

Global burden of disease attributable to diabetes mellitus in Brazil

Carga global de doença devida e atribuível ao diabetes mellitus no Brasil

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Abstract

Type II diabetes mellitus accounts for 90% of all cases of diabetes, and its inclusion in health evaluation has shown that its complications have a considerable impact on the population's quality of life. The current article presents the results of the Global Burden of Disease Study in Brazil for the year 1998, with an emphasis on diabetes mellitus and its complications. The indicator used was disability-adjusted life years (DALY), using a discount rate of 3%. In Brazil, ischemic heart disease, stroke, and diabetes accounted for 14.7% of total lost DALYs. Brazil showed a higher proportion of years lived with disability (YLDs) among total DALYs for diabetes as compared to other countries. Retinopathy and neuropathy were the complications that contributed most to YLDs. According to forecasts, diabetes mellitus will have an increasing impact on years of life lost due to premature death and disability in the world, shifting from the 11th to 7th cause of death by 2030. It is thus urgent to implement effective measures for prevention, early diagnosis, counseling, and adequate follow-up of patients with diabetes mellitus.

Diabetes Mellitus; Potential Years of Life Lost; Cost of Illness

Introduction

Diabetes mellitus is a worldwide public health problem and one of the main chronic syndromes currently affecting humankind, regardless of socioeconomic status and geographic location. The syndrome has a multiple etiology, resulting from lack of insulin and/or the inability of insulin to adequately exert its effects. Diabetes mellitus is characterized by chronic hyperglycemia, frequently accompanied by dyslipidemia, arterial hypertension, and endothelial dysfunction ¹.

Diabetes is classified in two main types: type I, which appears most frequently during childhood or adolescence; and type II, related to obesity and physical inactivity. Type II diabetes mellitus accounts for approximately 90% of all cases of diabetes and occurs most frequently after 40 years of age ^{2,3}.

Various factors are associated with increased prevalence of diabetes mellitus in recent decades, including the increase in population life expectancy, along with growing intake of saturated fat, physical inactivity, and obesity ^{4,5,6,7}. Other factors like progressive urbanization, leading to changes in lifestyle and cultural habits and stress in large cities, have been identified as triggering factors for diabetes in individuals with genetic susceptibility ^{8,9,10}. The inclusion of chronic non-communicable diseases, especially diabetes, in the current health profile of populations is extremely relevant in light of estimates by the World

Health Organization (WHO) that non-communicable diseases currently account for 58.5% of all deaths and 45.9% of the global burden of disease, as expressed by disability-adjusted life years (DALYs) ⁴.

According to estimates, in 1995 diabetes mellitus affected 4% of the world's adult population, while by 2025 this proportion may increase to 5.4%, or approximately 300 million people. The largest share of this increase will occur in developing countries, which is expected to show the same current pattern of concentration of cases in the 45-64-year age group ^{10,11,12}.

In Brazil, the most comprehensive study on diabetes mellitus prevalence was conducted in 1988, in nine State capitals. Estimated prevalence was 7.5% in individuals 30-69 years of age, with the highest prevalence (17.4%) in the 60-69-year age group ¹³.

Studies suggest that diabetics are two to four times more likely to die of heart disease (as compared to non-diabetics), and four times more likely to present peripheral vascular disease and stroke ^{14,15,16,17,18,19}. Some 30% of patients in peritoneal dialysis, hemodialysis, and transplant programs in the United States are diabetics ²⁰, and 50% of non-trauma amputations in the United States are in diabetics ^{21,22}. According to WHO estimates, 15 years after onset of the disease, 2% of diabetics have developed blindness and 10% severe visual impairment. Additionally, 30-45% display some degree of retinopathy, 10-20% nephropathy, 20-35% neuropathy, and 10-25% cardiovascular disease ^{10,11}.

Meanwhile, studies have shown a strong association between various non-communicable diseases like cardiovascular diseases, respiratory diseases, and diabetes and a relatively small set of risk factors, especially smoking, excess alcohol consumption, overweight, hypertension, hypercholesterolemia, low consumption of fruit and vegetables, and physical inactivity ²³.

The current article presents the results of the Global Burden of Disease Study in Brazil for the year 1998 with an emphasis on diabetes mellitus and its complications as the most important cause of healthy years of life lost to premature death or disability in the country (available at <http://www.ensp.fiocruz.br/projetos/carga/apresentacao.htm>).

