

Economic impact of Diabetes

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Summary

Diabetes imposes a large economic burden on the national healthcare system. Healthcare expenditures on diabetes will account for 11.6% of the total healthcare expenditure in the world in 2010. About 95% of the countries covered in this report will spend 5% or more, and about 80% of the countries will spend between 5% and 13% of their total healthcare dollars on diabetes.

Global health expenditures to prevent and treat diabetes and its complications will total at least US dollar (USD) 376 billion in 2010. By 2030, this number will exceed some USD490 billion. Expressed in International Dollars (ID), which correct for differences in purchasing power, the global expenditures on diabetes will be at least ID418 billion in 2010, and at least ID561 billion in 2030. An average of USD703 (ID878) per person will be spent on diabetes in 2010 globally.

Expenditures spent on diabetes care are not evenly distributed across age and gender groups. More than three-quarters of the global expenditure in 2010 will be used for persons who are between 50 and 80 years of age. Also, more money is expected to be spent on diabetes care for women than for men.

There is a large disparity in healthcare spending on diabetes between regions and countries. More than 80% of the global expenditures on diabetes are made in the world's economically richest countries, not in the low- and middle-income countries where 80% of people with diabetes will soon live. The North American and Caribbean Region will spend USD214 billion, or 57% of the global total on diabetes in 2010. In contrast, the African Region will spend, in total, USD1.4 billion for diabetes, or 0.4% of the global total.

One country, the United States of America (USA), will spend USD198 billion, or 52.7% of global expenditure. India, the country with the largest population of people living with diabetes, will spend an estimated USD2.8 billion, or less than 1% of the global total. An average of USD 7,383 per person with diabetes will be spent on diabetes-related care in the USA but less than USD10 per person will be spent in Burundi, Côte d'Ivoire and Myanmar.

A relatively simple formula was used to derive the country estimates in this report. The accuracy of these estimates is subject to how well assumptions used in the formula fit the situation of each individual country. The estimated per capita expenditure on diabetes was compared with independent estimates obtained from industrialized countries where direct studies of diabetes costs have been conducted. The IDF approach appears to yield a reasonably accurate estimate. In general, these estimates are less accurate for developing countries than they are for developed countries because of poor quality data in the developing countries, underlining the need for well-designed health economic studies to understand the true impact of diabetes.

Besides the health expenditures, other measurements have also been used to assess the economic impact of diabetes. Several of such measures were described in the *Diabetes Atlas*, third edition. The main conclusions reached by using these measures include the following. First, diabetes also imposes a large financial burden on people with diabetes and their families.

The size of this burden depends on their economic status and the social insurance policies of the countries in which they live. Individuals with diabetes and their families in developing countries pay a larger share of the expenditure because of the poorer organized systems of medical care insurance and/or lack of governmental provision of medical services. In Latin America, families pay 40-60% of expenditures for medical care from their own pockets. In the poorest countries, people with diabetes and their families bear almost the whole cost of whatever medical care they can afford. In India, for example, the poorest persons with diabetes spend an average of 25% of their total income on healthcare.

Second, at the societal level, diabetes leads to loss in productivity and economic growth. The American Diabetes Association estimated that the US economy lost USD\$58 billion, equivalent to about an half of the direct health care expenditure on diabetes in 2007, as a result of lost earnings due to lost work days, restricted activity days, lower productivity at work, mortality and permanent disability caused by diabetes. Such losses are perhaps relatively larger in poorer countries because premature death due to diabetes occurs at much younger ages. The World Health Organization (WHO) predicts net losses in national income from diabetes and cardiovascular disease of ID557.7 billion in China, ID303.2 billion in the Russian Federation, ID336.6 billion in India, ID49.2 billion in Brazil and ID2.5 billion in Tanzania (2005 ID), between 2005 and 2015.

Finally, the largest economic burden caused by diabetes is the monetary value associated with disability and loss of life as a result of the disease itself and its related complications, including heart, kidney, eye and foot disease. Economists have used different methods to value disability and loss of life associated with diseases and the most appropriate method is still under debate. No matter what method is used, it is very likely the economic burden that is measured by the monetary value associated with this disability and loss of life would be far larger than the estimated economic burden using measures described above.

Fortunately, the economic burden of diabetes can be reduced by implementing many inexpensive, easy-to-use interventions, and most of the interventions are cost-effective or cost-saving, even in the poorest countries. Tragically, these interventions are not widely used in poor and middle income countries. More resources should be invested to deliver these cost-effective interventions, in particular to those in the developing countries where the great majority of persons with diabetes live.

Health expenditures for diabetes

New estimates for 2010 and 2030. In 2003, the second edition of the IDF *Diabetes Atlas* presented the first worldwide tables of country-specific estimates of expenditures for health and healthcare caused by diabetes. These estimates were generated using a formula that combined estimates of national health spending, the prevalence of diabetes by country, and the ratio of diabetic to non-diabetic medical care expenses ("R") [1]. A single R value and a single value for countrywide per capita health expenditures were used for the estimates. In 2006, in the third edition of the *Diabetes Atlas*, these country-specific estimates were improved by using different values for R and per capita health expenditures for each of 42 different subgroups, divided by age and sex within each country. Expenditure estimates nearly doubled using the more precise formula. The same method used in the third edition was utilized in this edition. The Appendix details and critiques the formula and the data.

How to read the tables of health expenditures. Table 1 summarizes the new estimates on total and per capita expenditure on diabetes and the total spending on diabetes as the proportion of the total health expenditure for the world and each of the IDF regions. Table 2 shows the estimated total expenditure on diabetes by region, age, and sex. Tables 3 to 9 display the same information as Table 1 but for every country by IDF region. The cost estimates are for both years 2010 and 2030.

The estimated total expenditure for diabetes is the expenditure attributable to diabetes not the total health expenditures spent on persons with diabetes. Similarly, the estimated per capita

expenditure is the healthcare resources a person with diabetes consumed because of their diabetes condition, not their total health annual expenditure.

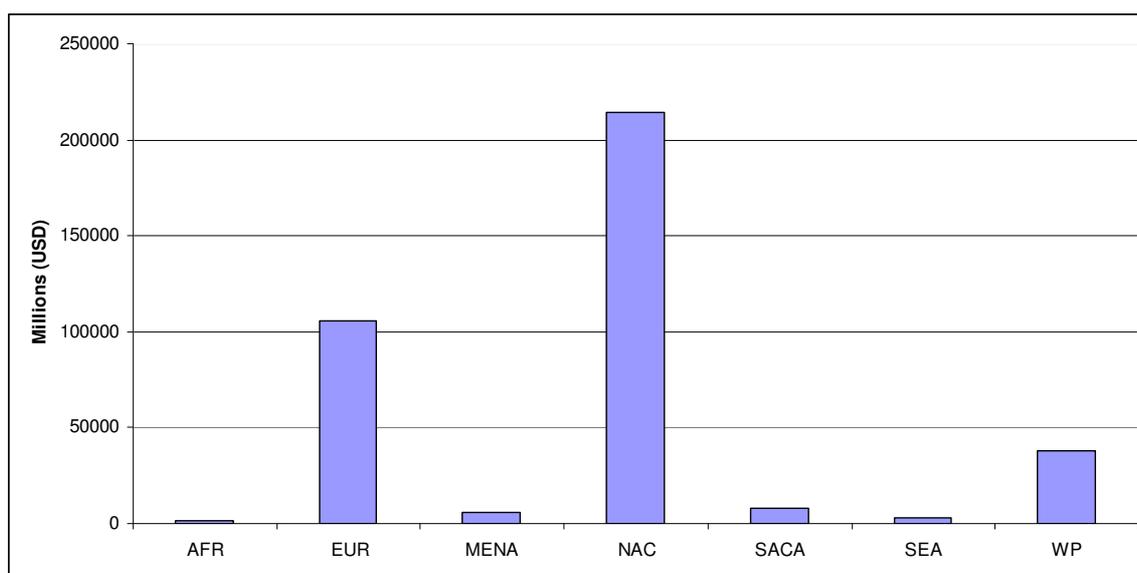
Estimates are shown in both United States Dollar (USD) and in International Dollar (ID). US dollars are best used to compare *currency prices or expenditures* for diabetes care. International dollars are best used to compare the *amount* of diabetes care that countries produce. The International Dollar is a USD that has been adjusted to account for differences in purchasing power, as estimated from surveys of how much the USD buys of a standard basket of goods and services in different countries. Amounts in both USD and ID are expressed as of their value in 2005, the most recent year for which national health expenditure estimates have been published [2].

Estimates are shown at two values of the diabetes cost ratio, R. R is the ratio of medical care expenditures for persons with diabetes to age- and sex-matched persons without diabetes. R is the key parameter in the conversion of per capita health spending into estimates of spending caused by diabetes. Based on current evidence, which is very limited, we think that R rarely falls below 2.0 in any country and usually does not exceed 3.0. In the industrialized countries of North America, Europe, and the Western Pacific, R has probably been falling, and a value closer to 2 should be assumed [3, 4]. In other countries, it is impossible as yet to recommend a ratio. See the Appendix for details.

