Jagger et al. (2003) show diabetics in U.K. have lower total life expectancy than those without diabetes – life expectancy at age 75 reaches 10.3 among non-diabetics and 7.2 among diabetics. Results also show that active life expectancy of diabetics is reduced in 2.4 years – active life expectancy of diabetics aged 75 is 4.7 years, while non-diabetics are expected to live, on average, 7.1 years without any losses on autonomy.
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The effects of diabetes on life expectancy and healthy life expectancy

- Laditka and Laditka (2005) show that individuals with diabetes live shorter lives with more disability. Diabetes reduces the total life expectancy by 4.1 years among white, highly educated women aged 70. These white highly educated women are expected to live almost 40% of their remaining lives with some sort of impairment if they are diabetic at age 70, compared with 28% among their non-diabetic counterparts.
 - Among white highly educated men, life expectancy is reduced in 2.8 years for those with diabetes. They are also expected to live a larger percentage of their lives with some impairment compared with non-diabetics, 26.5% and 19.1%, respectively.
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The effects of diabetes on life expectancy and healthy life expectancy

- Laditka and Laditka (2005) conclude that diabetic toll in terms of total life expectancy and unimpaired life expectancy is higher for women. Also, as expected, having lower education and/or being non-white reduce the total life expectancy and increases the number (and percentage) of years expected to be lived with impairment for both diabetics and non-diabetics.
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Hypothesis and goals

The main hypothesis of this paper is that diabetes is likely to impose an important burden on those with the condition. More specifically, this paper aims to:

- 1) estimate the diabetes-free life expectancy using data from seven regions in Latin America and the Caribbean based on the Sullivan method and,
 - 2) estimate the total, active and inactive life expectancies for individuals with and without diabetes based data from a nationally representative panel data from Mexico conducted in 2001 and 2003.
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Data

- **Salud, Bienestar y Envejecimiento en América Latina y el Caribe Proyecto (SABE)**
 - **Mexican Health and Aging Study (MHAS)**
 - **Life tables by 5-year age groups, sex and country**
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Data - SABE

SABE is a multicenter survey that investigates the health and well being of older people (aged 60 and over) and, in some cases, of their surviving spouse in seven capital/major cities in countries of Latin America and the Caribbean. The cities investigated were: Buenos Aires (Argentina); Bridgetown (Barbados); São Paulo (Brazil); Santiago (Chile); Havana (Cuba); Mexico City (Mexico); Montevideo (Uruguay).

The final sample is composed by 10,902 individuals aged 60 and over.

Data - MHAS

MHAS is a prospective two-wave panel study of a nationally representative cohort of Mexicans born prior to 1951 (50 and older). The survey has national and urban/rural representation. Surviving spouses regardless of their age were also interviewed. The baseline interview was conducted in 2001 and the second wave during 2003.

Data - MHAS

- First wave: A total of 15,186 complete interviews were obtained (response rate reached 90.1%)
 - In the first wave, the final sample is composed by 13,055 individuals aged 50 and over with complete information on age, sex and diabetic status. There are 7,150 individuals aged 60 and over.
 - Mortality information was obtained in the next-of-kin questionnaires.
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Disability measures – SABE and MHAS

- **Activities of daily living (ADL):** dressing, bathing, eating, getting in and out of a bed (transferring), toileting, and getting across the room
 - **Instrumental activities of daily living (IADL):** preparing a hot meal, money management, shopping, and taking medication.
 - **Nagi (Nagi, 1976)** - physical performance measure: lifting or carrying objects weighted 5 Kg or over; lifting up a coin (using fingers to grasp or handle); pulling or pushing a large object such as a living room chair; stooping, kneeling or crouching; and, reaching or extending arms above shoulder level.
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ADL, IADL and NAGI

ADL, IADL and Nagi scale were measured in two different ways:

- **Binary** - scoring '0' indicates no limitation and scoring '1' indicates having difficulty performing at least one activity;
 - **Binary with severity** - scoring '0' indicates having difficulty performing none or less than 3 activities, score '1' indicates having difficulties performing 3 or more activities.
-

ADL and IADL help

- Two measures capture the need for help in basic life activities (ADL and IADL limitations). Individuals were asked in MHAS whether a spouse or another person assisted them on basic and instrumental daily activities.
 - Help on ADL activities and on IADL activities are in the binary form, in which those scoring '0' indicate that they do not have require assistance on ADL or IADL activities, while score '1' was assigned for those who have reported requiring human assistance in least one activity of each scale.
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Life tables

- Buenos Aires – INDEC
 - Bridgetown – data from Barbados – WHO
 - São Paulo – SEADE
 - Santiago – INE
 - Havana - Esther María León Díaz
 - Mexico - Roberto Ham-Chande
 - Mexico City – CONAPO
 - Montevideo – INE ((<http://www.ine.gub.uy>))
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Methods

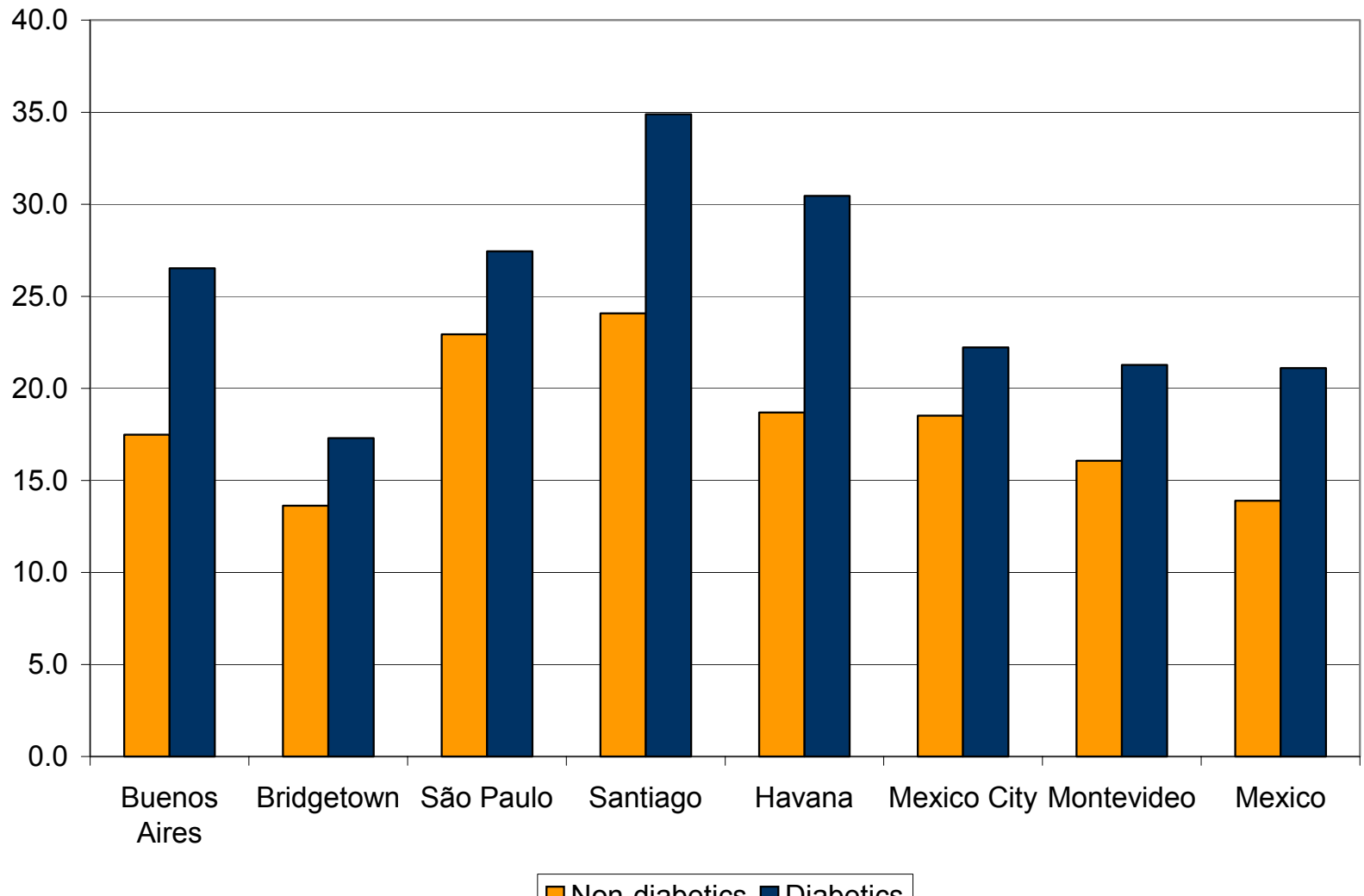
- Sullivan method will be used to estimate the diabetes-free life expectancy based on prevalence data from SABE and MHAS 2001
 - Multistate life table method (MSLT) will be used to estimate active (disability-free) and disabled life expectancy by sex and diabetic status - IMach 0.98g version (stepm=1 and estepm=1).
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Descriptive data – SABE and MHAS

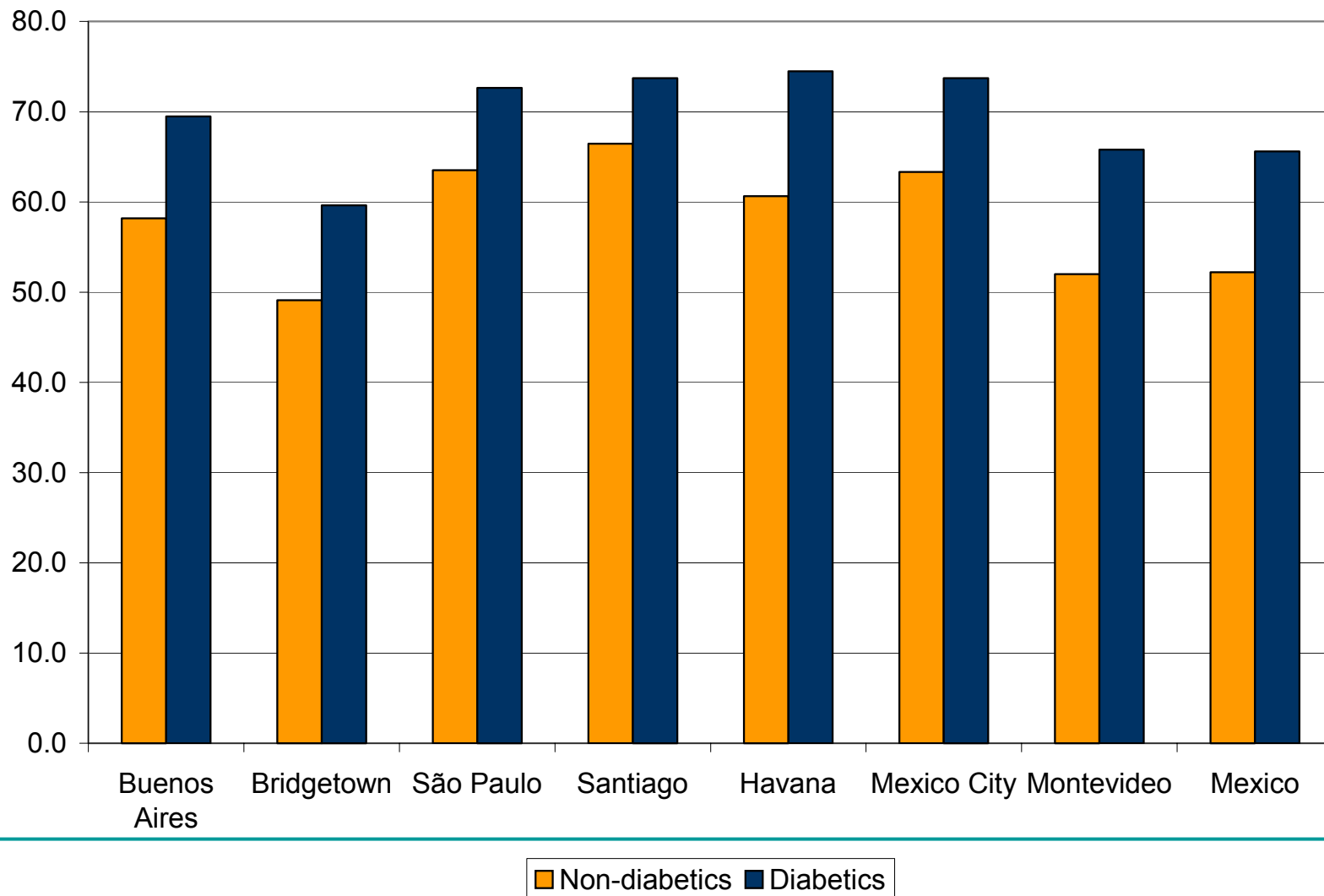
Variables	SABE			MHAS 2001		
	Non-diabetics	Diabetics	p-value	Non-diabetics	Diabetics	p-value
Age (mean)	71.8	71.6	0.221	69.6	68.9	0.002
Female	61.0	66.5	0.000	52.4	60.3	0.000
ADL	19.0	25.3	0.000	13.9	21.1	0.000
IADL	15.2	22.5	0.000	11.4	17.7	0.000
Nagi	59.2	69.9	0.000	52.2	65.6	0.000
Severe ADL	6.2	8.9	0.000	4.5	8.9	0.000
Severe IADL	4.0	6.6	0.000	3.1	5.6	0.000
Severe Nagi	20.5	29.8	0.000	21.3	31.0	0.000
BMI (mean) *	26.6	27.7	0.000	26.8	27.9	0.003
Obesity	23.8	28.4	0.000	22.0	28.5	0.053
Cancer	3.9	3.8	0.855	1.9	2.3	0.311
Heart disease	19.8	26.4	0.000	3.9	7.8	0.000
Stroke	6.2	9.3	0.000	3.5	5.3	0.003
Arthritis	42.0	45.0	0.017	24.7	27.2	0.074