Material and methods

The Global Burden of Disease Study in Brazil was conducted by the National School of Public Health, Oswaldo Cruz Foundation (ENSP/FIOCRUZ) from 2000 to 2002. The study was

approved by the Research Ethics Committee of the ENSP/FIOCRUZ, under protocol number 42/2001. In this study, the methodology developed by Murray & Lopez ²⁴ was adapted to the Brazilian context, aiming to establish the dimension of relevant health problems for the country as well as for each of its five major regions.

The indicator used in these studies was the DALY, which extends the concept of potential years of life lost due to premature death (Murray & Lopez ²⁴) to include equivalent years of healthy life lost due to health problems or disability. The number of DALYs was calculated by the sum of the two portions: years of life lost due to premature death (years of life lost – YLL) and years of life lost due to disability (years lived with disability – YLD).

An important concept incorporated into each of the two DALY components is the discount rate ^{25,26}, which refers to the practice of assigning a lower value to years of life lost in the future as compared to the present ²⁷. For the purposes of the Global Burden of Disease Study, a panel of health cost-effectiveness experts recommended a 3% discount rate ²⁸.

Global burden of disease studies classify the causes of years of life lost to premature death or disability in three major groups: Group I, which includes infectious and parasitic diseases, maternal causes, perinatal causes, and nutritional deficiencies; Group II, chronic non-communicable diseases; and Group III, external causes. These three major groups are subdivided into subgroups, for example Group II is subdivided into I.C – diabetes mellitus, among other subdivisions. In all, this study covered 113 diseases or health problems.

The mortality data used to estimate YLL are from the national Mortality Information System/Unified National Health System (SIM/SUS). For the Global Burden of Disease Study in Brazil, specific procedures were adopted in the mortality component, including three phases: (a) correction for under-recording of deaths; (b) reallocation of garbage codes; and (c) redistribution of ill-defined signs, symptoms, and conditions (chapter XVIII of the 10th Revision of the International Classification of Diseases – ICD-10 ²⁹).

For morbidity (YLD), specific clinical/epidemiological parameters were collected from a number of data bases as well as from the scientific literature in order to provide estimates, particularly of incidence and duration, which are used in the formula to calculate the YLD by cause of disease, sex, age group, and geographic region of the country.

In the case of diabetes mellitus, the number of YLD was calculated for diabetes cases and sequel-

ae, like retinopathy, amputation, and neuropathy. Estimates included uncomplicated cases of diabetes, diabetic neuropathy, retinopathy with moderate loss of vision, retinopathy with blindness (severe loss of vision), amputation (toes, ankle, foot, leg, and thigh) and diabetic foot.

A public-domain software called DISMOD II (Barendregt J. Department of Public Health, Erasmus University, Rotterdam, Netherlands), was used to estimate unavailable parameters and ensure the consistency of available information, estimating the final parameters for the respective diseases.

Future scenarios were taken into consideration to project the global burden of disease, so as to evaluate the future impacts of diseases and other health problems on the Brazilian population. The methodology was based on the description of mortality rate tendencies and their extrapolation as described by Leite et al.³⁰

Since data are scarce on type I diabetes mellitus in Brazil and prevalence is low, cases of diabetes and sequelae were only modeled for type II diabetes mellitus. Cases of chronic renal failure secondary to diabetes were included among renal diseases, as recommended by the authors of global burden of disease studies³¹ and were not the object of analysis in the current study.

Table 1 provides a summary of the main information raised through a systematic literature review on the clinical/epidemiological parameters used to estimate the DALYs for each complication or sequelae related to diabetes mellitus.

Results

Table 2 shows the mortality rates and the absolute number of YLLs, YLDs, and DALYs according to major groups of causes and diabetes mellitus by sex. Group II accounts for a large share of the total estimated disease burden, with 66.3% of the DALYs. Groups I and III accounted for 23.5% and 10.2%, respectively. Diabetes showed mortality rates ranging from 0.2 e 0.3 per thousand inhabitants and accounted for 5.1% of the estimated DALYs (6% for women and 4.4% for men). The proportion of YLD in DALY is a much higher percentage than the proportion of YLL in DALY: 73.4%, 71.6%, and 72.5% for men, women, and both sex, respectively (Tabela 3).

Figure 1 shows the share of diabetes mellitus in total DALYs by sex, age, and major region of the country. As shown, there was no marked difference by sex. However, age plays an important role in terms of DALYs, with a high burden of disease for diabetes mellitus in the 45-59 and 60-69-year age brackets. Importantly, one cannot ignore the

impact of diabetes mellitus on the latter two age groups, given that based on the methodology used in burden of disease studies, the older individuals are, the less they lose in terms of DALYs.