Annual total health expenditures for diabetes in 2010

The annual global health expenditure for diabetes in 2010 is estimated to fall between USD376.0 billion (assuming R=2) and USD 672.2 billion (assuming R=3), or between ID418 billion and ID746 billion (Table 2). However, spending on diabetes varies by region. The IDF's North America and Caribbean Region will spend USD214.2 billion (assuming R=2), or 57% of the total global health expenditure. The IDF's European Region will spend USD105.5 billion (R=2), or 28% of the global total and IDF's Western Pacific Region (WP, Table 2), which includes Australia, China, Japan and Korea, will spend USD38.2 billion or about 10% of the world total (R=2). The remaining IDF regions including South-East Asia, the Middle East and North Africa, South and Central America, and Africa will only spend 4.8% of the global total. Figure 1 graphs expected 2010 expenditures for diabetes by IDF region, assuming R=2.

Figure 1 Health expenditures for diabetes in 2010 (USD) by region, assuming R=2



AFR- Africa, EUR – Europe, MENA – Middle East and North Africa, NAC – North America and Caribbean, SACA – South and Central America, SEA – South-East Asia, WP – Western Pacific

There is a large disparity in healthcare spending attributable to diabetes by country. One country, the United States of America, will spend USD198.0 billion (R=2) (Table 6), or 52.7% of the global expenditure. India, the country with the largest population of persons living with diabetes, will spend an estimated USD2.0 billion (R=2) (Table 8). The 46 countries in IDF's African region (AFR, Table 3) will spend, in total, USD1.4 billion for diabetes, or 0.4% of the global total (R=2), despite being home to 4.3% of all adults with diabetes.

More than three-quarters of global expenditure for the care of diabetes in 2010 will be used for persons who are between 50 and 80 years of age (Table 2). This is because the prevalence of diabetes is much higher in older age-groups, and because persons who have lived with diabetes for many years have higher rates of complications, which are expensive to treat. Also, the countries that spend the most per capita for diabetes have older populations, and type 2 diabetes in these countries begins on average at older ages.

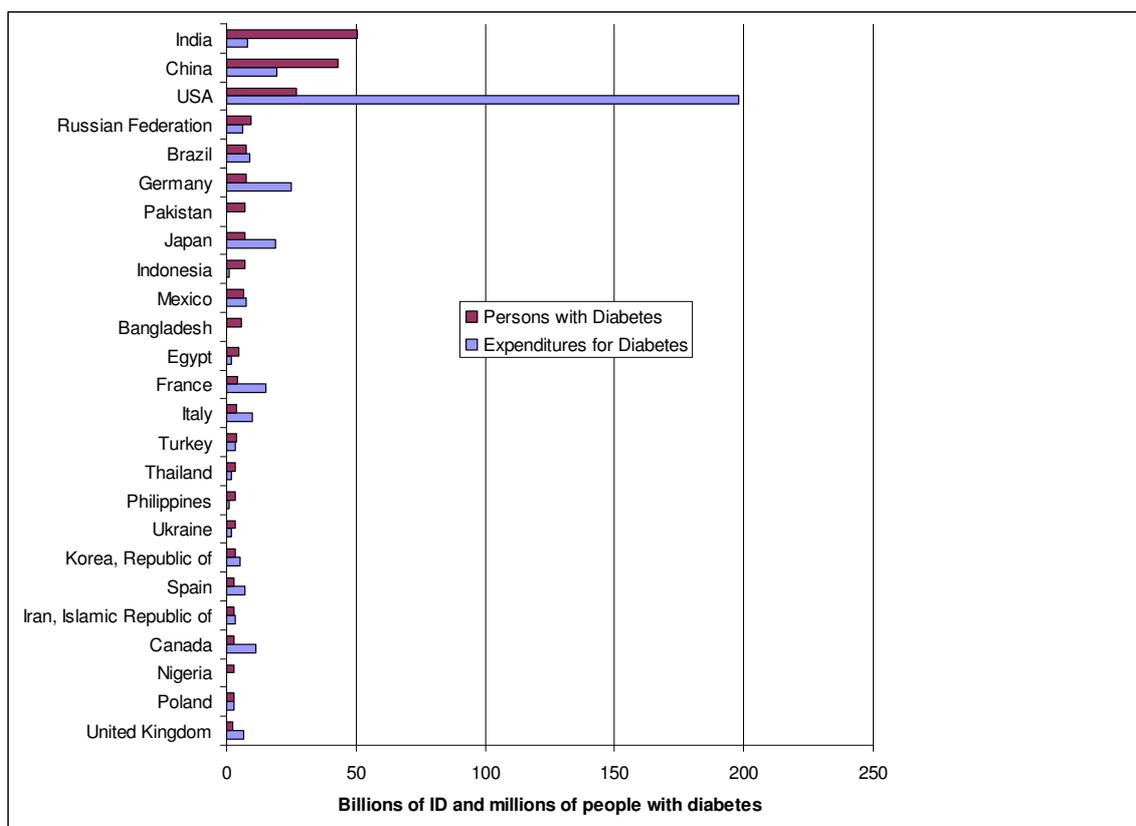
More money is expected to be spent on diabetes care for women than for men (about 8 percentage points—53% vs. 47%—more, USD203.0 billion vs. USD173.0 billion assuming R=2, Table 2). In these calculations, per capita diabetes care expenditure are higher for women than for men, especially at younger ages, mirroring the US data that were used to calculate age-and sex- specific value of R.

Expenditures Per Person. Countries vary widely in the resources they spend on diabetes. In 2010 (R=2), the IDF formula predicts that the USA will spend an average of USD7,383 for diabetes for each person who has the condition, Luxemburg will spend USD7,268, and Iceland will spend USD7,001. However, spending at this level is uncommon. Globally, the mean of each country's average 2010 expenditure will be USD703 (ID 878) at R=2 (Table 1).

In each IDF region, some countries are predicted to spend very little on diabetes in 2010: less than USD10 in Burundi, Côte d'Ivoire and Myanmar, less than USD20 in Ethiopia, Liberia, Guinea-Bissau, Niger, Madagascar, Eritrea, Montenegro, Sierra Leone and Somalia, and almost nothing in the Democratic People's Republic of Korea. Most of these amounts could not cover the annual wholesale cost of a generic oral agent capable of preventing acute, life-threatening hyperglycaemia. Fortunately, poorer countries provide more of some kinds of medical care than these estimates in USD imply, because the US Dollar buys more in these countries. Estimates adjusted for purchasing power are shown in International Dollar. For example, ID estimates are 66 for the Democratic People's Republic of Korea, 32 for Burundi, and 62 for Myanmar. Unfortunately, prices of drugs and glucose testing supplies are often as high or higher in developing countries as in the United States.

The great majority of spending in 2010 will occur in the world's largest industrialized countries. Figure 2 compares the number of persons living with diabetes to annual ID health expenditures for diabetes in the 25 countries with the largest populations of persons with diabetes (R=2). A large majority of persons living with diabetes reside in low and middle-income countries, where they receive less than 20% of global spending. Tables 3-9 show the total and per capita expenditure caused by diabetes in each IDF county.

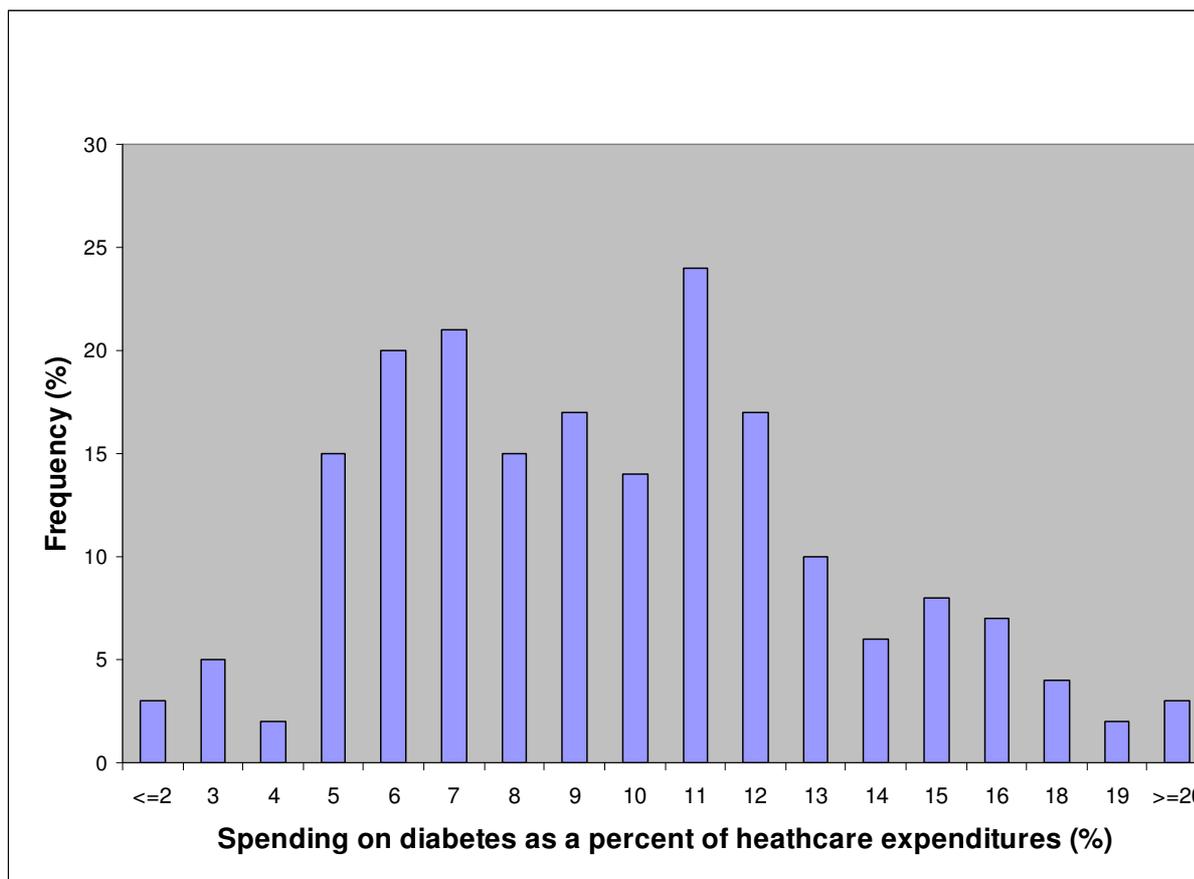
Figure 2 Annual health expenditure for diabetes (ID) vs persons with diabetes in the 25 countries with the largest numbers of persons with diabetes in 2010