Note: * BMI in SABE does not include Argentina. Only 20% of the MHAS sample has anthropometric measures.

Prevalence of ADL among elderly people (60+) in Latin America and the Caribbean by diabetic status, SABE and MHAS



Prevalence of Nagi limitations among elderly people (60+) by diabetic status, SABE and MHAS



**Results: diabetes-free life
expectancy using data from
SABE and MHAS**

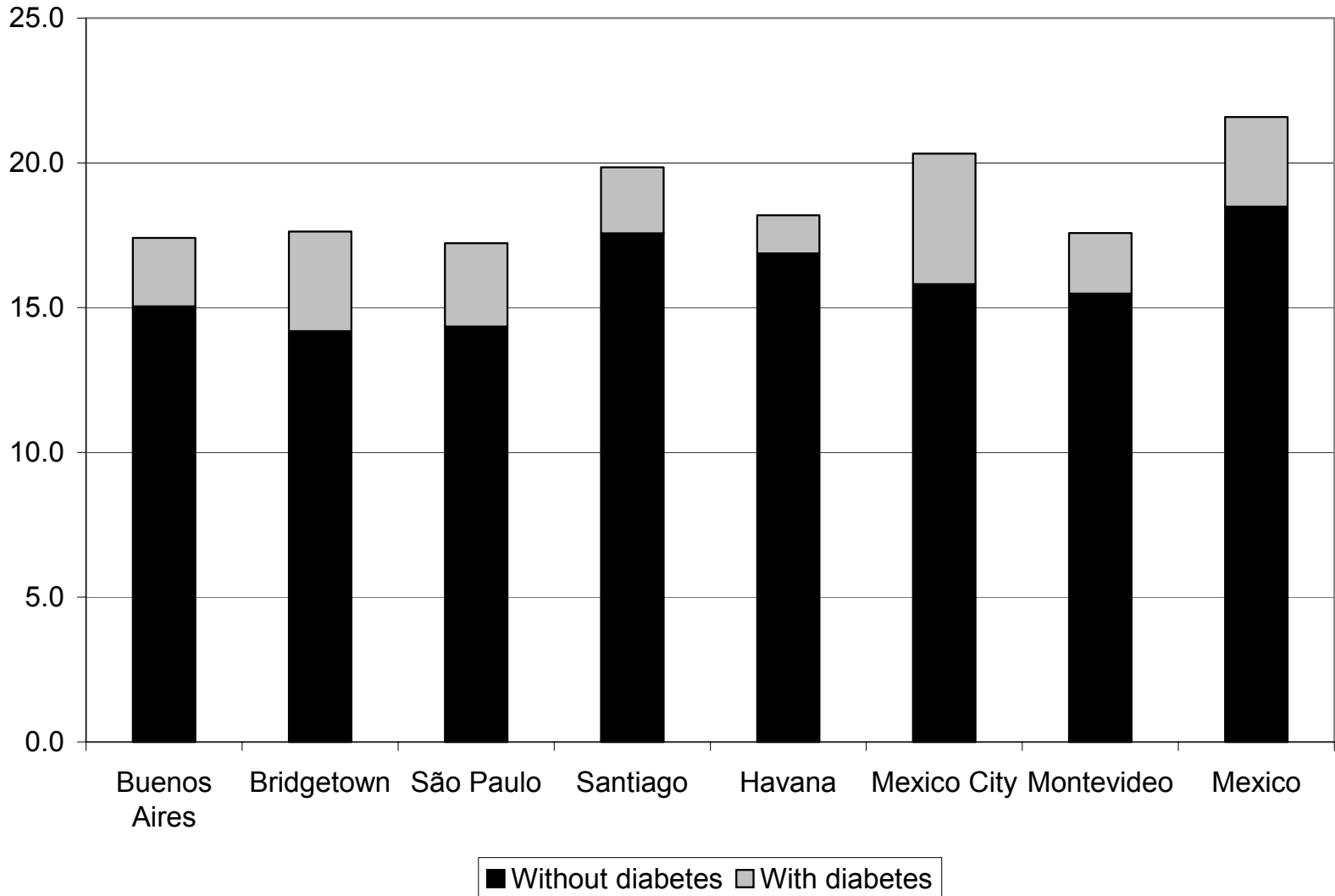
Males: total life expectancy and diabetes-free life expectancy (self-reports)

Sex and region	Total life expectancy at age 60 (e_{60})	Diabetes life expectancy (DLE_{60})	Diabetes-free life expectancy ($DFLE_{60}$)	s.e. ($DFLE$)
Males				
Buenos Aires (Argentina)	17.4	2.4	15.0	0.01
Bridgetown (Barbados)	17.6	3.4	14.2	0.29
São Paulo (Brazil)	17.2	2.9	14.3	0.01
Santiago (Chile)	19.9	2.3	17.6	0.22
Havana (Cuba)	18.4	1.3	17.1	0.01
Mexico City (Mexico)	20.3	4.5	15.8	0.01
Montevideo (Uruguay)	17.6	2.1	15.5	0.01
Mexico	21.6	3.1	18.5	0.13

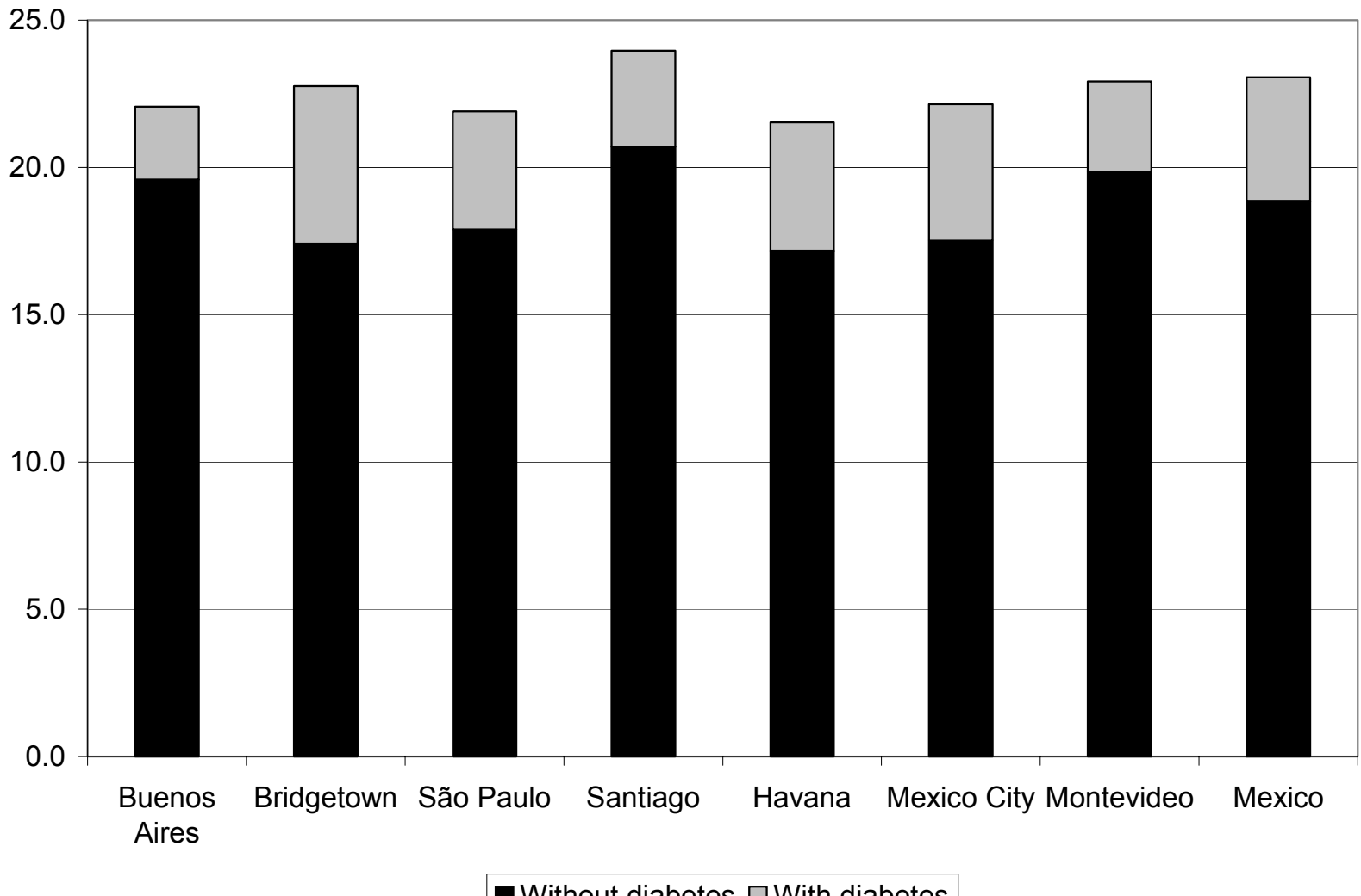
Females: total life expectancy and diabetes-free life expectancy (self-reports)

Sex and region	Total life expectancy at age 60 (e_{60})	Diabetes life expectancy (DLE_{60})	Diabetes-free life expectancy ($DFLE_{60}$)	s.e. ($DFLE$)
Females				
Buenos Aires (Argentina)	22.1	2.5	19.6	0.01
Bridgetown (Barbados)	22.8	5.4	17.4	0.32
São Paulo (Brazil)	21.9	4.0	17.9	0.01
Santiago (Chile)	24.0	3.3	20.7	0.23
Havana (Cuba)	22.0	4.5	17.6	0.02
Mexico City (Mexico)	22.1	4.6	17.5	0.01
Montevideo (Uruguay)	22.9	3.1	19.9	0.01
Mexico	23.1	4.2	18.9	0.01