Unlike other regions of Brazil, in the Northeast a large share of total DALYs lost to diabetes were in the mortality component (YLL)(Table 3).

Table 3 shows diabetes mellitus sequelae by sex for Brazil as a whole and by region. Diabetic retinopathy and neuropathy were relevant consequences of the disease and underlying causes of loss of quality of life in all regions of the country. The national average was 24.7% of all YLD from diabetes mellitus due to retinopathy, with the highest proportion observed in the North (28.2%) and the lowest in the Northeast (18.7%). For diabetic neuropathy, the proportion varied from 11.4% in the Northeast to 13.4% in the Southeast (Table 3).

Table 4 shows the four principal causes of lost DALYs in Brazil according to sex and the projection of these diseases for the year 2013. Diabetes mellitus was the leading cause of lost DALYs for both sexes in 1998 and is estimated to remain in the same position in 2013, with an increase of 29.6% in 15 years. The largest proportional increase in relation to 1998 (35.1%) is projected for men, with diabetes mellitus moving from fourth to second cause by 2013.

Discussion

In the European Global Burden of Disease Study in 2000, cardiovascular diseases, cancer, and diabetes accounted for approximately 32% of total DALYs³². In burden of disease studies in Australia and the Netherlands^{33,34}, ischemic heart disease/stroke and diabetes mellitus accounted for 20.8% and 20.3% of total DALYs, respectively. In Brazil, the proportion is 14.7% for the combination of ischemic heart disease, stroke, and diabetes (data not shown).

Analyzing the share of diabetes mellitus in total DALYs due to all causes, in the 1990 Global Burden of Disease Study, diabetes accounted for 1.4% of total DALYs in Latin America and the Caribbean³¹. However, in the 1994 Global Burden of Disease Study in the Netherlands, the share was 3.4%³⁴. In 2001, in the developed countries, diabetes mellitus accounted for 2.8% of total lost DALYs³⁵.

Results similar to those found in the current study (5.1%) were observed in the Global Burden of Disease Study in Australia in 1996, where the share was approximately 5% for men and women combined, and also for men and women separately³³.

Table 1

Parameters used to estimate disability-adjusted life years (DALYs) for each complication or sequelae related to diabetes mellitus. Brazil, 1998.

	Uncomplicated cases	Amputations	Retinopathy with moderate loss of vision	Retinopathy with blindness	Diabetic neuropathy	Diabetic foot
Definition	Syndrome with a multiple etiology resulting from lack of insulin and/or inability of insulin to produce its effects ¹	Hospitalization from included amputation at the level of the ankle, foot, knee, toe, or thigh	Great difficulty in reading small print in newspapers or difficulty in recognizing faces at 4 meters distance. Visual acuity ranging from 20/80 to 20/160 using prescription eyeglasses	Individuals incapable of reading, with great difficulty recognizing persons at 4 meters distance. Visual acuity less than or equal to 20/200 using prescription eyeglasses	Presence of signs or symptoms of neurological dysfunction in patients with diabetes mellitus after excluding other causes	Consequence of coexistence of vascular insufficiency and neuropathy ^{47,48 *}
Incidence	**	Total cases hospitalized in the year 2000	After 10 years of evolution, 58% of incident cases of diabetes develop retinopathy ^{49 ***}	**		After 15 years of evolution, 55.5% present peripheral vascular disease (diabetic foot) ⁵⁰
Prevalence	Parameters based on last national survey ⁵¹	Incidence multiplied by duration	After 10 years of evolution, present in 58% of prevalent cases of diabetes, as mild or moderate ^{49 ***}	Prevalence zero up to 29 years, and 2.1% of blindness among diabetics 30 years or older ⁵²	Based on odds of prevalent cases of diabetic neuropathy and diabetes cases estimated in countries with established market economies ^{31 #}	**
Duration	Parameters from Australian Global Burden of Disease Study ³³		Duration of cases of uncomplicated diabetes resulting from modeling with the DISMOD II software for Brazil			0.2 years ³¹ or estimates from DISMOD II software for Australia ³³
Remission		Zero		**	Zero	**
Relative risk		5.0 ⁵³	2.0 ⁵³	2.0 ⁵³	2.0 ⁵³	2.0 ⁵³
Mortality	SIM/SUS			DISMOD II		
Proportion of treatment	27.5% of patients treated			**		

SIM/SUS: Mortality Information System/Unified National Health System.