Spending on diabetes as a percent of total healthcare expenditure

Healthcare expenditures spent on diabetes account for 11.6% of the total healthcare expenditure in the world in 2010 (Table 1). This percentage varied from 7% in the Africa Region to 14% in the Middle East and North African Region and North America and Caribbean Region. However, there is a wide variation by country. About 95% of the countries covered in this report will spend 5% or more, and about 80% of the countries will spend between 5% and 13% of their total healthcare dollars on diabetes (Figure 3).

Figure 3 Frequency of spending on diabetes as a percent of a country's healthcare expenditure in the world, 2010



Projections to 2030. Tables 1 through 9 also show projected aggregate, per capita health expenditures for diabetes and spending on diabetes as a percent of total health expenditure in 2005 dollars for the year 2030. The 2030 estimates differ from the 2010 estimates only as a result of predicted changes in demographics [5]. Age- and sex-specific diabetes prevalences are assumed to remain the same, but increasing urbanization is recognized, and is accounted for by using higher age- and sex-specific diabetes prevalence in urban than rural populations of developing countries. However, no increase in diabetes prevalence due to increased obesity (apart from the increases related to urbanization in developing countries) is factored in, despite the near certainty that this will occur—and health expenditures per capita remain in 2005 dollars and take their same values they had when estimated by WHO for 2005 [2]. Given these assumptions, we project that annual global healthcare expenditure for diabetes for 2030 falls between USD490.1 billion (assuming R=2) and USD893.0 billion (assuming R=3). Our International Dollar projection falls between ID561.3 billion (assuming R=2) and ID1,020.4 billion (assuming R=3).

These figures indicate that health expenditures for diabetes will grow by 30% to 34% between 2010 and 2030, which is more than the assumed global population growth (28.6%) among persons aged 20-79 years over the same period. Expenditures will grow more quickly than population because the global prevalence of diabetes will increase as a result of ageing and increasing urbanization.

Interpretation of changes in estimates on diabetes expenditure since the *Diabetes Atlas*, third edition

Differences in diabetes expenditure between the estimates presented here and those in the *Diabetes Atlas*, third edition should be interpreted with caution. This is because reasons that led to differences in estimates vary. For those countries where recent, good-quality data on diabetes prevalence and overall healthcare expenditure are available, the change in estimates IDF *Diabetes Atlas* fourth edition

reflects the actual change in the healthcare expenditure on diabetes. In this case, the change in estimates should be interpreted as a “true” increase or decrease in diabetes expenditure. In contrast, for those countries where data used in the third edition were relatively poor and better data have become available since then, the change in estimates is a result of using improved data. In this case, changes in estimates were not interpretable because estimates from the two editions were not comparable. This is particularly true for those countries where healthcare expenditures on diabetes showed a decrease when no turmoil or natural disasters led to a worse national economy.

Comparisons to other estimates. Despite the many difficulties that accompany international comparisons of economic studies [6], the cost estimates derived using our method appear to be confirmed by independent estimates obtained from industrialized countries where direct studies of diabetes costs have been conducted. Therefore, our estimates of global health expenditures for diabetes are roughly accurate, given that nearly all diabetes expenditures occur in these countries.

To demonstrate the validity of our study method and estimates, a comparison of the estimates from these independent studies with our estimates from the *Diabetes Atlas*, third edition is more appropriate because these studies are several years old. Koster and colleague estimated the medical cost of diabetes in Germany (CoDiM) and reported net per capita costs of Euro (EUR) 2,507 in 2001, quite similar to our estimate of USD 2,589 in 2002 dollars ($R=2$) [3]. CoDiM also observed an overall R for direct medical care of 2.0. Similarly, the CODE-2 study estimated annual per capita type 2 diabetes costs at EUR2,834 in Western Europe in 1999. CODE-2 estimated expenditures that ranged from EUR1,305 +/-2,197 in Spain to EUR3,576 +/-920 in Germany [7]. IDF’s formula-based per capita estimates for 2007 (in 2002 dollars) as presented in the *Diabetes Atlas*, third edition were similar: USD1,344 for Spain and USD2,859 for Germany, assuming $R=2$, (In 1999 and 2002, the exchange rate between Euros and dollars was approximately 1.0.). In Australia, the DiabCo\$t Study [8] estimated a direct medical care cost per person with diabetes (including costs for treating both diabetes and other health conditions) of Australian dollar (AUD) 4,260 (in 2001 AUD). This equals approximately USD2,179 at mid-2001 exchange rates, similar to IDF’s formula-based estimate of USD2,531 in 2002 dollars. However, the IDF estimate omits expenditures not caused by diabetes. Adding these non-diabetes related costs would make the IDF estimates much higher than the estimates from DiabCo\$t Study [7].

The latest estimate for the direct cost of medical care was USD116 billion for diagnosed diabetes and 18 billion for undiagnosed diabetes in the USA in 2007 [4, 9]. In the *Diabetes Atlas*, third edition, using the same methodology, we predicted a slightly higher cost of USD125.2 billion at $R=2$, which we recommend for use in the USA. Some differences existed between our estimates and direct estimates cited above. On one hand, the estimate from these independent studies included expenditure for all age groups while the IDF estimates included costs only for persons between 20 and 79 years of age. On the other hand, the IDF estimate covered a broader scope than these independent studies such as expenditure on diabetes medical research. But overall, the IDF estimate for the US was in line with the estimate from the independent studies.

Published studies of expenditures for diabetes are nearly all from developed countries. Therefore, confirmation of estimates for developing countries remains uncertain. Our per capita estimate appears similar to a published estimate for the publicly supported medical care systems in Mexico, after removing indirect costs and adjusting for inflation [10]. In China, a study of patients of endocrinologists from four different provincial capitals, including Beijing and Shanghai, estimated that the median direct medical cost of type 2 diabetes was USD473 per year for patients without diabetes complications and USD996 for patients with both microvascular and macrovascular complications [11]. IDF’s countrywide estimate for China based on formula is much lower, USD97 and ID401, but it encompasses nearly a billion rural Chinese who have no health insurance, and tens of millions of urban residents who cannot afford treatment by the endocrine specialists who contributed the Chinese data. Similarly, IDF’s countrywide estimates for India and Iran are somewhat lower than estimates reported from studies conducted in various cities in India and Iran [12-14].

Tables 1 – 9

Table 1

Global health expenditure for diabetes, 2010 and 2030

Region	Health expenditure for diabetes in 2010 ('000)				Spending on diabetes as a % of total health expenditure in 2010, R=2	Mean health expenditure per person with diabetes in 2010		Health expenditure for diabetes in 2030 ('000)			
	US Dollars (USD)		International Dollars (ID)			R=2		US Dollars (USD)		International Dollars (ID)	
	R=2	R=3	R=2	R=3		USD	ID	R=2	R=3	R=2	R=3
AFR	1,360,001	2,428,829	2,760,601	4,933,394	7%	111	219	2,038,596	3,666,401	4,312,818	7,748,206
MENA	5,575,419	9,254,580	11,255,720	19,019,468	14%	483	596	11,382,670	19,008,939	22,421,595	38,053,579
EUR	105,466,358	196,048,243	106,347,710	197,115,798	10%	2,046	2,056	124,613,549	234,815,304	126,042,567	236,642,012
NAC	214,225,151	373,276,922	216,859,501	377,783,710	14%	1,149	1,357	288,682,344	517,281,497	293,310,969	525,265,583
SACA	8,051,822	14,384,661	17,273,767	30,924,764	9%	344	737	13,208,022	23,946,087	28,202,408	51,189,469
SEA	3,099,199	5,413,277	8,955,615	15,639,475	11%	154	426	5,311,322	9,346,234	15,362,678	27,030,663
WP	38,205,994	71,428,989	54,365,057	100,288,354	8%	636	756	44,828,062	84,947,205	71,681,417	134,480,914
Global Total	375,983,944	672,235,502	417,817,971	745,704,963	12%	703	878	490,064,566	893,011,667	561,334,452	1,020,410,426

Totals for cost per person are means of the mean per-person costs per region per country.
 Expenditure data are in 2005 USD and derived from the World Health Statistics 2008
<http://www.who.int/whosis/whostat/2008/en/index.html>

Table 2

Health expenditure for diabetes (USD*) by sex, age and region, and the diabetes cost ratio, R, in 2010