Males: total life expectancy and diabetes-free life expectancy

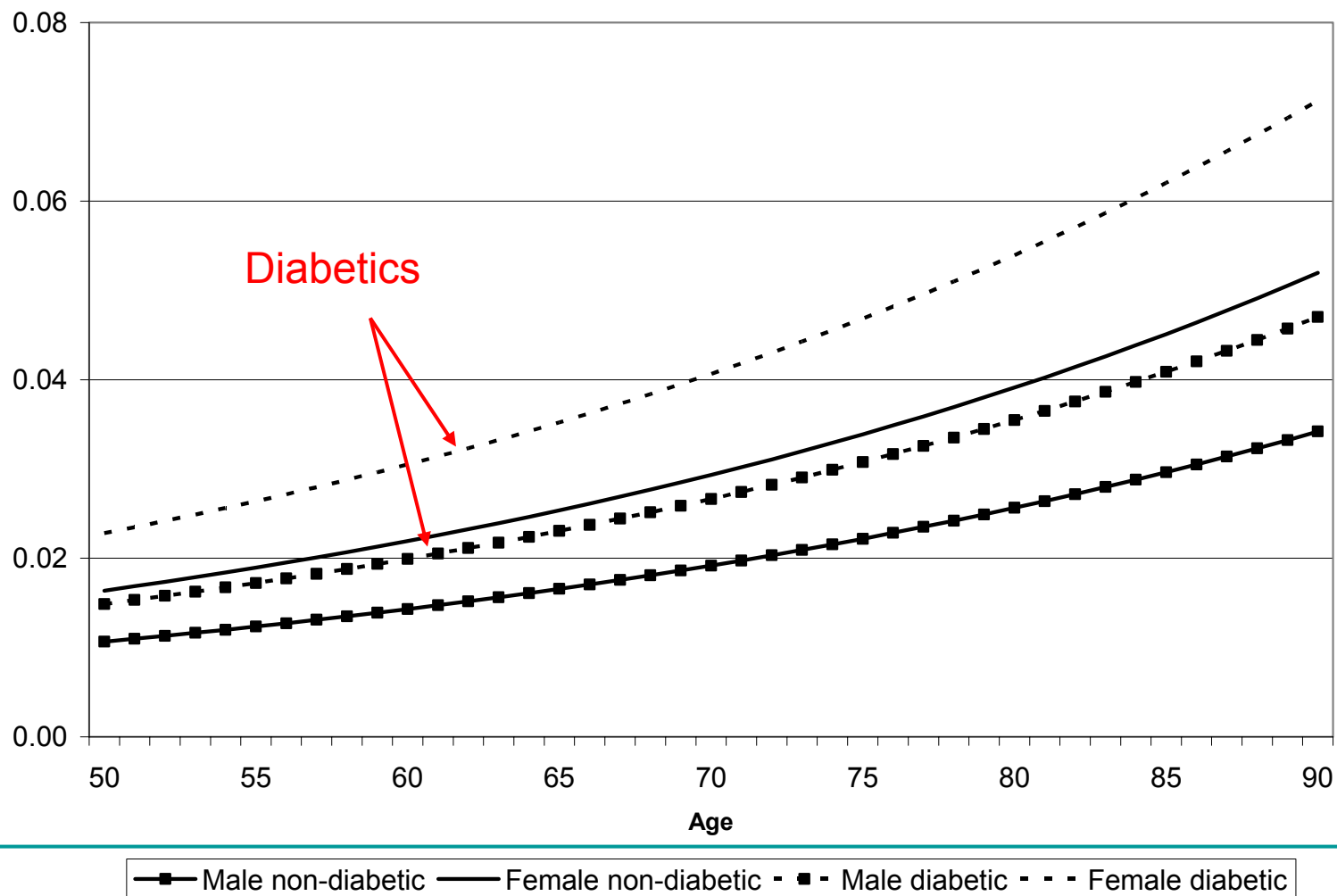


Females: total life expectancy and diabetes-free life expectancy

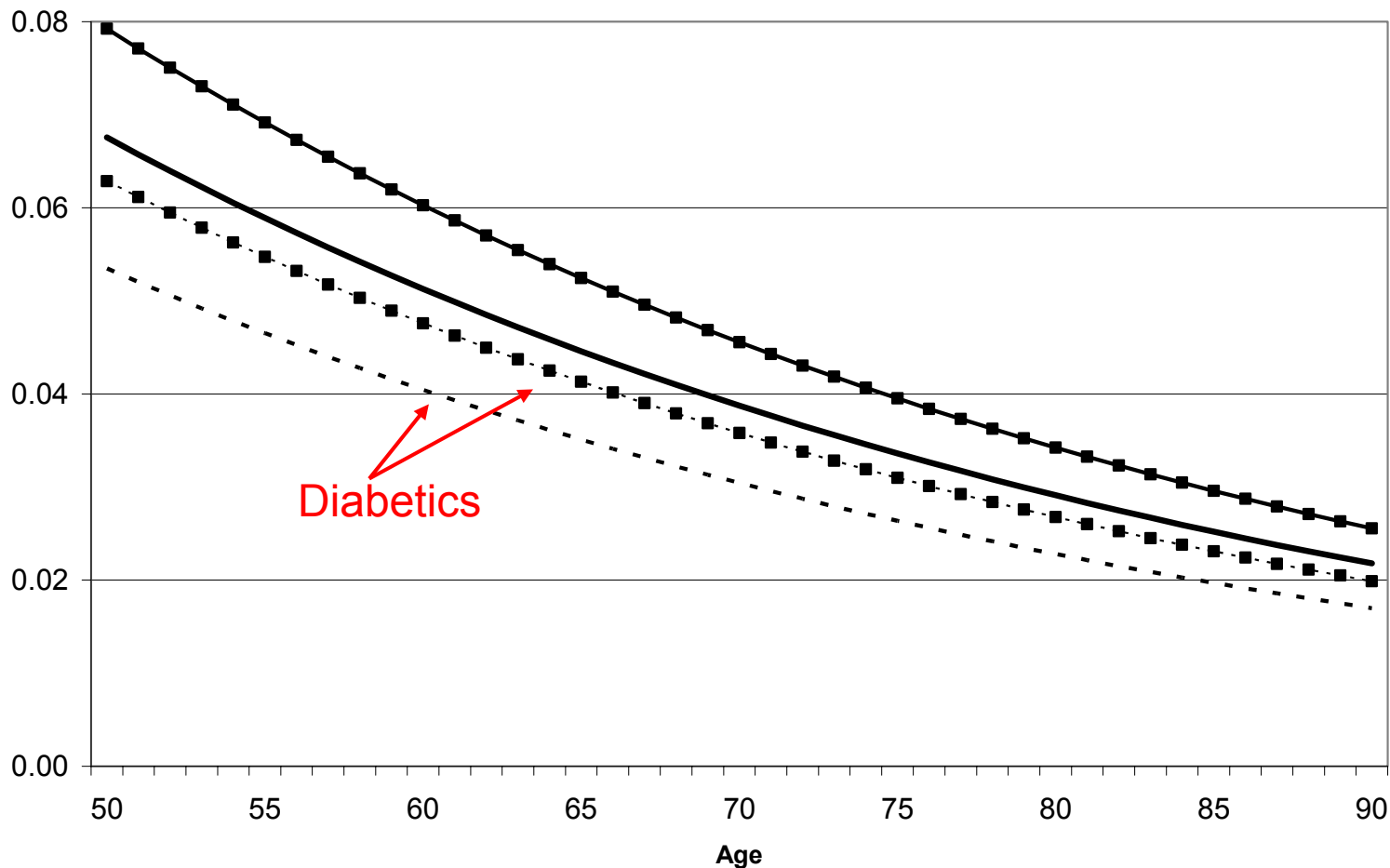


Results: active and inactive
life expectancy by diabetes
status using data from Mexico
(MHAS)

Incidence: Conditional probabilities to be observed in the Nagi state in wave 2 being active in wave 1 by sex and diabetic status, Mexico, MHAS

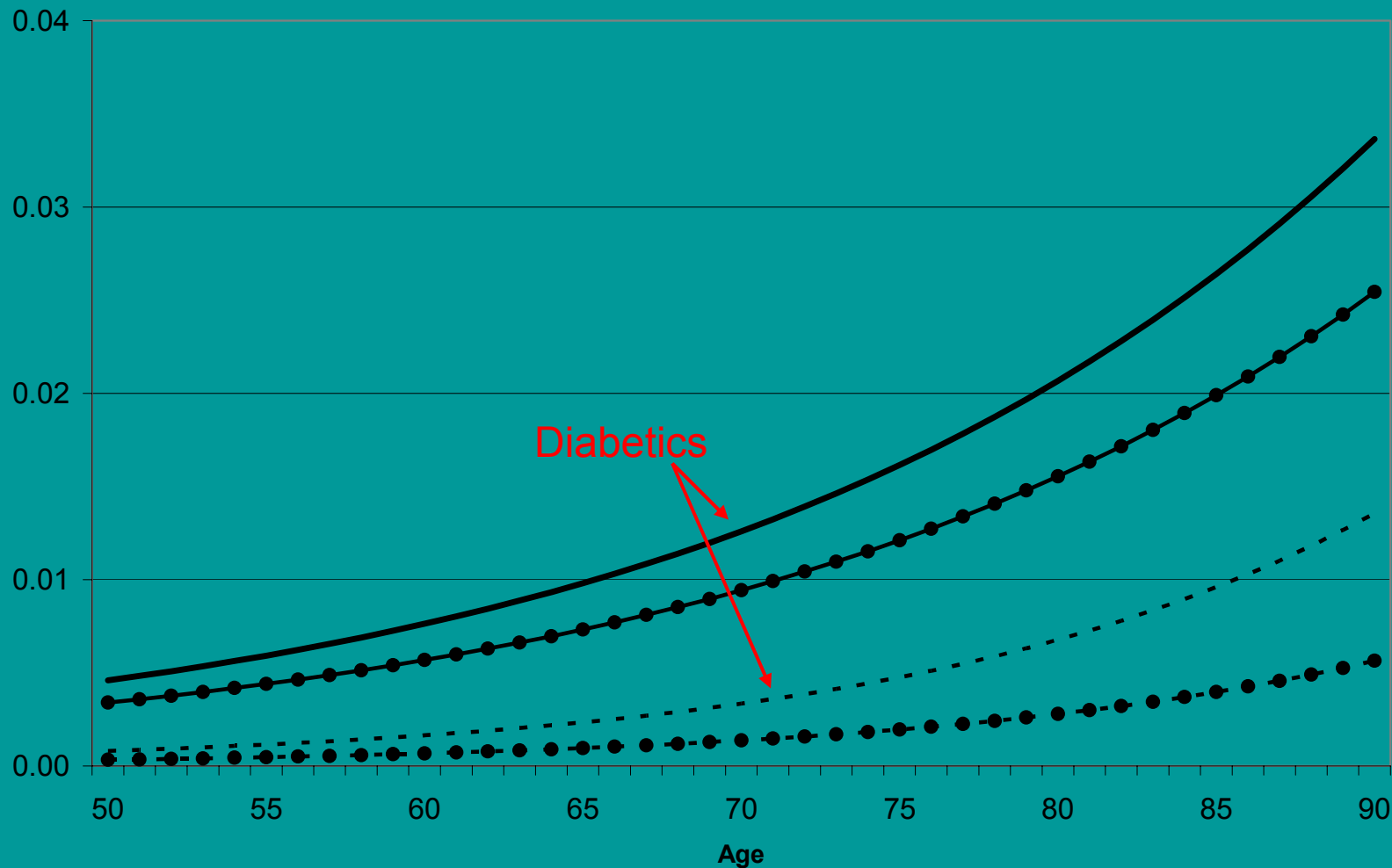


Recovery: Conditional probabilities of recovering from IADL limitation, by sex and diabetic status, Mexico, MHAS



—■— Male non-diabetic — Female non-diabetic ···■··· Male diabetic - - - Female diabetic

Males: Probabilities of dying by IADL and diabetes status. Mexico. MHAS



-●- Non-diabetic, active -.- Diabetic, active —●— Non-diabetic, inactive — Diabetic, inactive