* Principal complications: ulcers, gangrene, chronic sensory-motor neuropathy, autonomic neuropathy, peripheral vascular disease, repetitive painless fractures (Charcot joints), abnormal proprioception, and diabetic mononeuropathy. The International Classification of Diseases, 10th Revision (ICD-10) ²⁹ codes were defined for diabetic foot (listed above), which in some cases included ICD-10 codes already selected for diabetic neuropathy, since the two complications are not mutually exclusive;

** Parameters not used;

*** As a function of advanced age, it was assumed that only 30% of the incident cases in the last age group would develop the disease;

These values were applied to the total prevalence of diabetes estimated by the Global Burden of Disease Study for Brazil ³¹, obtaining the estimated prevalence of diabetic neuropathy in Brazil in 1998. We opted to use the data from the global burden of disease/established market economies and not Latin America, because for chronic non-communicable diseases like diabetes, the epidemiological transition in Brazil is more consistent with the pattern in First World countries.

Table 2

Mortality rate, absolute number, and percentage of all-cause and diabetes mellitus years of life lost (YLL), years lived with disability (YLD) and disability-adjusted life years (DALYs), according to sex. Brazil, 1998.

Gender/Specification	Mortality rate *	Number of YLL	YLLs/DALYs	Number of YLD	YLD/DALYs	Number of DALYs	Total DALYs (%)
Male							
All causes	8.1	10,996,759	54.4	9,224,311	45.6	20,221,071	100.0
Group I	1.6	2,842,218	65.2	1,519,743	34.8	4,361,962	21.6
Group II	5.3	5,797,516	45.3	6,997,201	54.7	12,794,717	63.3
Diabetes mellitus	0.2	235,897	26.6	651,105	73.4	887,002	4.4
Group III	1.2	2,357,025	76.9	707,366	23.1	3,064,392	15.2
Female							
All causes	5.9	7,034,511	40.7	10,262,656	59.3	17,297,168	100.0
Group I	1.2	2,098,198	47.2	2,345,053	52.8	4,443,251	25.7
Group II	4.5	4,513,813	37.4	7,558,954	62.6	12,072,767	69.8
Diabetes mellitus	0.3	295,588	28.4	746,773	71.6	1,042,360	6.0
Group III	0.2	422,501	54.1	358,649	45.9	781,150	4.5
Both sexes							
All causes	7.0	18,031,271	48.1	19,486,968	51.9	37,518,239	100.0
Group I	1.4	4,940,416	56.1	3,864,796	43.9	8,805,213	23.5
Group II	4.9	10,311,329	41.5	14,556,156	58.5	24,867,484	66.3
Diabetes mellitus	0.3	531,485	27.5	1,397,878	72.5	1,929,362	5.1
Group III	0.7	2,779,526	72.3	1,066,016	27.7	3,845,541	10.2

* Mortality rate per 1,000 inhabitants.

Mortality due to diabetes does not reflect the entire magnitude of the burden resulting from the disease, since a large share of individuals present long-term complications and thus account for an important proportion of the morbidity (YLD).

In relation to the YLL and YLD components in the more overall context of total DALYs for diabetes, in Australia a high percentage was due to morbidity: 58.4%, 59.3%, and 57.4% for both sexes combined, men, and women, respectively³³. Similar results were observed in the Global Burden of Disease Study in the Netherlands for both sexes (60.5%)³⁴. The share of the YLD component was higher in the present study: 72.5%, 73.4%, and 71.6% for the total, men, and women, respectively.

The higher share of YLDs in total DALYs for diabetes mellitus in Brazil as compared to other countries (Australia and the Netherlands) may be due to the existence of numerous sub-clinical cases (30-50% of all cases in most populations) and often with an apparently benign clinical course, with silent onset and late complications. Diabetes mellitus jeopardizes the lives of a huge contingent of individuals, leading to permanent reduction in their quality of life².

As for the proportional share of diabetes mellitus in Group II and according to age group, there

was an important increase in the proportional distribution of DALYs lost to diabetes mellitus in Group II in the 45-59 and 60-69 year age groups.

The Global Burden of Disease Study in Australia³³ also showed an increasing share of diabetes in the wider context of Group II when comparing the 15-34 and 35-54-year age brackets, among men (1% and 6.6%, respectively) and women (1.7% and 5.5%, respectively). A smaller increase was also observed in the 1990 Global Burden of Disease Study for the entire world³¹, with proportions of 1.3% and 2.7% for the 15-44 and 45-59-year brackets among men and 1.3% and 3.6%, respectively, for the same age brackets in women.