Health expenditure for diabetes by age group ('000 USD), both sexes, R=2								
Age	AFR	MENA	EUR	NAC	SACA	SEA	WP	Total
20-29	123,830	356,146	2,685,106	9,076,133	221,022	203,066	662,420	13,327,722
30-39	217,118	945,409	4,334,822	11,789,553	651,958	376,868	2,191,161	20,506,888
40-49	291,754	1,294,689	11,953,281	29,137,479	1,441,722	615,289	5,061,389	49,795,602
50-59	356,627	1,498,414	23,389,507	55,201,075	2,396,100	895,367	9,441,568	93,178,658
60-69	252,905	1,003,204	32,761,684	67,075,664	2,196,907	682,525	12,430,168	116,403,055
70-79	117,768	477,558	30,341,959	41,945,247	1,144,113	326,085	8,419,288	82,772,018
Total	1,360,001	5,575,419	105,466,358	214,225,151	8,051,822	3,099,199	38,205,994	375,983,944

Health expenditure for diabetes by age group ('000 USD), both sexes, R=3								
Age	AFR	MENA	EUR	NAC	SACA	SEA	WP	Total
20-29	214,393	602,899	4,572,215	15,429,667	381,352	347,857	1,123,837	22,672,219
30-39	370,823	1,531,358	7,297,124	19,879,046	1,107,089	624,913	3,647,729	34,458,080
40-49	487,052	1,997,780	19,559,618	47,134,610	2,376,066	991,914	8,293,645	80,840,685
50-59	606,813	2,358,969	39,157,687	89,521,132	3,975,926	1,474,501	15,945,892	153,040,919
60-69	462,196	1,678,720	56,963,239	110,910,017	3,853,926	1,194,901	22,254,442	197,317,441
70-79	287,553	1,084,854	68,498,362	90,402,451	2,690,302	779,192	20,163,443	183,906,157
Total	2,428,829	9,254,580	196,048,243	373,276,922	14,384,661	5,413,277	71,428,989	672,235,502

Health expenditure for diabetes by age group ('000 USD), women, R=2								
Age	AFR	MENA	EUR	NAC	SACA	SEA	WP	Total
20-29	71,042	177,300	1,368,895	4,774,667	113,068	106,634	278,003	6,889,610
30-39	121,302	438,437	1,983,093	6,291,677	336,234	167,376	845,895	10,184,015
40-49	168,481	619,751	5,531,965	15,881,003	798,037	306,894	2,288,138	25,594,269
50-59	218,392	770,544	11,732,771	31,107,977	1,419,382	471,157	4,868,500	50,588,723
60-69	153,161	538,945	15,826,414	35,903,834	1,271,693	334,831	6,429,235	60,458,113
70-79	81,825	286,494	17,494,689	25,151,519	755,103	163,839	5,319,740	49,253,209
Total	814,203	2,831,470	53,937,828	119,110,677	4,693,518	1,550,731	20,029,511	202,967,938

Health expenditure for diabetes by age group ('000 USD), women, R=3								
Age	AFR	MENA	EUR	NAC	SACA	SEA	WP	Total
20-29	130,822	323,288	2,506,731	8,706,679	209,765	195,898	514,177	12,587,359
30-39	220,830	768,882	3,631,408	11,361,410	614,003	302,925	1,553,716	18,453,173
40-49	298,321	1,031,249	9,863,348	27,437,880	1,403,309	534,139	4,096,659	44,664,905
50-59	366,206	1,196,920	19,571,831	49,876,489	2,321,693	768,696	8,167,478	82,269,314
60-69	274,091	881,812	27,338,969	58,406,027	2,178,626	580,209	11,326,559	100,986,294
70-79	189,557	609,978	37,624,267	51,282,675	1,670,516	374,523	12,001,728	103,753,244
Total	1,479,827	4,812,130	100,536,554	207,071,160	8,397,912	2,756,390	37,660,316	362,714,288

Health expenditure for diabetes by age group ('000 USD), men, R=2								
Age	AFR	MENA	EUR	NAC	SACA	SEA	WP	Total
20-29	52,787	178,845	1,316,211	4,301,466	107,953	96,432	384,417	6,438,113
30-39	95,816	506,972	2,351,728	5,497,876	315,724	209,492	1,345,266	10,322,874
40-49	123,273	674,938	6,421,316	13,256,476	643,686	308,395	2,773,250	24,201,333
50-59	138,235	727,870	11,656,735	24,093,098	976,717	424,211	4,573,068	42,589,935
60-69	99,744	464,259	16,935,269	31,171,830	925,214	347,694	6,000,933	55,944,942
70-79	35,944	191,065	12,847,270	16,793,728	389,010	162,245	3,099,548	33,518,809
Total	545,798	2,743,948	51,528,530	95,114,474	3,358,304	1,548,469	18,176,482	173,016,005

Health expenditure for diabetes by age group ('000 USD), men, R=3								
Age	AFR	MENA	EUR	NAC	SACA	SEA	WP	Total
20-29	83,570	279,611	2,065,484	6,722,988	171,587	151,959	609,660	10,084,860
30-39	149,993	762,476	3,665,716	8,517,636	493,085	321,988	2,094,013	16,004,907
40-49	188,731	966,530	9,696,270	19,696,730	972,757	457,774	4,196,987	36,175,780
50-59	240,607	1,162,049	19,585,856	39,644,642	1,654,233	705,805	7,778,414	70,771,606
60-69	188,105	796,908	29,624,269	52,503,990	1,675,300	614,692	10,927,883	96,331,148
70-79	97,996	474,876	30,874,095	39,119,776	1,019,787	404,669	8,161,716	80,152,914
Total	949,003	4,442,450	95,511,690	166,205,762	5,986,749	2,656,887	33,768,672	309,521,214

Expenditure data are in 2005 USD and derived from the World Health Statistics 2008
<http://www.who.int/whosis/whostat/2008/en/index.html>

Table 3

Health expenditure for diabetes, 2010 and 2030 – African Region

Country/territory	Health expenditure for diabetes in 2010 ('000)				Spending on diabetes as a % of total health expenditure in 2010, R=2	Mean health expenditure per person with diabetes in 2010		Health expenditure for diabetes in 2030 ('000)			
	US Dollars (USD)		International Dollars (ID)			R=2		US Dollars (USD)		International Dollars (ID)	
	R=2	R=3	R=2	R=3		USD	ID	R=2	R=3	R=2	R=3
Angola	14,740	26,332	16,788	29,990	5%	66	75	32,980	58,367	37,561	66,474
Benin	8,722	15,489	14,329	25,447	7%	50	82	18,490	32,960	30,377	54,148
Botswana	32,340	57,606	54,475	97,034	7%	735	1,238	49,706	89,186	83,728	150,230
Burkina Faso	10,277	18,399	32,733	58,604	5%	49	156	22,999	40,890	73,256	130,241
Burundi	339	621	1,924	3,517	3%	6	32	843	1,534	4,779	8,691
Cameroon	34,457	61,321	54,850	97,614	7%	83	132	61,469	108,871	97,848	173,304
Cape Verde	2,260	4,025	5,114	9,110	7%	182	411	4,695	8,340	10,624	18,876
Central African Republic	1,813	3,251	7,529	13,505	6%	22	92	3,039	5,401	12,622	22,434
Chad	5,628	10,206	10,489	19,020	5%	40	75	8,165	14,866	15,216	27,706
Comoros	302	541	691	1,236	5%	25	56	721	1,283	1,649	2,933
Congo	4,498	7,951	3,772	6,669	8%	54	46	8,333	14,681	6,989	12,313
Congo, Democratic Republic of	6,963	41,107	23,673	76,169	5%	59	109	41,567	73,689	77,021	136,542
Côte d'Ivoire	23,098	12,477	42,799	42,423	7%	9	32	16,304	28,821	55,433	97,992
Djibouti	2,001	3,548	3,182	5,642	7%	106	169	2,815	5,072	4,477	8,065
Equatorial Guinea	3,943	7,085	5,270	9,469	7%	356	475	7,092	12,679	9,478	16,945
Eritrea	652	1,174	1,957	3,522	3%	14	43	1,763	3,122	5,289	9,367
Ethiopia	8,946	16,270	29,819	54,234	4%	11	36	21,787	39,199	72,625	130,664
Gabon	14,612	26,112	14,506	25,923	7%	432	429	24,833	44,659	24,653	44,335
Gambia	856	1,542	3,652	6,578	6%	25	105	1,660	2,998	7,081	12,793
Ghana	23,073	41,476	71,527	128,575	6%	50	156	44,751	80,317	138,728	248,982
Guinea	6,329	11,325	33,150	59,322	6%	37	192	12,999	23,307	68,092	122,082
Guinea-Bissau	434	781	1,388	2,500	6%	17	55	877	1,564	2,807	5,004
Kenya	22,334	39,720	88,407	157,227	5%	43	170	52,153	92,177	206,438	364,865
Lesotho	2,507	4,557	6,848	12,448	6%	67	183	3,152	5,695	8,611	15,557
Liberia	1,197	2,115	4,909	8,670	7%	17	71	2,435	4,288	9,983	17,579
Madagascar	4,290	7,745	15,731	28,398	5%	16	58	10,091	18,112	37,000	66,410
Malawi	4,012	7,366	13,514	24,813	3%	35	117	9,196	16,534	30,976	55,694
Mali	9,007	16,260	19,301	34,844	6%	49	105	19,883	35,357	42,606	75,766
Mauritania	1,846	3,288	5,319	9,478	6%	30	86	2,806	5,085	8,089	14,658
Mozambique	8,080	14,453	27,125	48,521	6%	25	82	14,180	25,019	47,605	83,993
Namibia	12,244	21,854	25,526	45,561	7%	284	592	19,151	34,391	39,928	71,701