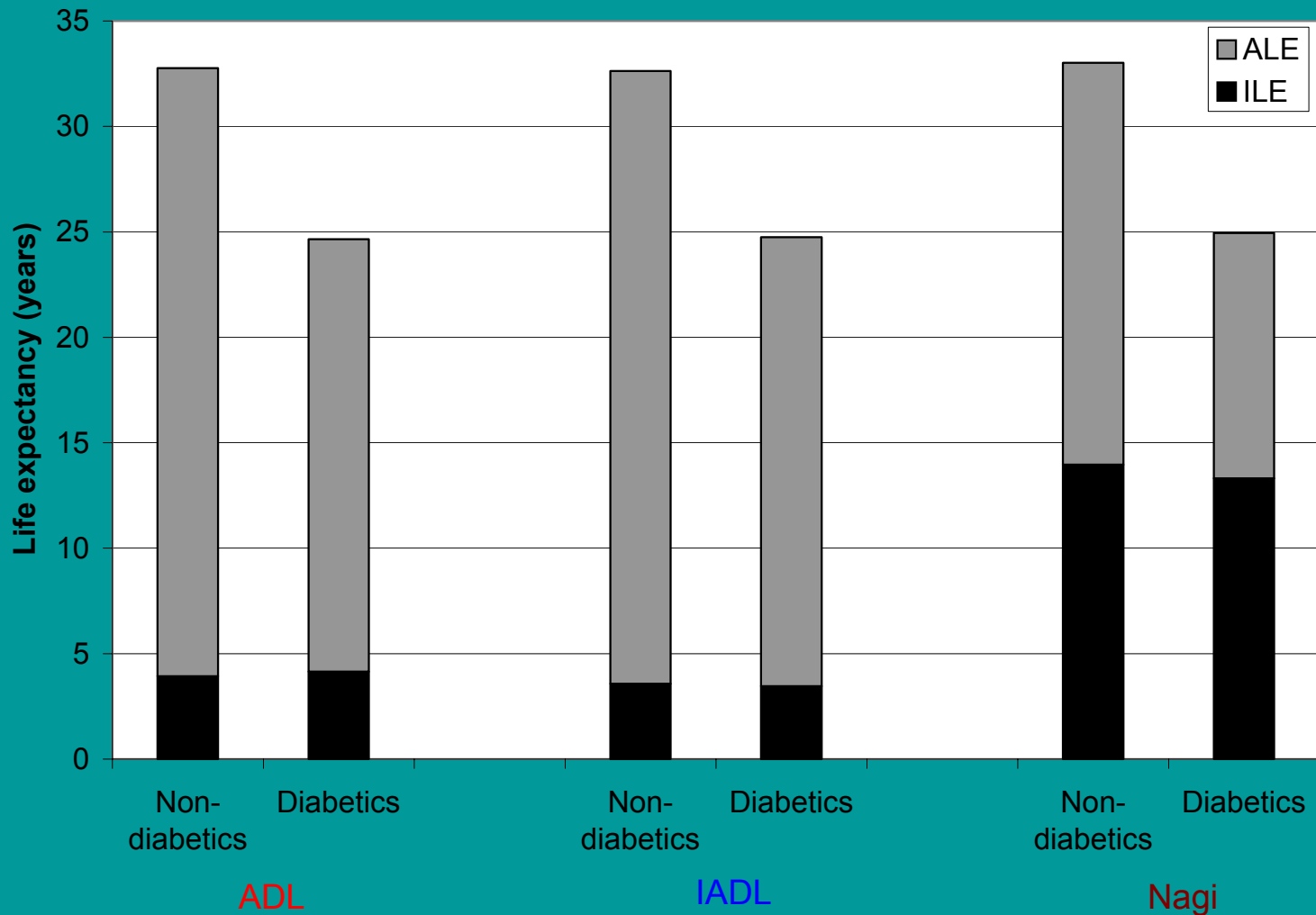
Effects of diabetes on healthy life expectancy, Mexico

Impairment and sample size	Age							
	50 (s.d)		60 (s.d)		70 (s.d)		80 (s.d)	
ADL (N=12,050)								
<i>Non-diabetics</i>								
TLE	32.8	(0.606)	24.2	(0.585)	16.6	(0.567)	10.4	(0.531)
ALE	28.8	(0.520)	20.5	(0.498)	13.4	(0.478)	7.8	(0.437)
ILE	3.9	(0.224)	3.7	(0.230)	3.2	(0.239)	2.6	(0.247)
<i>Diabetics</i>								
TLE	24.7	(0.927)	17.2	(0.782)	11.1	(0.656)	6.6	(0.537)
ALE	20.5	(0.739)	13.4	(0.599)	7.9	(0.470)	4.0	(0.345)
ILE	4.2	(0.381)	3.8	(0.360)	3.3	(0.345)	2.6	(0.336)

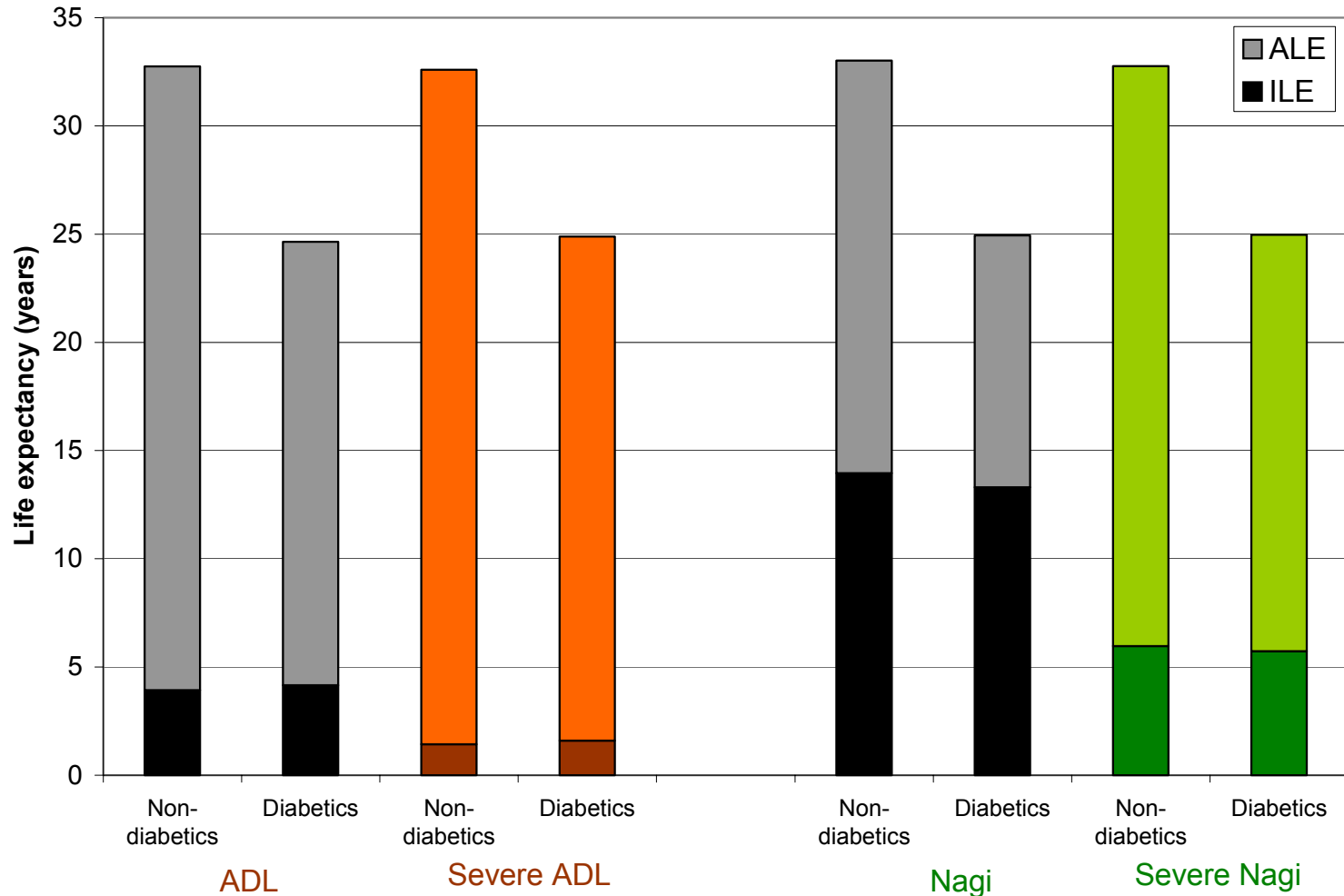
Note: TLE (Total Life Expectancy), ALE (Active Life Expectancy) and ILE (Inactive Life Expectancy)

Source: MHAS

Effects of diabetes on active and inactive life expectancies at age 50



Effects of diabetes on active and inactive life expectancies at age 50



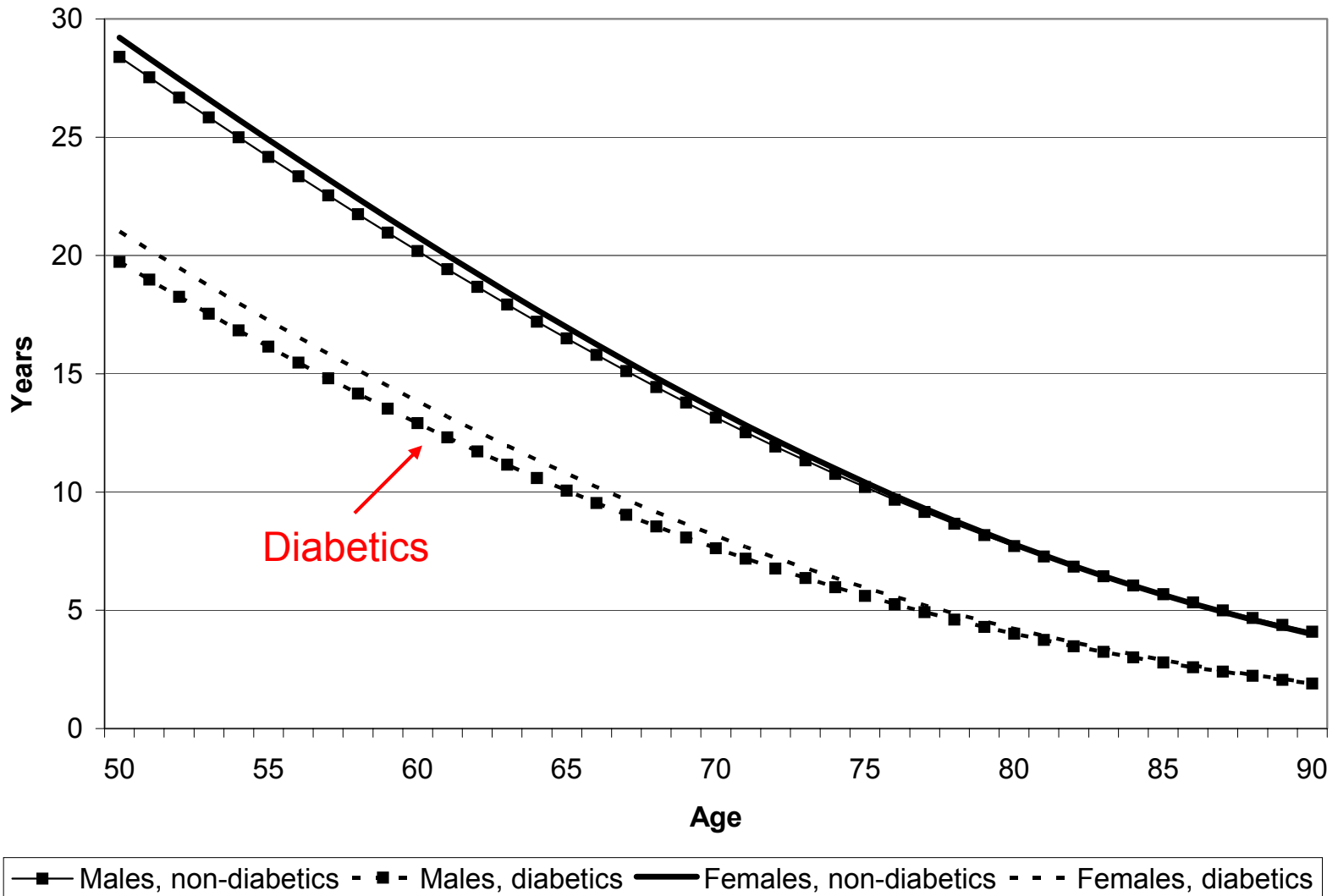
Effects of diabetes on total, active and inactive life expectancies by age and sex