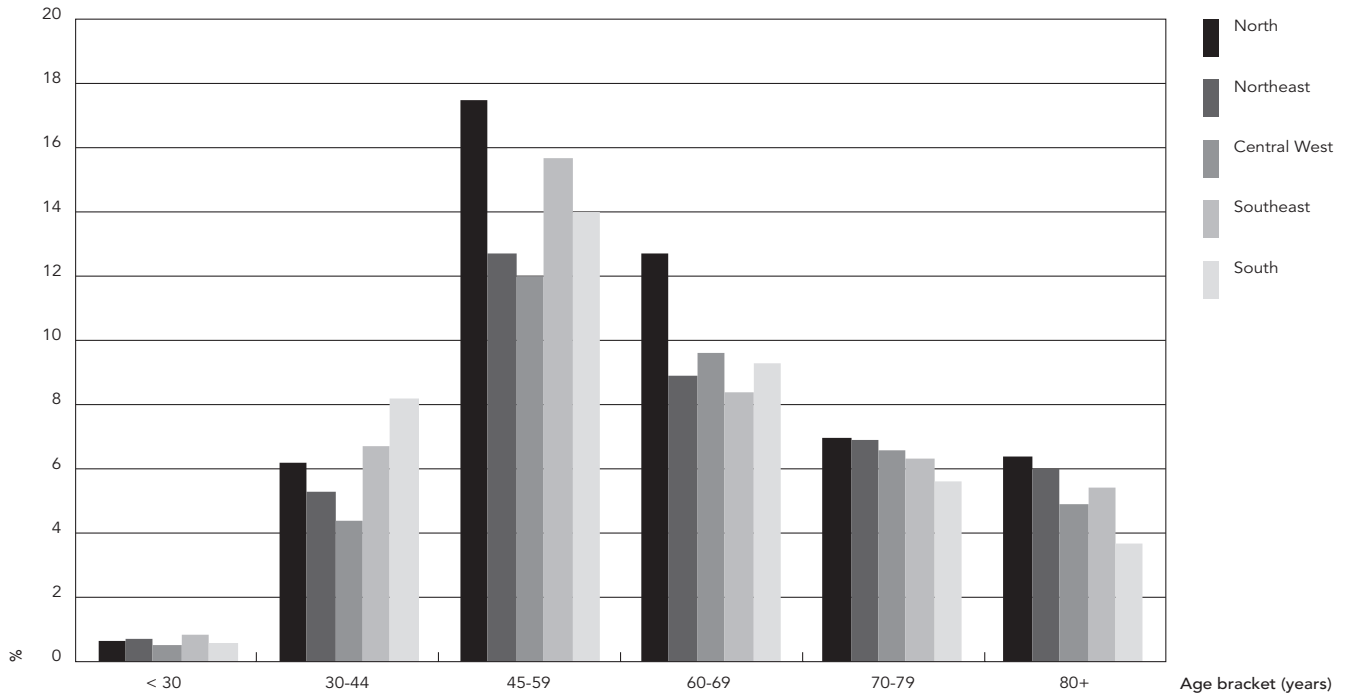
Among the principal complications of diabetes, retinopathy (24.7%) and neuropathy (12.8%) contributed the most to the morbidity component (YLD). These results were similar to those for diabetic neuropathy in the Australian study³³, in which 9.6% of the total YLDs due to diabetes were associated with this sequela. For retinopathy, the proportion in Australia (13%) was lower than in Brazil (24.7%).

Forecasts indicate a growing impact of diabetes mellitus as a relevant cause of years of life lost to premature death and disability by 2013 and point to the need for specific health measures aimed at reducing its future prevalence, with the

Figure 1

Proportional distribution of disability-adjusted life years (DALYs) lost to diabetes mellitus in Group II, non-communicable diseases by sex, age, and major geographic areas of Brazil, 1998.