Niger	3,791	6,837	10,531	18,991	6%	17	47	8,406	15,215	23,349	42,264
Nigeria	133,439	237,862	222,399	396,436	7%	47	79	249,599	443,274	415,998	738,790
Réunion	▪	▪	▪	▪	▪	▪	▪	▪	▪	▪	▪
Rwanda	1,905	3,504	13,633	25,078	2%	35	250	4,696	8,574	33,615	61,375
Sao Tome and Principe	263	476	655	1,185	7%	86	215	536	954	1,335	2,376
Senegal	16,925	30,553	30,732	55,478	7%	66	120	33,225	59,346	60,329	107,760
Seychelles	5,084	8,337	6,973	11,436	18%	690	946	7,564	12,439	10,374	17,062
Sierra Leone	1,860	3,318	9,535	17,005	8%	14	71	3,518	6,217	18,030	31,863
Somalia	1,232	2,233	2,669	4,837	5%	11	25	2,910	5,247	6,306	11,369
South Africa	865,095	1,545,033	1,605,474	2,867,326	7%	674	1,251	1,086,148	1,972,976	2,015,711	3,661,518
Swaziland	5,157	9,255	12,715	22,821	6%	248	611	6,018	10,829	14,838	26,702
Tanzania, United Republic of	15492.12	27,880	36,452	65,600	5%	31	72	35,055	62,320	82,483	146,635
Togo	8,402	14,386	31,275	53,549	14%	30	112	18,118	30,698	67,440	114,266
Uganda	9,503	17,318	56,156	102,333	3%	42	251	25,985	46,523	153,547	274,908
Western Sahara	▪	▪	▪	▪	▪	▪	▪	▪	▪	▪	▪
Zambia	11,150	19,868	19,202	34,218	6%	66	114	21,334	37,335	36,742	64,299
Zimbabwe	8,904	15,972	61,903	111,040	6%	38	263	14,549	25,987	101,152	180,674
AFR Total	1,360,001	2,428,829	2,760,601	4,933,394	7%	111	219	2,038,596	3,666,401	4,312,818	7,748,206

Expenditure data are in 2005 USD and derived from the World Health Statistics 2008
<http://www.who.int/whosis/whostat/2008/en/index.html>

Table 4

Health expenditure for diabetes, 2010 and 2030 – European Region

Country/territory	Health expenditure for diabetes in 2010 ('000)				Spending on diabetes as a % of total health expenditure in 2010, R=2	Mean health expenditure per person with diabetes in 2010		Health expenditure for diabetes in 2030 ('000)					
	US Dollars (USD)		International Dollars (ID)					R=2		US Dollars (USD)		International Dollars (ID)	
	R=2	R=3	R=2	R=3				USD	ID	R=2	R=3	R=2	R=3
Albania	26,816	50,922	56,011	106,364	7%	261	545	36,673	71,301	76,600	148,930		
Andorra	13,545	25,052	14,110	26,097	10%	2,970	3,094	18,712	35,191	19,493	36,658		
Austria	2,838,538	5,112,748	2,611,485	4,703,782	12%	4,007	3,686	3,382,734	6,205,429	3,112,151	5,709,060		
Azerbaijan	36,747	65,644	114,389	204,344	10%	89	277	61,958	111,128	192,868	345,931		
Belarus	157,262	284,568	397,010	718,396	11%	238	601	172,922	315,349	436,543	796,101		
Belgium	2,295,389	4,385,559	2,042,637	3,902,651	9%	3,763	3,348	2,810,304	5,434,030	2,500,853	4,835,672		
Bosnia and Herzegovina	83,166	153,429	266,612	491,856	11%	307	984	95,149	174,357	305,025	558,945		
Bulgaria	156,428	290,272	422,126	783,307	10%	301	813	153,367	286,858	413,865	774,095		
Channel Islands	▪	▪	▪	▪	▪	▪	▪	▪	▪	▪	▪		
Croatia	232,543	437,508	357,567	672,727	10%	736	1,132	242,307	462,220	372,579	710,725		
Cyprus	101,907	179,361	114,966	202,346	12%	1,547	1,745	140,463	252,225	158,463	284,547		
Czech Republic	663,262	1,227,928	1,104,163	2,044,190	10%	979	1,630	768,508	1,455,465	1,279,371	2,422,981		
Denmark	1,486,379	2,779,535	1,046,957	1,957,815	9%	4,930	3,473	1,621,958	3,107,799	1,142,455	2,189,034		
Estonia	57,142	104,244	93,686	170,912	11%	584	957	58,486	107,319	95,889	175,953		
Finland	1,009,470	1,904,253	821,803	1,550,240	9%	3,157	2,570	1,122,455	2,186,940	913,783	1,780,373		
France	17,242,239	32,081,752	14,962,237	27,839,467	10%	4,141	3,593	21,361,923	40,479,165	18,537,160	35,126,460		
Georgia	42,266	77,159	109,274	199,484	11%	147	381	47,939	87,466	123,940	226,131		
Germany	28,108,815	51,318,714	25,180,168	45,971,836	12%	3,751	3,360	30,288,414	56,013,228	27,132,675	50,177,230		
Greece	2,067,278	3,941,035	2,367,754	4,513,860	9%	2,742	3,140	2,403,451	4,577,554	2,752,790	5,242,896		
Hungary	641,388	1,188,032	996,964	1,846,660	10%	973	1,513	698,737	1,317,478	1,086,107	2,047,869		
Iceland	30,510	63,223	19,795	41,020	3%	7,001	4,542	45,496	97,970	29,519	63,565		
Ireland	907,828	1,709,891	709,802	1,336,910	7%	5,035	3,937	1,306,723	2,506,982	1,021,685	1,960,129		
Israel	648,770	1,197,029	906,924	1,673,342	9%	2,035	2,845	967,736	1,819,307	1,352,810	2,543,233		
Italy	11,022,611	20,883,104	10,129,992	19,191,976	9%	2,807	2,580	12,613,638	23,933,107	11,592,177	21,994,988		
Kazakhstan	124,545	221,440	257,505	457,842	8%	213	441	180,565	323,800	373,329	669,477		
Kyrgyzstan	6,193	11,135	24,992	44,939	7%	44	177	11,538	20,766	46,563	83,804		
Latvia	83,745	152,511	162,576	296,071	11%	493	958	85,842	157,299	166,645	305,366		

Liechtenstein												
Lithuania	124,923	227,276	240,366	437,304	11%	521	1,003	135,576	248,312	260,863	477,779	
Luxembourg	176,755	334,774	154,165	291,988	8%	7,268	6,339	252,131	480,324	219,908	418,937	
Macedonia, the Former Yugoslav Republic of	34,274	63,170	87,062	160,464	10%	287	730	42,187	79,211	107,162	201,210	
Malta	43,022	77,440	60,371	108,667	11%	1,437	2,017	52,139	96,834	73,163	135,881	
Moldova	17,662	31,737	51,769	93,023	11%	76	222	19,554	35,807	57,314	104,951	
Monaco	12,373	22,989	10,998	20,435	9%	5,866	5,214	17,718	33,413	15,749	29,700	
Montenegro	503	946	178	335	1%	14	5	573	1,086	203	385	
Netherlands	3,793,953	7,159,055	3,396,441	6,408,963	9%	4,113	3,682	4,816,096	9,307,548	4,311,488	8,332,347	
Norway	1,104,203	2,160,903	804,704	1,574,790	6%	6,933	5,053	1,429,031	2,884,251	1,041,428	2,101,941	
Poland	1,587,531	2,872,480	2,703,613	4,891,920	11%	594	1,011	1,868,848	3,485,719	3,182,705	5,936,285	
Portugal	1,556,896	2,853,311	1,761,022	3,227,412	11%	1,957	2,214	1,791,737	3,308,574	2,026,654	3,742,365	
Romania	398,018	743,760	807,180	1,508,345	10%	295	597	435,144	819,961	882,472	1,662,880	
Russian Federation	3,123,376	5,638,531	6,325,682	11,419,552	11%	325	657	3,354,749	6,125,977	6,794,275	12,406,763	
San Marino	6,525	12,199	5,966	11,154	9%	3,797	3,471	8,888	16,900	8,127	15,452	
Serbia	147,478	275,466	274,782	513,250	10%	240	448	165,626	312,094	308,595	581,495	
Slovakia	244,760	450,641	441,819	813,457	10%	779	1,407	319,562	603,000	576,845	1,088,482	
Slovenia	248,607	449,312	785,566	1,419,765	11%	1,626	5,138	282,379	523,721	892,280	1,654,888	
Spain	6,694,086	12,449,384	6,974,043	12,970,037	9%	2,277	2,373	8,837,728	16,500,546	9,207,336	17,190,625	
Sweden	1,986,899	3,798,437	1,605,726	3,069,732	8%	4,101	3,315	2,270,267	4,416,821	1,834,732	3,569,484	
Switzerland	3,776,167	6,790,212	2,711,094	4,875,024	12%	5,995	4,304	4,375,079	8,056,867	3,141,082	5,784,417	
Tajikistan	4,036	7,253	15,021	26,999	6%	31	115	8,864	15,875	32,992	59,089	
Turkey	2,104,674	3,691,919	3,253,178	5,706,570	11%	572	884	3,681,649	6,513,164	5,690,694	10,067,345	
Turkmenistan	33,910	60,312	66,950	119,077	7%	265	523	70,304	125,570	138,806	247,921	
Ukraine	484,052	881,904	1,845,449	3,362,257	11%	145	554	487,322	891,991	1,857,917	3,400,716	
United Kingdom	7,647,875	15,096,950	6,482,223	12,795,946	6%	3,574	3,030	9,130,774	18,281,745	7,739,106	15,495,330	
Uzbekistan	29,016	51,832	190,837	340,895	7%	43	283	61,630	110,262	405,336	725,188	
EUR Total	105,466,358	196,048,243	106,347,710	197,115,798	10%	2,046	2,056	124,613,549	234,815,304	126,042,567	236,642,012	