Impairment and sample size	Age 50		Age 60		Age 70	
	Males	Females	Males	Females	Males	Females
IADL (N=12,065)						
<i>Non-diabetics</i>						
TLE	31.1	34.2	22.8	25.4	15.5	17.4
ALE	29.0	29.0	20.7	20.3	13.5	12.6
ILE	2.1	5.2	2.1	5.1	2.0	4.8
ILE/TLE (%)	6.8%	15.2%	9.2%	20.0%	13.1%	27.5%
<i>Diabetics</i>						
TLE	22.6	26.4	15.6	18.6	9.9	12.0
ALE	20.8	21.5	13.8	13.9	8.1	7.7
ILE	1.8	4.9	1.8	4.7	1.8	4.4
ILE/TLE (%)	8.1%	18.4%	11.7%	25.4%	17.8%	36.2%

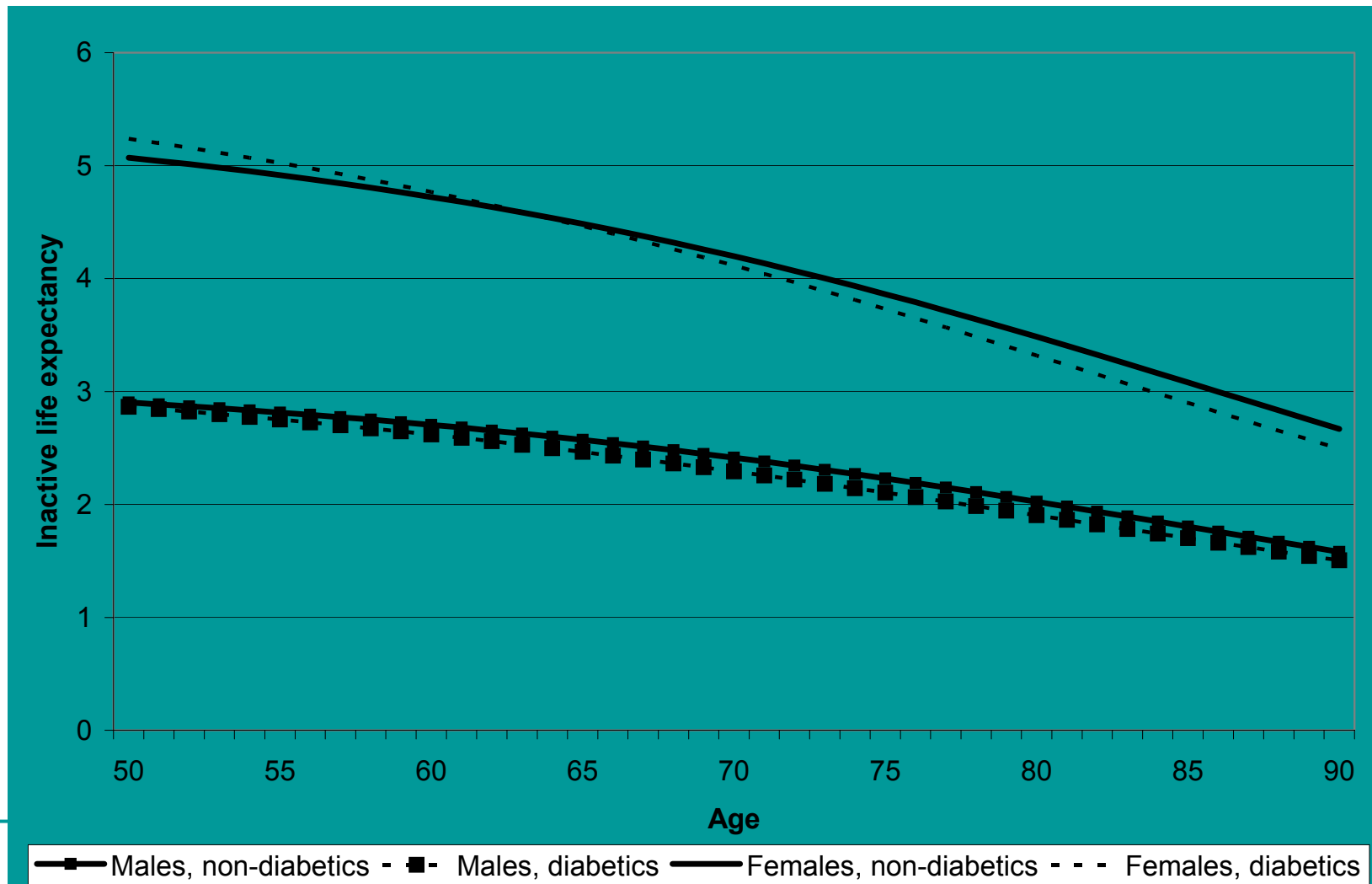
Note: TLE (Total Life Expectancy), ALE (Active Life Expectancy) and ILE (Inactive Life Expectancy)

Source: MHAS

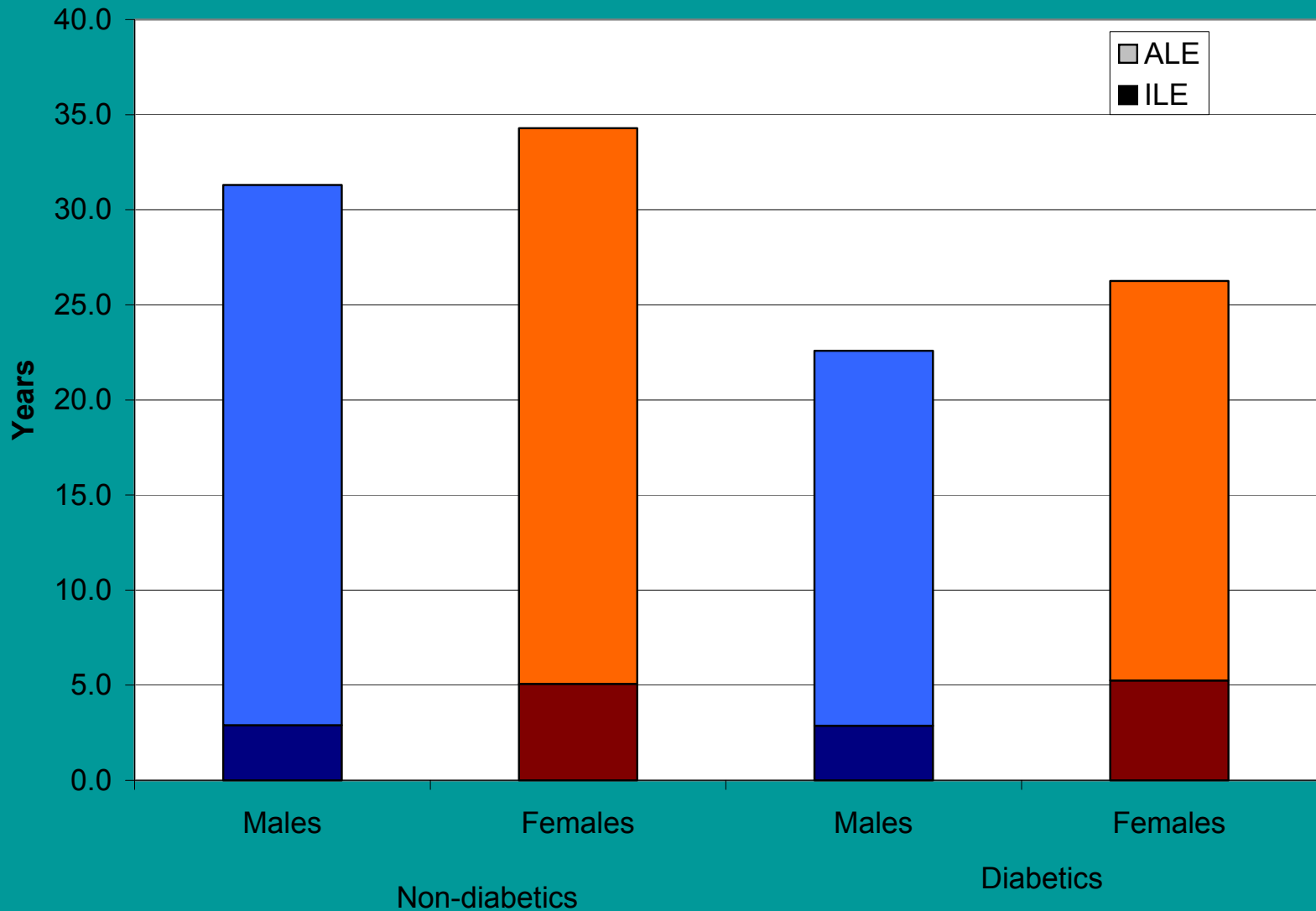
Active life expectancy (ADL) by diabetic status and sex



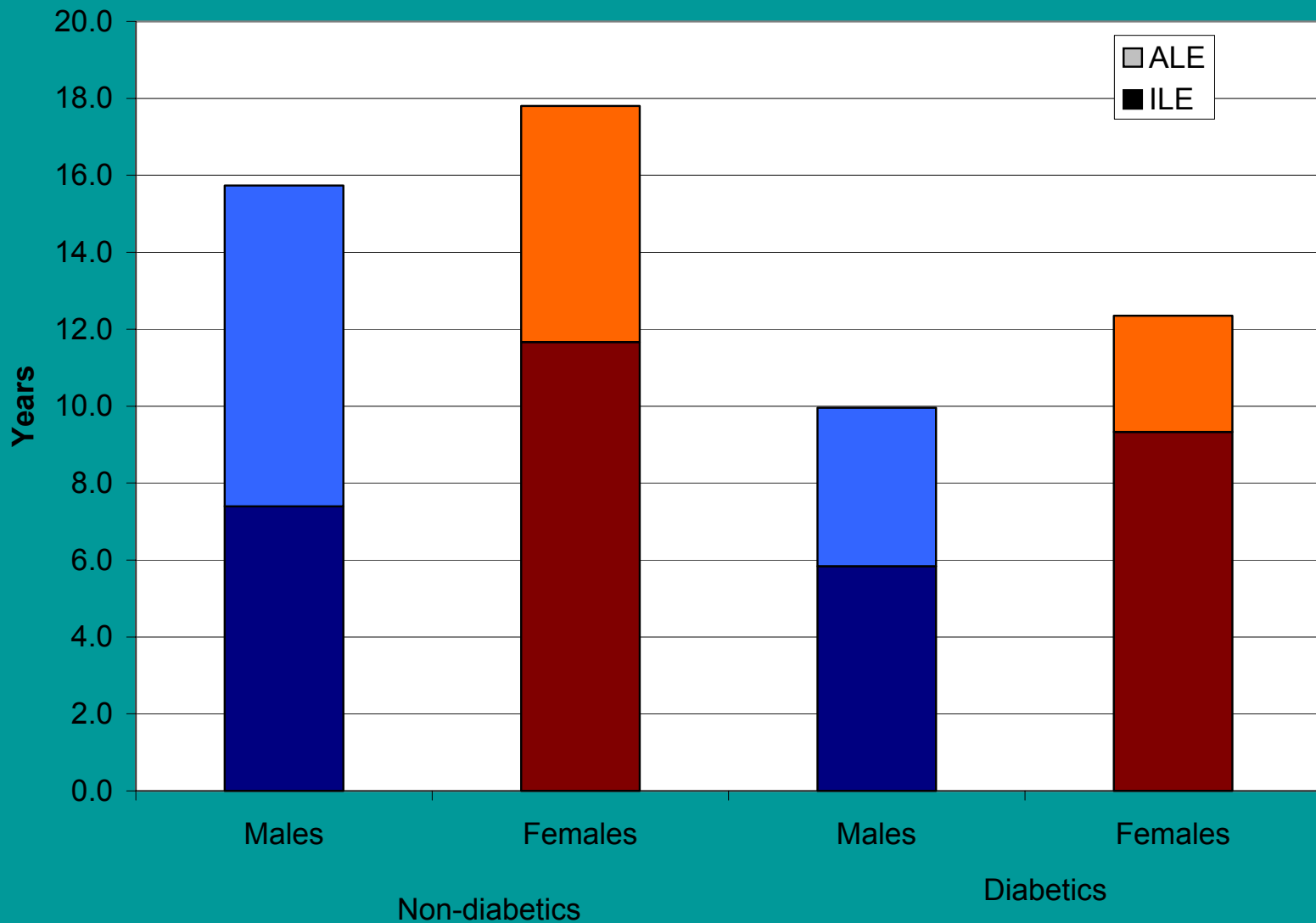
Inactive life expectancy (ADL) by diabetic status and sex