1a) Males



1b) Females

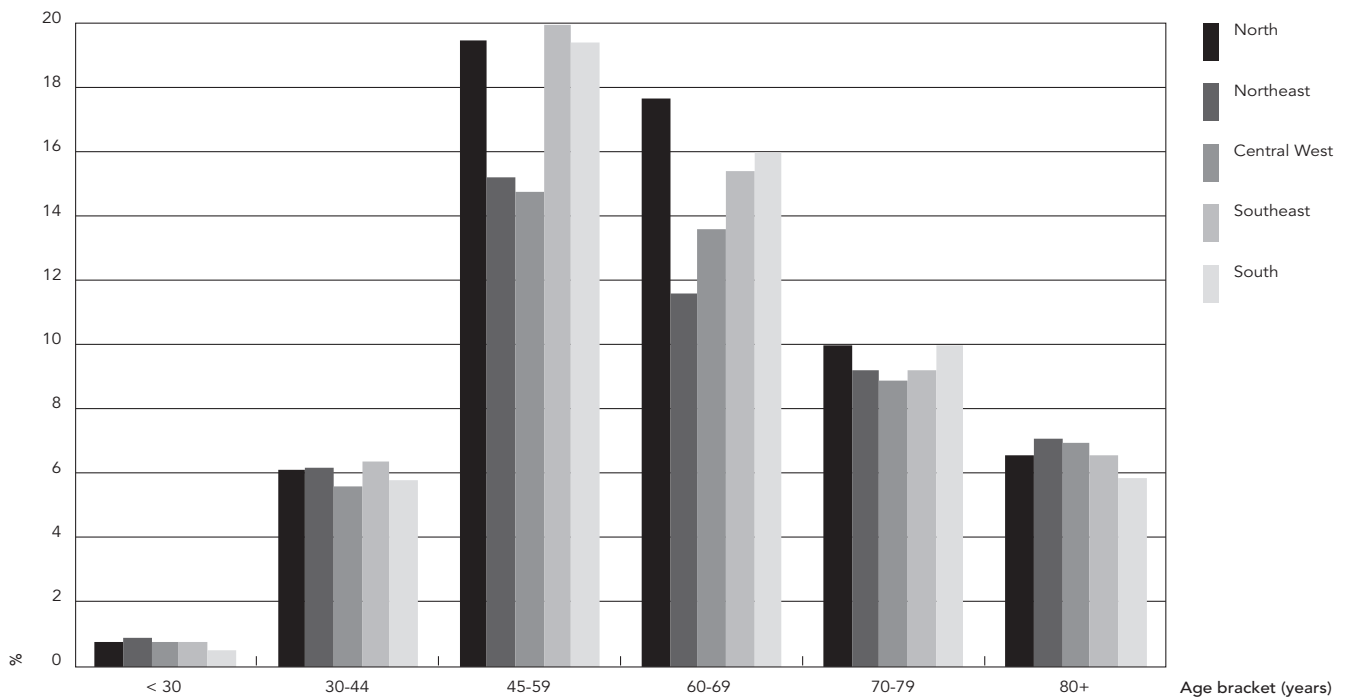


Table 3

Number of deaths, years of life lost (YLL), years lived with disability (YLD), and disability-adjusted life years (DALYs), and proportional distribution of YLL and YLD according to groups of sequelae of diabetes mellitus among total DALYs, by sex and major geographic regions of Brazil, 1998.

Gender/ Disease categories	North		Northeast		Central West		Southeast		South		Brazil	
	Number	%	Number	%	Number	%	Number	%	Number	%	Number	%
Male												
Number of deaths	821		7,090		843		7,165		2,145		18,064	
Total YLL	10,961	20.6	87,183	40.4	11,641	27.3	97,890	22.4	28,221	20.5	235,897	26.6
Total YLD	42,329	79.4	128,467	59.6	30,991	72.7	339,831	77.6	109,487	79.5	651,105	73.4
YLD (cases)	16,874	31.7	50,895	23.6	12,213	28.6	141,347	32.3	45,753	33.2	267,081	30.1
YLD (diabetic foot)	200	0.4	510	0.2	145	0.3	1,863	0.4	678	0.5	3,397	0.4
YLD (neuropathy)	6,378	12.0	24,464	11.3	4,947	11.6	55,700	12.7	17,851	13.0	109,340	12.3
YLD (blindness)	2,886	5.4	9,236	4.3	2,651	6.2	23,140	5.3	7,420	5.4	45,333	5.1
YLD (retinopathy)	15,921	29.9	42,650	19.8	11,017	25.8	114,452	26.1	37,487	27.2	221,527	25.0
YLD (amputation)	69	0.1	712	0.3	18	0.0	3,330	0.8	298	0.2	4,427	0.5
Total DALYs	53,290	100.0	215,650	100.0	42,632	100.0	437,722	100.0	137,708	100.0	887,002	100.0
Female												
Number of deaths	1,121		10,302		1,112		10,088		3,111		25,734	
Total YLL	13,925	25.7	114,327	44.2	14,354	29.4	117,756	22.8	35,226	21.4	295,588	28.4
Total YLD	40,267	74.3	144,149	55.8	34,467	70.6	398,180	77.2	129,709	78.6	746,773	71.6
YLD (cases)	15,900	29.3	57,318	22.2	13,496	27.6	162,342	31.5	52,364	31.7	301,419	28.9
YLD (diabetic foot)	181	0.3	525	0.2	125	0.3	1,842	0.4	772	0.5	3,445	0.3
YLD (neuropathy)	6,908	12.7	29,759	11.5	5,655	11.6	72,425	14.0	22,251	13.5	136,998	13.1
YLD (blindness)	2,655	4.9	9,859	3.8	2,557	5.2	23,479	4.6	7,396	4.5	45,947	4.4
YLD (retinopathy)	14,416	26.6	46,152	17.9	12,623	25.9	135,930	26.3	46,774	28.4	255,895	24.5
YLD (amputation)	208	0.4	535	0.2	10	0.0	2,162	0.4	151	0.1	3,067	0.3
Total DALYs	54,192	100.0	258,476	100.0	48,821	100.0	515,936	100.0	164,935	100.0	1,042,360	100.0
Both sexes												
Number of deaths	1,942		17,392		1,955		17,253		5,256		43,798	
Total YLL	24,886	23.2	201,510	42.5	25,995	28.4	215,646	22.6	63,447	21.0	531,485	27.5
Total YLD	82,596	76.8	272,616	57.5	65,458	71.6	738,012	77.4	239,196	79.0	1,397,878	72.5
YLD (cases)	32,773	30.5	108,213	22.8	25,708	28.1	303,689	31.8	98,117	32.4	568,501	29.5
YLD (diabetic foot)	381	0.4	1,035	0.2	270	0.3	3,706	0.4	1,450	0.5	6,842	0.4
YLD (neuropathy)	13,286	12.4	54,223	11.4	10,603	11.6	128,124	13.4	40,102	13.3	246,338	12.8
YLD (blindness)	5,541	5.2	19,095	4.0	5,208	5.7	46,619	4.9	14,817	4.9	91,280	4.7
YLD (retinopathy)	30,337	28.2	88,802	18.7	23,640	25.8	250,381	26.3	84,262	27.8	477,422	24.7
YLD (amputation)	277	0.3	1,247	0.3	28	0.0	5,493	0.6	449	0.1	7,494	0.4
Total DALYs	107,482	100.0	474,126	100.0	91,453	100.0	953,658	100.0	302,643	100.0	1,929,362	100.0