Expenditure data are in 2005 USD and derived from the World Health Statistics 2008
<http://www.who.int/whosis/whostat/2008/en/index.html>

Table 5

Health expenditure for diabetes, 2010 and 2030 – Middle East and North African Region

Country/territory	Health expenditure for diabetes in 2010 ('000)				Spending on diabetes as a % of total health expenditure in 2010, R=2	Mean health expenditure per person with diabetes in 2010		Health expenditure for diabetes in 2030 ('000)			
	US Dollars (USD)		International Dollars (ID)			R=2		US Dollars (USD)		International Dollars (ID)	
	R=2	R=3	R=2	R=3		USD	ID	R=2	R=3	R=2	R=3
Afghanistan	28,625	48,537	37,213	63,098	11%	33	43	57,171	96,399	74,322	125,318
Algeria	264,178	455,675	428,066	738,363	11%	162	262	461,074	803,886	747,111	1,302,593
Armenia	21,564	38,837	66,162	119,159	12%	117	360	27,503	49,968	84,385	153,311
Bahrain	73,004	114,695	95,933	150,719	19%	950	1,248	135,284	221,460	177,775	291,018
Egypt	557,078	936,607	1,992,627	3,350,170	16%	116	416	993,584	1,673,525	3,553,974	5,986,069
Iran, Islamic Republic of	1,048,047	1,829,837	3,346,830	5,843,394	11%	365	1,166	2,186,954	3,827,379	6,983,810	12,222,336
Iraq	112,917	189,087	248,801	416,632	13%	96	212	251,460	421,711	554,064	929,194
Jordan	109,467	184,985	294,790	498,154	13%	407	1,097	244,660	410,537	658,856	1,105,554
Kuwait	232,650	373,650	165,937	266,504	16%	1,010	720	561,520	924,319	400,502	659,267
Lebanon	141,371	250,086	179,479	317,500	12%	692	878	232,755	411,111	295,497	521,933
Libyan Arab Jamahiriya	107,813	189,147	132,953	233,253	12%	362	447	204,725	362,054	252,463	446,480
Morocco	206,626	358,325	598,985	1,038,739	12%	137	396	356,397	623,753	1,033,151	1,808,183
Occupied Palestinian Territory	▪	▪	▪	▪	▪	▪	▪	▪	▪	▪	▪
Oman	91,422	149,041	114,277	186,301	18%	507	634	187,995	313,389	234,993	391,737
Pakistan	172,513	293,537	563,542	958,888	12%	24	79	332,612	566,774	1,086,533	1,851,461
Qatar	251,556	387,696	147,643	227,545	18%	2,960	1,737	463,458	735,330	272,011	431,577
Saudi Arabia	1,409,562	2,246,478	1,793,416	2,858,242	21%	682	868	2,989,442	4,836,078	3,803,532	6,153,046
Sudan	34,795	63,105	64,791	117,505	6%	52	96	69,958	126,256	130,267	235,098
Syrian Arab Republic	100,498	172,058	181,225	310,268	14%	103	186	220,411	377,176	397,463	680,154
Tunisia	138,377	238,390	417,757	719,697	12%	230	694	245,444	424,647	740,992	1,282,004
United Arab Emirates	453,346	698,950	340,146	524,422	16%	1,067	800	1,114,218	1,720,645	835,998	1,291,000
Yemen	20,009	35,860	45,148	80,914	5%	74	167	46,044	82,542	103,895	186,248
MENA Total	5,575,419	9,254,580	11,255,720	19,019,468	14%	483	596	11,382,670	19,008,939	22,421,595	38,053,579

Expenditure data are in 2005 USD and derived from the World Health Statistics 2008

<http://www.who.int/whosis/whostat/2008/en/index.html>

Table 6

Health expenditure for diabetes, 2010 and 2030 – North America and Caribbean Region

Country/territory	Health expenditure for diabetes in 2010 ('000)				Spending on diabetes as a % of total health expenditure in 2010, R=2	Mean health expenditure per person with diabetes in 2010	Health expenditure for diabetes in 2030 ('000)					
	US Dollars (USD)		International Dollars (ID)				R=2		US Dollars (USD)		International Dollars (ID)	
	R=2	R=3	R=2	R=3			USD	ID	R=2	R=3	R=2	R=3
Anguilla	▪	▪	▪	▪	▪	▪	▪	▪	▪	▪	▪	
Antigua and Barbuda	2,372	4,222	2,740	4,876	11%	769	888	3,808	6,802	4,398	7,857	
Aruba	▪	▪	▪	▪	▪	▪	▪	▪	▪	▪	▪	
Bahamas	39,283	66,960	45,060	76,807	14%	1,743	1,999	65,465	113,480	75,093	130,168	
Barbados	18,246	31,793	27,734	48,326	12%	908	1,380	27,010	48,879	41,055	74,296	
Belize	4,119	6,955	7,843	13,243	13%	320	610	8,966	15,071	17,071	28,696	
Bermuda	▪	▪	▪	▪	▪	▪	▪	▪	▪	▪	▪	
British Virgin Islands	▪	▪	▪	▪	▪	▪	▪	▪	▪	▪	▪	
Canada	11,217,092	19,853,674	11,181,119	19,790,003	13%	3,914	3,901	15,493,896	28,247,409	15,444,207	28,156,819	
Cayman Islands	▪	▪	▪	▪	▪	▪	▪	▪	▪	▪	▪	
Dominica	1,984	3,312	3,011	5,026	15%	384	583	2,830	4,755	4,294	7,214	
Grenada	3,001	5,110	4,922	8,383	15%	592	970	4,585	7,803	7,520	12,800	
Guadeloupe	▪	▪	▪	▪	▪	▪	▪	▪	▪	▪	▪	
Guyana	3,911	6,610	15,515	26,218	15%	88	348	4,876	8,499	19,343	33,712	
Haiti	14,971	26,385	37,962	66,904	10%	48	121	27,788	48,665	70,464	123,400	
Jamaica	38,897	65,647	48,049	81,093	14%	238	294	56,436	95,555	69,714	118,038	
Martinique	▪	▪	▪	▪	▪	▪	▪	▪	▪	▪	▪	
Mexico	4,836,480	8,280,356	7,397,570	12,665,101	15%	708	1,084	8,513,062	14,695,229	13,021,034	22,476,880	
Netherlands Antilles	▪	▪	▪	▪	▪	▪	▪	▪	▪	▪	▪	
Saint Kitts and Nevis	1,473	2,518	1,784	3,050	12%	659	798	2,245	3,850	2,720	4,663	
Saint Lucia	4,526	7,713	5,563	9,480	13%	488	599	7,836	13,311	9,631	16,360	
Saint Vincent and the Grenadines	1,779	3,126	3,542	6,223	11%	322	641	3,063	5,334	6,097	10,619	
Suriname	8,985	15,224	13,971	23,673	15%	303	471	13,370	22,844	20,790	35,523	
Trinidad and Tobago	71,993	118,985	107,077	176,969	15%	668	994	103,480	173,444	153,909	257,968	
United States of America	197,956,040	344,778,333	197,956,040	344,778,333	14%	7,383	7,383	264,343,629	473,770,569	264,343,629	473,770,569	
US Virgin Islands	▪	▪	▪	▪	▪	▪	▪	▪	▪	▪	▪	
NAC Total	214,225,151	373,276,922	216,859,501	377,783,710	14%	1,149	1,357	288,682,344	517,281,497	293,310,969	525,265,583	

Expenditure data are in 2005 USD and derived from the World Health Statistics 2008
<http://www.who.int/whosis/whostat/2008/en/index.html>

Table 7

Health expenditure for diabetes, 2010 and 2030 – South and Central American Region