Active and inactive life expectancy (ADL) at age 50, by sex – Mexico



Active and inactive life expectancy (Nagi) at age 70, by sex – Mexico



Assistance on daily activities

Diabetes status, health status and sample size	AGE			
	50	(s.d)	80	(s.d)
ADL assistance (N=12,050)				
<i>Non-diabetics</i>				
Total life expectancy	32.4	(0.594)	10.2	(0.516)
Without help	30.4	(0.543)	8.5	(0.456)
With help	2.0	(0.165)	1.7	(0.202)
<i>Diabetics</i>				
Total life expectancy	24.6	(0.903)	6.4	(0.517)
Without help	22.2	(0.785)	4.5	(0.381)
With help	2.4	(0.289)	2.0	(0.318)
IADL assistance (N=12,065)				
<i>Non-diabetics</i>				
Total life expectancy	32.4	(0.588)	10.1	(0.513)
Without help	29.1	(0.484)	7.2	(0.379)
With help	3.3	(0.228)	2.8	(0.278)
<i>Diabetics</i>				
Total life expectancy	24.7	(0.885)	6.3	(0.525)
Without help	21.5	(0.727)	3.7	(0.319)
With help	3.3	(0.338)	2.6	(0.356)

Assistance on daily activities, by sex

Impairment and sample size	Age 50		Age 70	
	Males	Females	Males	Females
ADL assistance (N=12,050)				
<i>Non-diabetics</i>				
Life expectancy	31.0	33.8	15.3	17.3
Without help	29.5	31.2	13.9	14.8
With help	1.5	2.6	1.4	2.4
With help (%)	4.8%	7.7%	9.0%	13.9%
<i>Diabetics</i>				
Life expectancy	22.7	26.0	9.8	11.9
Without help	21.1	23.0	8.3	9.1
With help	1.6	3.0	1.5	2.8
With help (%)	7.1%	11.6%	15.5%	23.3%
IADL assistance (N=12,065)				
<i>Non-diabetics</i>				
Life expectancy	30.9	33.9	15.3	17.2
Without help	29.0	29.1	13.5	12.7
With help	1.9	4.8	1.8	4.5
With help (%)	6.1%	14.1%	12.0%	26.0%
<i>Diabetics</i>				
Life expectancy	22.8	26.2	9.9	11.8
Without help	21.1	21.6	8.2	7.7
With help	1.7	4.6	1.6	4.1
With help (%)	7.5%	17.4%	16.6%	34.9%

What does this paper add to the literature?

- To my knowledge this is the first study using panel data from a developing country in Latin America that analyzes the effects of diabetes on total and active life expectancy.
 - The paper shows that, in Mexico, diabetes reduces both the total and active life expectancy at age 50 in about 8.7 years for men and 8 years among women. This contrasts with findings from Canada (Bélanger et al. 2002) and United States (Laditka and Laditka 2005) that show a heavier toll for women than for men in terms of total life expectancy.
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Other remarks

- Prevalence data from SABE and MHAS indicate that a large proportion of the remaining lives of those aged 60 are expected to be lived with diabetes. However, there are important differences across settings. Men aged 60 in Havana are expected to live 9.3% of their remaining years with diabetes, while this percentage reaches 21.7% in Mexico City. Among older women, residents in Buenos Aires are expected to live 13.2% of their remaining life with diabetes, but this percentage reaches 22.7% in Bridgetown.
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Final remarks

- Findings from MHAS confirm the previous results in the literature (Bélanger et al. 2002, Jagger et al. 2003, Laditka and Laditka 2005) that diabetes imposes losses of autonomy and reduces active life expectancy.
- Results from MHAS show that diabetes reduces the total life expectancy (at age 50) by about eight years and this reduction is basically in the form of reduction in active life expectancy.

Final remarks

- As shown in the literature, women in Mexico face higher disability burden than men. Women with diabetes at age 50 is expected to live 20% of their remaining lives with limitations on at least one ADL, but their male counterparts will live 12.7% of their remaining years with disability. For non-diabetic women and men the percentages reach 14.8 and 9.3%, respectively.
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Thank you

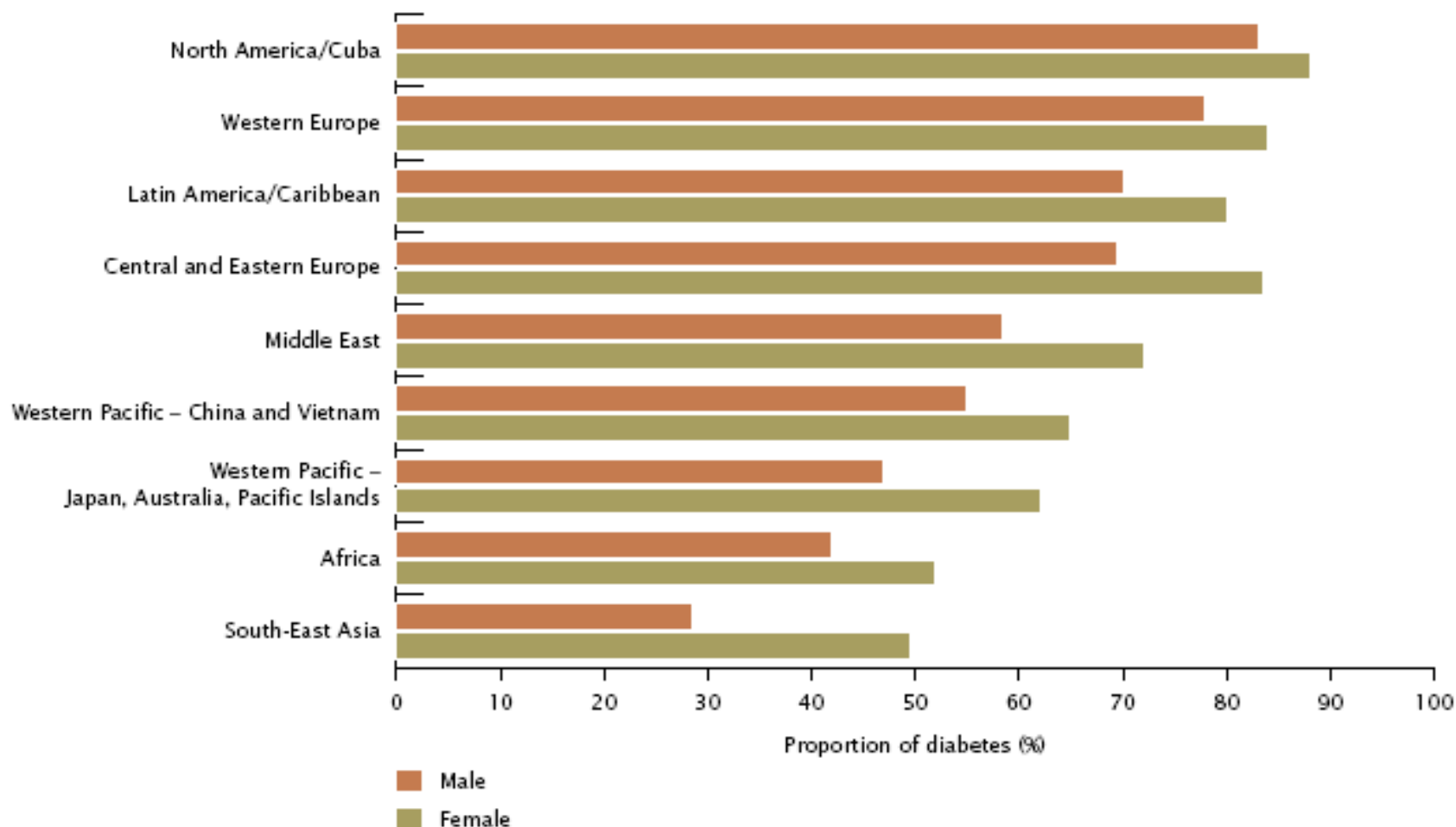


Diabetes: very brief overview

- Diabetes is a metabolic disease characterized by high blood sugar levels.
 - Diabetes results from defects in insulin secretion, or action, or both.
 - Diabetes mellitus is generally recognized to be a result of genetic susceptibility and environmental factors.
 - Type 1 diabetes: the body fails to produce insulin;
 - Type 2: results from insulin resistance combined with relative insulin deficiency.
 - Pre-diabetes: higher levels of blood glucose, but not as high for the diagnosis of type 2 diabetes.
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Diabetes and obesity

Proportion of diabetes (%) attributable to weight gain by region (30+ years)

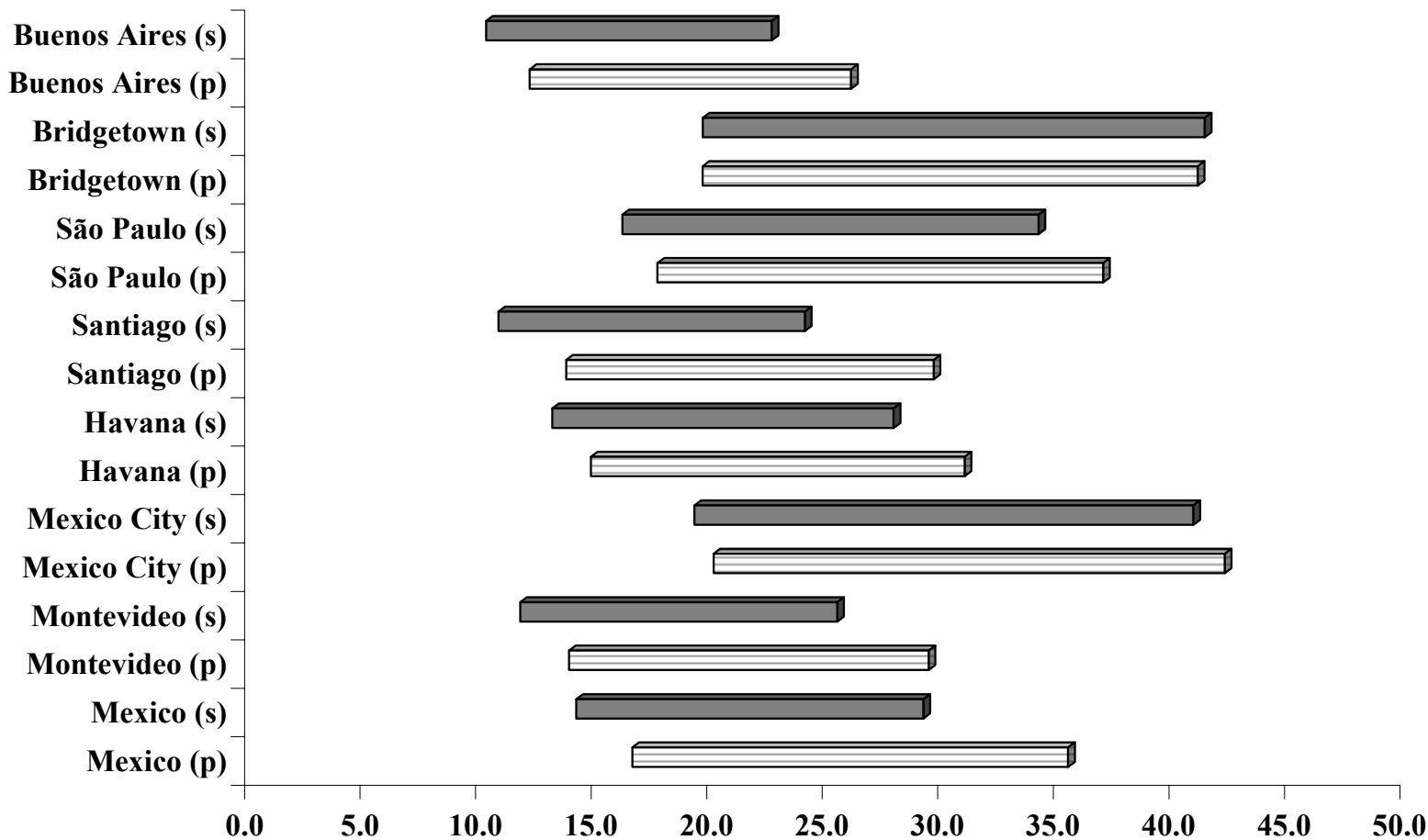


Source: *Diabetes Atlas* second edition, (c) International Obesity Task Force, 2003