intensification of surveillance and control activities. Problems related to difficulties in access to health services and human resources training also need to be solved.

Mathers & Loncar³⁶ prepared new mortality and burden of disease forecasts for 2030, based on WHO estimates for 2002. According to these authors, in 2002 diabetes mellitus was 11th among the 15 main causes of death, and they predicted that by 2030 the disease would increase to 7th place (3% of total DALYs). According to their forecasts for 2030, diabetes mellitus is expected to occupy 4th (4.8%), 6th (3.7%), and 9th places

(2.1%), respectively, in high, medium, and low-income countries.

Some potential limitations of the current study may lead to the underestimation of the burden of diabetes. The first relates to prevalence estimates for type I diabetes mellitus (which mainly affects children and adolescents and accounts for about 10% of cases), which was not included in the present study. As a matter of fact, some diabetes mellitus type I cases can occur later in life and may be confused with type II diabetes. Therefore, it is possible that some type I cases were unintentionally included in

Table 4

Absolute number of disability-adjusted life years (DALYs) estimated for 1998 and projected for 2013 and ranking of the four main causes of lost DALYs with the total increase for 15 years (1998-2013).

Gender/Disease categories	1998		2013		Total 15-year increase (%)
	Number of DALYs	Ranking	Number of DALYs	Ranking	
Both sexes					
All causes	37,518,239	-	40,177,049	-	7.1
Diabetes mellitus	1,929,362	1	2,501,066	1	29.6
Ischemic heart disease	1,886,374	2	1,959,036	2	3.9
Stroke	1,722,700	3	1,799,143	3	4.4
Recurrent depressive disorder	1,439,654	4	1,675,997	4	16.4
Male					
All causes	20,221,071	-	22,043,997	-	9.0
Violence	1,127,432	1	1,211,694	1	7.5
Diabetes mellitus	887,002	4	1,198,351	2	35.1
Ischemic heart disease	1,125,769	2	1,189,652	3	5.7
Stroke	938,656	3	1,004,468	4	7.0
Female					
All causes	17,297,168	-	18,133,052	-	4.8
Diabetes mellitus	1,042,360	2	1,302,715	1	25.0
Recurrent depressive disorder	1,090,559	1	1,239,262	2	13.6
Stroke	784,044	3	794,675	3	1.4
Ischemic heart disease	760,605	4	769,384	4	1.2

our estimations. On the other hand, we did not consider cases among adolescents and young adults, despite the recent increase in the prevalence of type II diabetes in this population. However, this limitation should be considered relatively less important, since type II diabetes accounts for some 90% of cases and typically affects “mature” adults (30 years or over), with a specific presentation and clinical evolution according to age group. The contrast between children/adolescents and “young” adults (30-44 years) is striking, with an important increase in the absolute and proportional number of DALY when moving from “young” adults (30-44 years) to “mature” adults (45-59 years).