Country/territory	Health expenditure for diabetes in 2010 ('000)				Spending on diabetes as a % of total health expenditure in 2010, R=2	Mean health expenditure per person with diabetes in 2010		Health expenditure for diabetes in 2030 ('000)			
	US Dollars (USD)		International Dollars (ID)			R=2		US Dollars (USD)		International Dollars (ID)	
	R=2	R=3	R=2	R=3		USD	ID	R=2	R=3	R=2	R=3
Argentina	1,046,138	1,902,592	3,304,846	6,010,462	8%	671	2,121	1,448,539	2,647,415	4,576,067	8,363,425
Bolivia	32,791	58,442	93,755	167,093	9%	120	342	59,185	105,719	169,218	302,266
Brazil	4,296,702	7,721,450	8,743,961	15,713,463	9%	563	1,146	7,230,733	13,224,138	14,714,835	26,911,655
Chile	399,154	716,655	671,624	1,205,857	9%	571	961	584,341	1,079,502	983,224	1,816,391
Colombia	464,843	832,913	1,343,651	2,407,574	8%	326	941	828,327	1,520,601	2,394,318	4,395,368
Costa Rica	126,141	213,124	263,855	445,801	13%	482	1,008	229,435	394,712	479,919	825,637
Cuba	339,322	580,310	364,498	623,366	13%	376	404	439,359	762,615	471,957	819,196
Dominican Republic	178,565	298,139	322,686	538,770	16%	295	533	299,239	501,935	540,757	907,051
Ecuador	102,904	184,467	191,807	343,836	9%	232	433	175,276	318,399	326,705	593,477
El Salvador	86,839	148,704	178,585	305,810	12%	273	562	162,587	276,164	334,360	567,931
French Guiana	▪	▪	▪	▪	▪	▪	▪	▪	▪	▪	▪
Guatemala	105,653	181,791	195,299	336,037	12%	227	420	219,976	373,058	406,622	689,591
Honduras	42,525	72,479	105,612	180,002	12%	156	387	89,360	151,293	221,927	375,739
Nicaragua	31,037	52,149	104,699	175,917	13%	125	422	61,681	103,808	208,072	350,180
Panama	99,196	167,906	186,523	315,721	13%	504	947	175,310	299,432	329,643	563,035
Paraguay	24,821	44,732	84,176	151,700	8%	165	561	45,893	83,336	155,636	282,618
Peru	186,511	332,059	408,832	727,874	9%	194	425	324,332	581,337	710,936	1,274,290
Puerto Rico	▪	▪	▪	▪	▪	▪	▪	▪	▪	▪	▪
Uruguay	75,858	139,304	166,175	305,159	8%	517	1,133	91,740	169,371	200,964	371,022
Venezuela	412,820	737,444	543,185	970,322	10%	399	525	742,708	1,353,252	977,248	1,780,595
SACA Total	8,051,822	14,384,661	17,273,767	30,924,764	9%	344	737	13,208,022	23,946,087	28,202,408	51,189,469

Expenditure data are in 2005 USD and derived from the World Health Statistics 2008
<http://www.who.int/whosis/whostat/2008/en/index.html>

Table 8

Health expenditure for diabetes, 2010 and 2030 - South-East Asian Region

Country/territory	Health expenditure for diabetes in 2010 ('000)				Spending on diabetes as a % of total health expenditure in 2010, R=2	Mean health expenditure per person with diabetes in 2010		Health expenditure for diabetes in 2030 ('000)			
	US Dollars (USD)		International Dollars (ID)			R=2		US Dollars (USD)		International Dollars (ID)	
	R=2	R=3	R=2	R=3		USD	ID	R=2	R=3	R=2	R=3
Bangladesh	116,472	202,764	553,244	963,129	10%	21	97	216,057	378,009	1,026,269	1,795,545
Bhutan	1,150	2,122	1,880	3,468	5%	97	158	2,427	4,456	3,967	7,283
India	2,815,149	4,927,972	7,819,860	13,688,812	11%	55	154	4,841,521	8,531,713	13,448,670	23,699,203
Maldives	6,652	11,517	18,482	32,000	11%	554	1,539	14,257	24,586	39,612	68,312
Mauritius	37,821	60,538	94,379	151,068	20%	254	634	55,589	90,459	138,717	225,732
Nepal	15,153	27,609	71,975	131,142	6%	30	141	31,539	57,255	149,809	271,963
Sri Lanka	106,802	180,755	395,795	669,855	16%	70	259	149,933	259,756	555,634	962,625
SEA Total	3,099,199	5,413,277	8,955,615	15,639,475	11%	154	426	5,311,322	9,346,234	15,362,678	27,030,663

Expenditure data are in 2005 USD and derived from the World Health Statistics 2008
<http://www.who.int/whosis/whostat/2008/en/index.html>

Table 9

Health expenditure for diabetes, 2010 and 2030 - Western Pacific Region

Country/territory	Health expenditure for diabetes in 2010 ('000)				Spending on diabetes as a % of total health expenditure in 2010, R=2	Mean health expenditure per person with diabetes in 2010		Health expenditure for diabetes in 2030 ('000)			
	US Dollars (USD)		International Dollars (ID)			R=2		US Dollars (USD)		International Dollars (ID)	
	R=2	R=3	R=2	R=3		USD	ID	R=2	R=3	R=2	R=3
Australia	4,105,052	7,701,169	3,872,764	7,265,391	9%	3,781	3,567	5,649,983	10,895,825	5,330,273	10,279,274
Brunei Darussalam	20,567	33,896	16,684	27,496	15%	730	592	39,627	66,837	32,145	54,216
Cambodia	18,671	32,809	107,518	188,936	8%	53	304	37,778	66,836	217,551	384,885
China	4,968,697	9,049,213	19,322,712	35,191,385	6%	115	448	7,469,708	13,994,490	29,048,866	54,423,016
China, Hong Kong	▪	▪	▪	▪	▪	▪	▪	▪	▪	▪	▪
China, Macau	▪	▪	▪	▪	▪	▪	▪	▪	▪	▪	▪
Cook Islands	521	936	656	1,179	8%	678	854	760	1,381	957	1,739
Fiji	10,259	17,367	18,786	31,800	14%	227	415	14,220	24,492	26,038	44,847
French Polynesia	▪	▪	▪	▪	▪	▪	▪	▪	▪	▪	▪
Guam	▪	▪	▪	▪	▪	▪	▪	▪	▪	▪	▪
Indonesia	287,345	519,209	862,036	1,557,626	7%	41	124	501,593	913,943	1,504,780	2,741,829
Japan	22,150,916	42,310,281	18,846,385	35,998,325	8%	3,125	2,658	21,442,994	41,361,937	18,244,074	35,191,458
Kiribati	962	1,718	2,308	4,119	11%	204	490	1,405	2,523	3,370	6,050
Korea, Democratic People's Republic of	1,321	2,400	62,108	112,820	8%	1	66	1,780	3,233	83,659	151,954
Korea, Republic of	4,130,467	7,324,294	5,361,541	9,507,280	12%	1,255	1,628	5,598,025	10,262,524	7,266,501	13,321,242
Lao People's Democratic Republic	4,512	8,055	19,551	34,906	8%	31	136	9,589	17,129	41,551	74,227
Malaysia	600,408	1,005,095	1,227,861	2,055,465	16%	325	665	1,073,139	1,828,693	2,194,618	3,739,760
Marshall Islands	1,907	3,315	3,776	6,562	16%	516	1,021	2,603	4,571	5,152	9,048
Micronesia, Federated States of	1,531	2,705	2,846	5,027	9%	506	941	2,558	4,568	4,755	8,490
Mongolia	1,392	2,539	4,494	8,198	2%	61	197	2,922	5,412	9,433	17,474
Myanmar	6,243	11,772	59,310	111,834	5%	7	64	11,965	22,910	113,664	217,644
Nauru	2,048	3,071	2,586	3,879	41%	752	949	2,664	4,044	3,364	5,107
New Caledonia	▪	▪	▪	▪	▪	▪	▪	▪	▪	▪	▪
New Zealand	568,953	1,072,590	526,335	992,246	8%	2,965	2,743	795,750	1,542,661	736,143	1,427,106
Niue	66	117	18	32	7%	1,594	442	99	175	27	49
Palau	1,190	2,065	1,554	2,697	13%	983	1,283	1,699	2,980	2,219	3,891

Papua New Guinea	4,818	8,922	24,373	45,136	4%	67	341	11,621	21,414	58,790	108,331
Philippines	208,945	360,977	1,123,785	1,941,470	11%	61	331	384,634	670,570	2,068,709	3,606,580
Samoa	1,252	2,194	2,415	4,232	12%	195	376	2,175	3,810	4,195	7,350
Singapore	492,898	844,391	595,237	1,019,709	15%	1,129	1,363	825,650	1,478,181	997,078	1,785,092
Solomon Islands	350	653	1,150	2,144	5%	58	190	906	1,665	2,976	5,470
Taiwan	▪	▪	▪	▪	▪	▪	▪	▪	▪	▪	▪
Thailand	509,784	906,374	1,680,208	2,987,336	11%	144	475	720,238	1,315,096	2,373,847	4,334,449
Timor-Leste	1,403	2,549	4,522	8,212	6%	86	277	2,861	5,218	9,219	16,812
Tokelau	▪	▪	▪	▪	▪	▪	▪	▪	▪	▪	▪
Tonga	995	1,676	2,429	4,093	18%	164	401	1,397	2,308	3,413	5,636
Tuvalu	318	524	225	371	19%	294	208	445	739	315	523
Vanuatu	392	733	778	1,455	5%	132	262	1,010	1,880	2,005	3,732
Viet Nam	101,810	195,379	608,107	1,166,994	5%	62	369	216,263	419,160	1,291,731	2,503,634
WP Total	38,205,994	71,428,989	54,365,057	100,288,354	8%	636	756	44,828,062	84,947,205	71,681,417	134,480,914

Expenditure data are in 2005 USD and derived from the World Health Statistics 2008

<http://www.who.int/whosis/whostat/2008/en/index.html>

Appendix

Methods Used for Tables 1 to 9

The estimates in Tables 1-9 were derived using the same method as that used in the *Diabetes Atlas*, third edition. This method requires information on country-by-country estimates of diabetes prevalence by age and sex, population size by age and sex, total healthcare expenditures by age and sex, and the ratio of expenditures per person with diabetes to expenditures per person without diabetes, matched for age and sex. The input data used here were the best available to the authors, but suffered some degree of uncertainty. Assumptions had to be made in order to estimate the cost for those countries with poor or no data. This was particularly true for developing countries where few data were available. A critical parameter, the diabetes cost ratio, is known by 10-year categories of age and sex only for a US population. This cost ratio was used for all countries where such data were not available. The International Diabetes Federation (IDF) and the World Health Organization (WHO) are currently funding studies that will obtain estimates from more settings. The first phase of such studies, which was carried on in Africa and China, are still ongoing at the time of writing this report. Our diabetes cost estimate will be improved by using those new cost ratios when they are available.