Aging, chronic diseases and disability

- Aging is associated with a natural decline in bodily systems. At the same time, it is usually associated with the onset and progression of chronic diseases. Chronic diseases and associated co-morbidities often lead to the impairments, functional limitations and difficulties performing activities of daily life. This progression is well described in the 'disablement process' (Verbrugge and Jette 1994).
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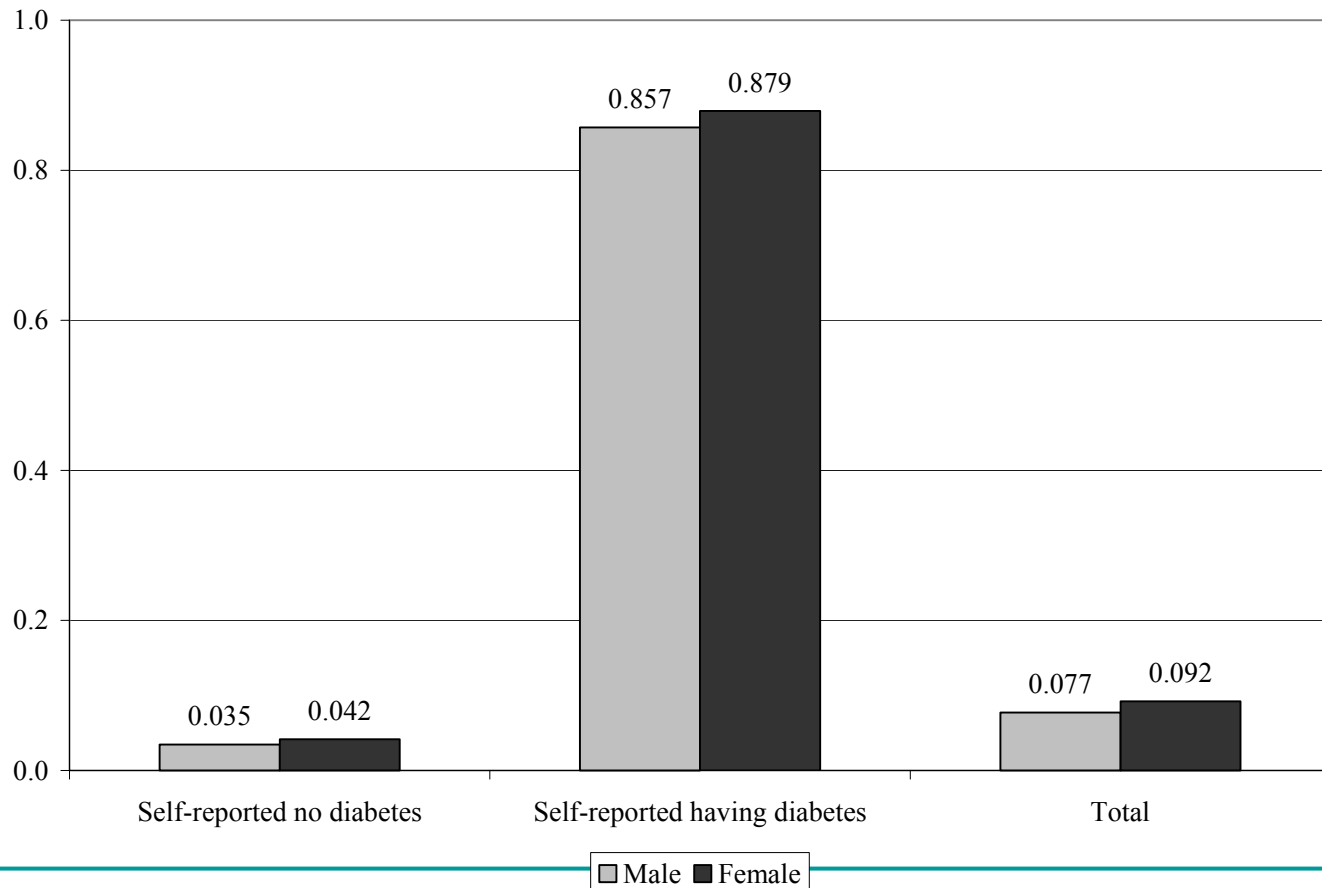
Self-reported and predicted diabetes prevalence rates, and 95% confidence intervals, SABE and MHAS



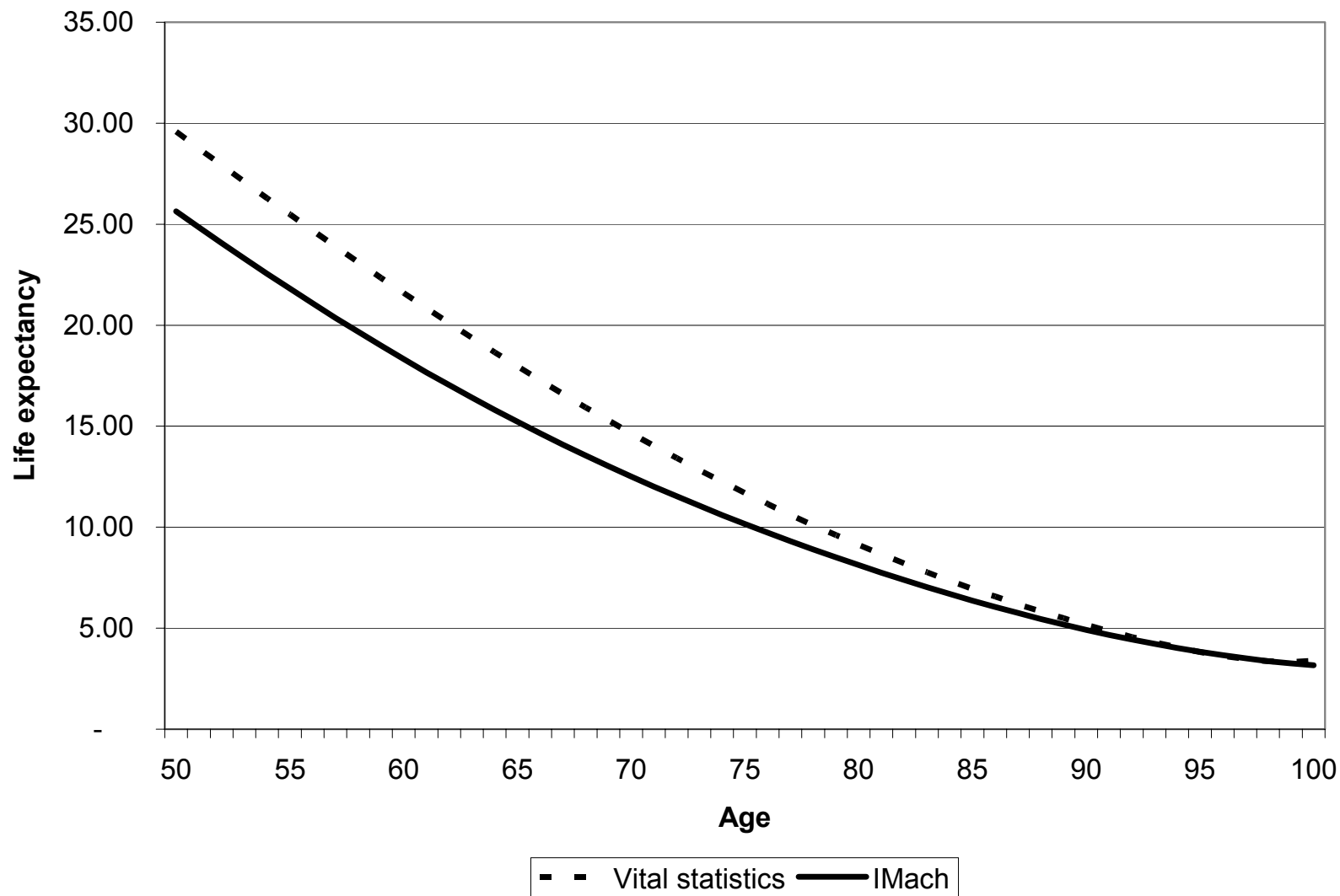
Differences in diabetes-free life expectancy – self-reports and predicted values

	Total life expectancy	Diabetes life expectancy (self-reports)	Diabetes life expectancy (predicted)	Relative difference (%)
Males				
Buenos Aires (Argentina)	17.4	2.4	2.5	5.3
Bridgetown (Barbados)	17.6	3.4	3.5	1.4
São Paulo (Brazil)	17.2	2.9	3.0	4.9
Santiago (Chile)	19.9	2.3	2.7	18.8
Havana (Cuba)	18.2	1.3	1.7	30.5
Mexico City (Mexico)	20.3	4.5	4.4	-2.2
Montevideo (Uruguay)	17.6	2.1	2.4	13.0
Mexico	21.6	3.1	3.4	8.9
Females				
Buenos Aires (Argentina)	22.1	2.5	2.9	18.0
Bridgetown (Barbados)	22.8	5.4	5.2	-3.6
São Paulo (Brazil)	21.9	4.0	4.2	5.5
Santiago (Chile)	24.0	3.3	3.8	17.1
Havana (Cuba)	21.5	4.4	4.5	3.5
Mexico City (Mexico)	22.1	4.6	4.7	1.8
Montevideo (Uruguay)	22.9	3.1	3.5	14.9
Mexico	23.1	4.2	4.6	9.4