The second potential limitation relates to the use of outdated prevalence rates for diabetes mellitus, since the last population-based multicenter study in Brazil was held in 1989. The blood glucose cutoff point used that year for defining an individual as diabetic was greater than or equal to 140mg/dL. This cutoff point was later reduced to 126mg/dL. Therefore, the global burden of disease related to diabetes mellitus is probably underestimated, since the prevalence rates used refer to 1989.

The third potential limitation is the lack of nationwide clinical/epidemiological parameters

for complications of the disease, since there are few population-based studies in Brazil that assess such complications.

In addition, due to the scarcity of data, some parameters for specific locations were expanded to an entire geographic region of the country. Another potential limitation was the underreporting of diabetes as the primary cause of death in the mortality information system.

Under-recording of diabetes mellitus in mortality statistics has been described frequently in the literature^{37,38}. Studies show that in 40-60% of cases the disease is omitted from death certificates and is recorded as the primary cause in fewer than 10%^{39,40,41}. Global burden of disease studies do not use co-morbidities, and thus only use primary causes of death for each of the 113 problems and sequelae selected for the study. Diabetes mellitus was no exception to this rule. Global burden of disease research methods need to be developed to deal with co-morbidities.

An important point involves the distinct stages in the epidemiological transition in different regions of Brazil and their relation with the quality of the information systems. The Northeast region still presents conditions that affect loss of quality of life like “asphyxia and birth trauma” as compared to the other regions

of Brazil, where non-communicable diseases (included in Group II) are more relevant. In addition, factors used to adjust for under-recording of deaths and the proportional distribution of ill-defined causes were also highest in the Northeast of Brazil, thus indicating worse quality in the morbidity and mortality information systems, besides an important delay in the reporting flow. This may have biased the estimates of global burden in these areas.

In recent decades, profound changes in diet quality and quantity, together with reduced physical activity in the overall population, have led to an increase in the prevalence of diabetes and its complications, and in turn to high costs for health systems⁴² and increased suffering for

thousands of individuals. This increase in diabetes thus represents an additional burden for society due to decreased work productivity, early retirement, and premature death⁴.

Given that approximately 50% of individuals with diabetes mellitus are unaware of their diagnosis, 20-30% of patients who know their diagnosis lack treatment or follow-up^{43,44}, 68% of known cases are diagnosed by chance or due to some clinical manifestation of late complications⁴³, and 50-78% had poor blood glucose control^{45,46}, effective measures are urgently needed to reduce this public health problem and ensure prevention, early diagnosis, with adequate and comprehensive counseling and treatment for patients with diabetes mellitus.

Resumo

O diabetes mellitus tipo II é responsável por 90% de todos os casos de diabetes, e sua inclusão na avaliação de saúde evidencia que as suas complicações têm um considerável impacto na qualidade de vida de uma população. O presente artigo apresenta os resultados do Estudo de Carga Global de Doença, realizado no Brasil para o ano de 1998, com ênfase no diabetes mellitus e suas complicações. O indicador utilizado foi o disability-adjusted life years (DALY), ao qual aplicou-se a taxa de desconto de 3%. No Brasil, doenças isquêmicas do coração, doenças cardiovasculares e diabetes contribuíram com 14,7% do total de DALY. Observou-se uma maior participação do years lived with disability (YLD) no total de DALY para o diabetes quando comparado a outros países. As complicações retinopatias e neuropatias foram as que mais contribuíram para o YLD. Projeções indicam que o diabetes mellitus terá crescente impacto sobre a perda de anos de vida por morte prematura e incapacidade no mundo, e que se deslocará de 11ª para 7ª causa de morte em 2030. Faz-se urgente a implantação e implementação de medidas efetivas para prevenção, diagnóstico precoce, aconselhamento e adequado acompanhamento dos pacientes com diabetes mellitus.

Diabetes Mellitus; Anos Potenciais de Vida Perdidos; Efeitos Psicossociais da Doença

Contributors

A. F. Oliveira conducted the literature search strategy and analysis of the available data and interpretation. J. G. Valente performed the analysis and commented on the analysis and interpretation. I. C. Leite, J. M. A. Schramm, A. S. R. Azevedo, and A. M. J. Gadelha commented on the analysis and interpretation.

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