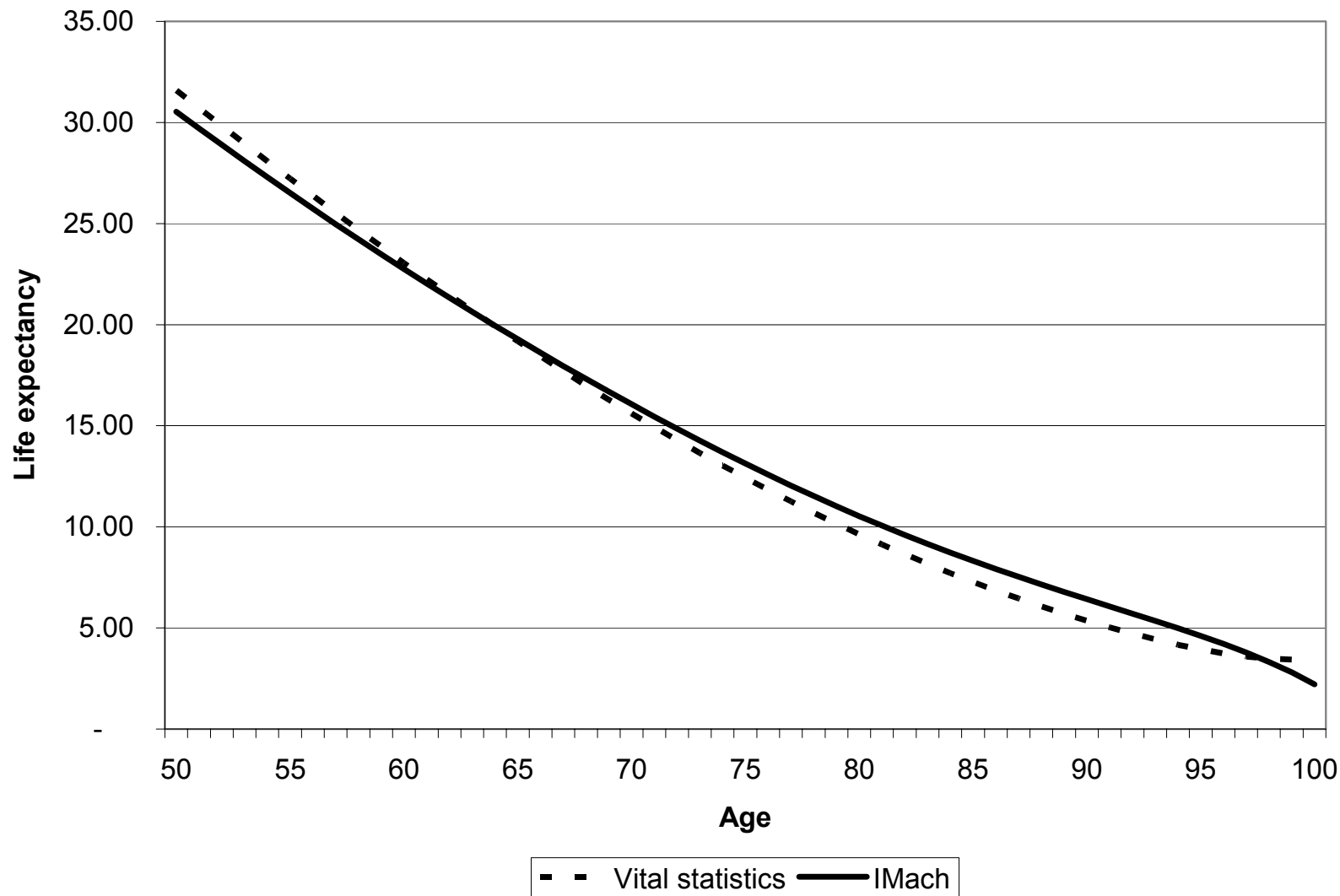
Predicted probabilities of truly having diabetes for an average person based by sex and diabetic status, ENSA 2000



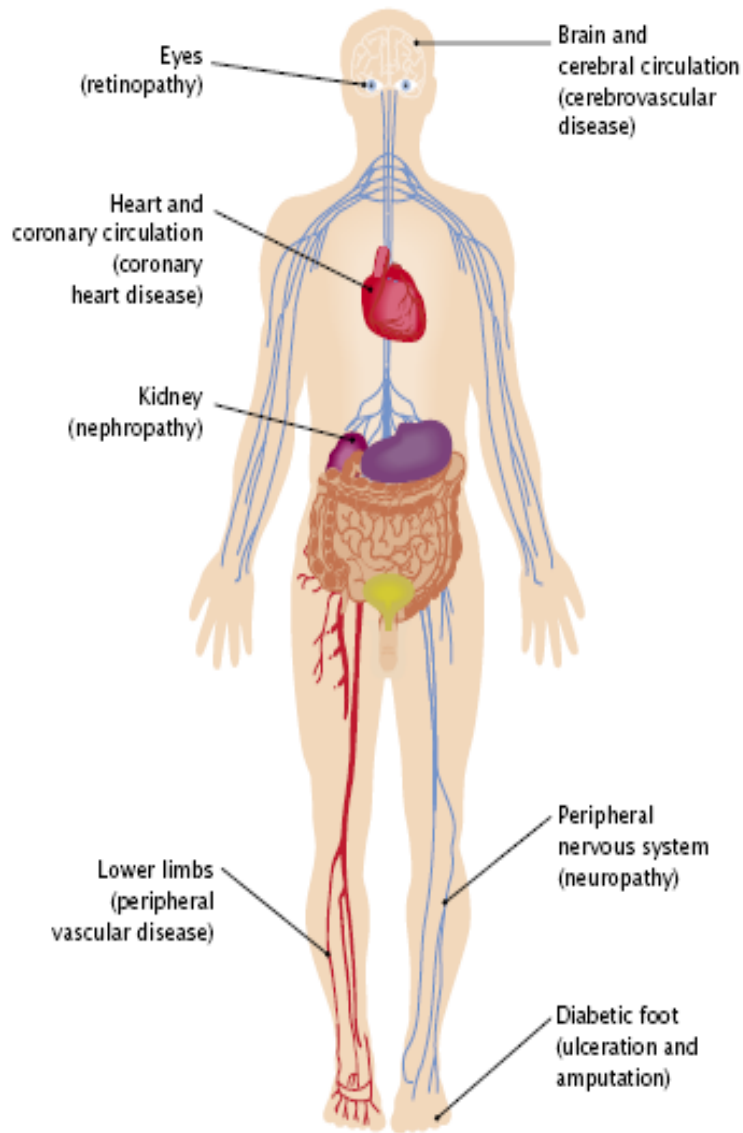
Differences in life expectancy: IMach versus vital statistics, males, Mexico



Differences in life expectancy: IMach versus vital statistics, females, Mexico



Diabetes and comorbidities

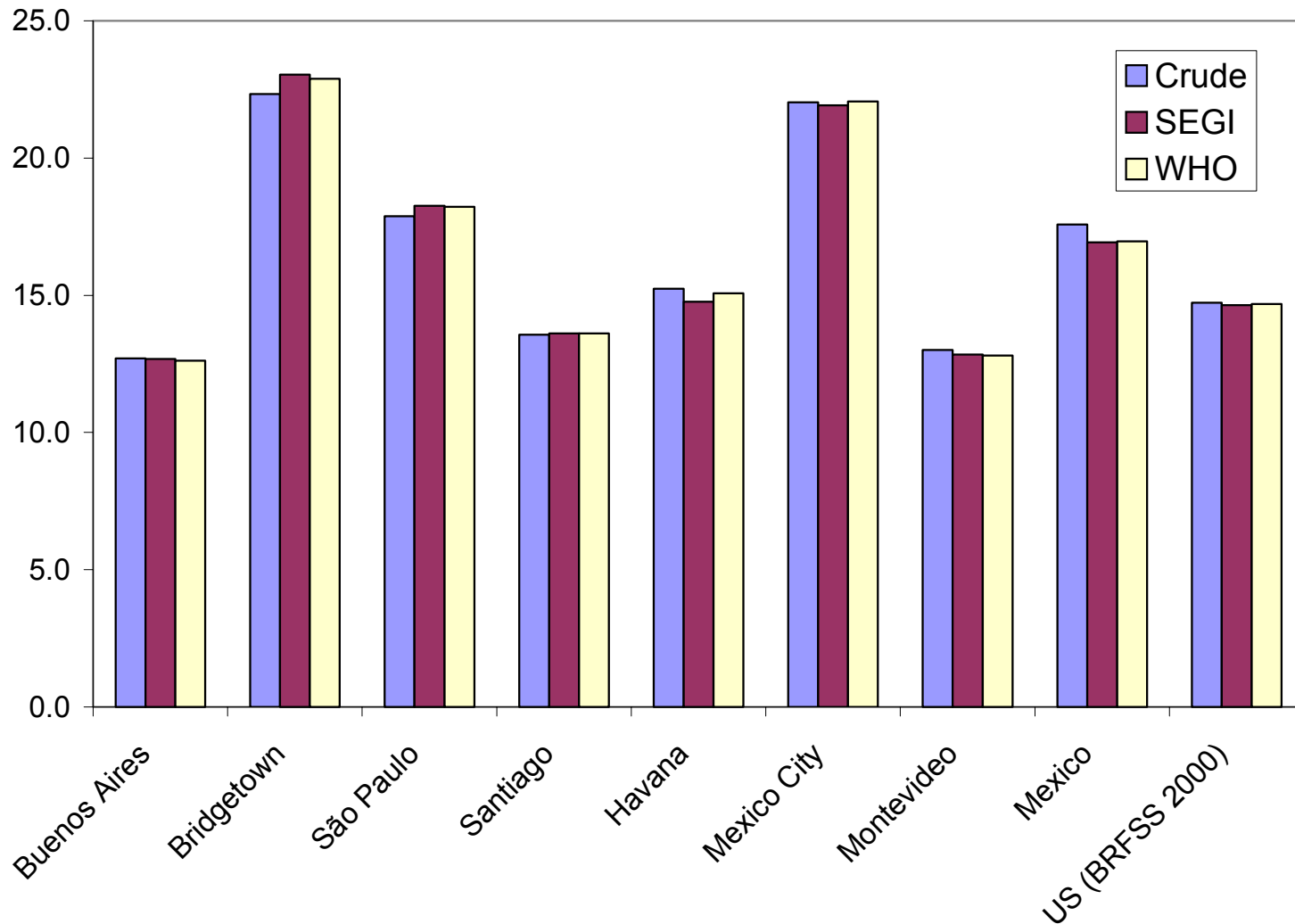


- Usually, functional disability among diabetics is thought to be a consequence of these medical conditions (Gregg et al. 2000, Gregg et al. 2002, Volpato et al. 2002, Egede 2004, Maty et al. 2004).

Diabetes costs

- A recent study conducted by Barceló and colleagues (2003) showed that the total annual cost associated with diabetes was estimated in more than US\$65 billion.
 - Indirect costs contributed to 82% of the overall costs. Indirect costs are due over 330,000 deaths occurring in year 2000 (over 757,000 years of productive life lost) and to approximately 178,000 individuals with permanent disability (over 136,000 years of productive life lost).
 - Direct costs (drugs, consultations and hospitalizations) represented 18% of the overall costs and are estimated at US\$703 per capita annually.
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Prevalence of diagnosed diabetes among elders (60+) in Latin America and the Caribbean – crude and age standardized rates



ADL measures

- SABE: “Here are a few everyday activities. Please tell me if you have any difficulty with these because OF A HEALTH PROBLEM. Exclude any difficulties you expect to last less than three months.”
 - ADL: Do you have difficulty with...?
 - ADL: Yes, no, does not know, NR.
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ADL measures

- MHAS: Only for those with NAGI, except dressing
 - MHAS: **“Please tell me if you have any difficulty with each of the activities I mention. If you do not do any of the following activities, simply tell me. Do not include difficulties that you believe will last less than three months.”**
 - **Because of a health problem, do you have any difficulty...?**
 - **Yes, no, can't do, doesn't do, DK, RF.**
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IADL measures

- SABE: “Here are a few everyday activities. Please tell me if you have any difficulty with these because OF A HEALTH PROBLEM. Exclude any difficulties you expect to last less than three months.”
 - IADL: Do you have difficulty with...?
 - IADL: Yes, no, cannot do it, does not do it, does not know, NR.
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IADL measures

- **MHAS: “Now I am going to mention other activities. Please tell me if you have any difficulty with the activities that I mention to you. If you do not do any of the following activities, simply tell me. Do not include difficulties that you believe will last less than three months.”**
 - **Because of a health problem, do you have any difficulty...**
 - **Yes, no, can't do, doesn't do, DK, RF.**
 - ***Is this because of a health problem?***
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Nagi measures - wording

- SABE: “We need to know about problems that people may have doing certain activities that are important to daily living BECAUSE OF A HEALTH OR PHYSICAL PROBLEM. Please tell me whether you have (at this time) any difficulty doing any of the activities that I am going to mention. EXCLUDE ANY DIFFICULTIES THAT YOU EXPECT TO LAST LESS THAN THREE MONTHS.”
 - Do you have any difficulty....?
 - Yes, no, cannot do it, DK, NR.
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Nagi measures - wording

- MHAS: “Please tell me if you have any difficulty in doing each of the daily activities that I am going to read. Don’t include difficulties that you believe will last less than three months.”
 - Because of a health problem, do you have difficulty with....?
 - Yes, no, cannot do it, does not do it, DK, RF.
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