Definition of health expenditures

The costs displayed in Tables 1 to 9 are the estimated total health expenditures caused by diabetes. Initial data on per capita total health expenditures by country were obtained from the WHO *World Health Report* for 2008 [2]. WHO defines “total health expenditure” to include all expenditures for medical care regardless of who paid for them. The WHO definition also includes expenditures for public health programmes, water supply and hygiene activities, nutritional support activities, education, training, and research—but only when these activities intentionally and primarily address a health problem. The WHO definition excludes the unpaid care-giving of relatives and others, and the opportunity costs of this care-giving, including loss of paid employment. It also excludes other opportunity costs, such as loss of educational opportunities for children who must stay home to care for disabled parents.

A significant portion of healthcare spending in the poorest countries comes from governmental programmes and from external donors, who focus on communicable and parasitic diseases rather than on diabetes and cardiovascular disease (despite diabetes causing as many deaths as HIV/AIDS). Our estimates of expenditures for diabetes in poor countries may therefore be overestimated.

Estimation of general per capita expenditures

In each country, expenditures for persons were estimated for 42 sub-populations based on sex and 5-year strata of age, ranging from age zero to ages greater than 100. Because data on total health expenditures by age and sex are very rare, even for developed countries, we started from estimates of population-wide total health expenditures per capita published by WHO for the year 2005 [2].

Per capita WHO expenditure estimates were divided into two components, a portion that was assumed to vary with age- and sex-specific mortality (about 80% of total expenditures) and a portion (about 20%) that was assumed to be constant within each age- and sex-subgroup. Total costs per subgroup were calculated as the sum of (a) constant costs multiplied by subgroup size and (b) the product of mortality-related costs and the predicted number of annual deaths in the subgroup.

Reliable mortality statistics by country are not universally available so each country’s mortality rates were assumed to match the rates published for the WHO Demographic Group (N=14) [15]. As mortality rates vary more widely with age than medical care costs, rates by sex and 5-year age group were transformed using a log function, $\ln(3.00 + \text{mortality rate})$. Subgroup mortality rates were further modified to account for the fact that only about half the children

who die in countries with high and very high childhood mortality receive medical care, and for the generally lower average expenditures for conditions that cause death in childhood.

The 20% of annual expenditures that were assumed not to vary with mortality were adjusted by age and sex to account for natural differences of medical care utilization, such as the higher use of medical care services by women of child-bearing age.

The resulting estimates were then fine-tuned by approximately equalizing, for each age and sex subgroup, the ratio of total per capita medical care costs predicted via these methods for the US population to the per capita medical care costs observed in a US sample of persons who did not have diabetes. (The samples without diabetes were members of the Kaiser Permanente medical care programme in the United States, selected and analysed by one of the authors [GN].) The resulting relative distributions of per capita health costs by age and sex, when multiplied by the population in each subgroup, yielded for each country an aggregate total health expenditure.

To ensure that average total per capita expenditures in each country still matched the estimates published by WHO, aggregate expenditures were compared to the WHO estimates for 2005, country by country. Expenditures were adjusted up or down so that the synthetic countrywide expenditure equalled the country's WHO-estimated expenditure for 2005. This result was then increased to account for population growth since the WHO estimates, by dividing the UN medium-variant projected population for each country in either 2010 or 2030, as appropriate, by the population assumed in WHO estimates for 2005, and multiplying by the resulting ratio.

The Diabetes Cost Ratio, R. The Tables give alternative estimates for values of a parameter called R, which is the ratio of all medical care costs for persons with diabetes to all medical care costs for age- and sex-matched persons who do not have diabetes. By comparing the total costs of matched persons with and without diabetes, the costs that diabetes causes can be isolated. Because R varies from country to country and over time, the tables show results for likely lower and upper bounds of R, $R=2$ and $R=3$.

Compared with the analysis in the *Diabetes Atlas*, second edition, both the analysis in this and the third edition explicitly accounted for demographic variation in R. R can be sensitive to age and sex, and countries differ markedly in the age structures of their populations. In industrialized countries, R is higher in younger age groups because younger persons without diabetes usually do not incur large medical costs. Conversely, R is lower at older ages because old persons without diabetes use substantial medical care. One recent study in Sweden reported R's of 7.7 for children aged from 0 to 14 years, 4.4 for persons aged from 15 to 44 years, 3.5 for adults aged from 45 to 54 years, 2.5 for persons aged 55 to 64 years, 1.7 for those aged 65 to 74 years, and 1.4 for old adults aged 75 years and older, respectively [16]. Variations in R by gender appear much smaller than by age group. For example, in the United States, for those who were aged 65 to 74 years old, the R's were 1.7 for both men and women [17]. Using age- and sex-specific R's appears to improve the accuracy of the cost estimates significantly. For example, the cost estimates based on age- and sex-specific R's are much more comparable to the published national studies of medical care cost than that based on a single global R.

To obtain an empirical basis for age- and sex-specific values of R, two of the authors [GAN and JBB] who are affiliated with Kaiser Permanente Northwest Region (KPNW), a large not-for-profit pre-paid medical care system in the United States, calculated ratios from this organization's large diabetes registry. The mean R for all KPNW registrants aged 20-79 for 2004 was 2.066 for women and 2.088 for men. To create age by sex distributions of R's for standard R's with a population-weighted mean of 2.0 and 3.0, the two authors adjusted the KPNW distributions of ratios up and down. Table A1 displays these observed and adjusted ratios and the numbers of subjects that contributed data. Because of low sample sizes in the age groups between 20 and 50, R's for these ages were estimated jointly.

R undoubtedly varies among and within countries. In developed countries, R is 1.9 in Germany [3], 1.8 in Sweden [17], and 2.3 in the United States [4]. In addition, values of R may be

decreasing, at least in industrialized countries. Earlier studies from the USA reported mean R's of 2.5 in 1992 [18] and 2.4 in 2002 [19], and 2.3 in 2007 [4]. There are several reasons why a lowering could be underway. One is that persons with type 2 diabetes are being diagnosed sooner, which means that the average person with diabetes will have fewer and fewer costly complications. One US study showed that R is lower (~ 2) during the first six years after diagnosis [20]. Additionally, the control of risk factors for diabetes complications (hyperglycaemia, hypertension, dyslipidaemia) has been improving in developed countries, as has the use of classes of drugs (aspirin, statins, ACE-inhibitors, other antihypertensives) that we now know to be highly effective in preventing cardiovascular complications. This means that the incidence of diabetes complications is probably decreasing, which also reduces average medical care costs. Finally, effective drugs in each of the classes used in diabetes are now off-patent, which further lowers treatment costs (when generic drugs are used). The KPNW organization from which we obtained age- and sex-distributions of R is at the forefront of these changes.

Do the age and sex patterns of diabetes treatment expenditures in industrialized countries like the US, Germany, and Sweden accurately describe the rest of the world? Little data are available on expenditure patterns in low- and middle-income countries. Based on limited information, it appears R is higher in these countries. For example, one study reported a value of 2.87 in Iran [14] and another study reported a value of 2.9 in Thailand [21]. One study of Chinese patients in 11 large cities reported an overall R of 2.5 [22]. A study in Taiwan reported a ratio of 4.3 but this estimate is high because it is not age- or sex-adjusted [23]. IDF and WHO are supporting studies to collect cost data in developing countries. The first of these studies in Africa and China will have results soon.

Computational details. The estimation method used here was the same as that used in the *Diabetes Atlas*, third edition. Using this method, data and calculations for each country were broken down into 10-year age-sex subgroups, starting with age 20-29 and ending with age 70-79. (Persons aged less than 20 or more than 79 years were omitted because data on the prevalence of diabetes in these age groups are lacking for most countries.) Costs were calculated for each subgroup, one at a time, for men and for women, using a different value of R for each subgroup. The subgroup costs were then combined, first within sex, and then combining the sexes, weighting each subgroup's contribution to the total by the proportion of the country's diabetic population that fell into each age-sex subgroup.

Specifically, we estimated countrywide and per-capita costs of medical care in 2010 by combining data describing (1) the estimated current prevalences of diabetes in 2010 (P_{as} , as estimated in the report on Diabetes and Impaired Glucose Tolerance); (2) estimated 2010 populations (N_{as} , based on United Nations projections, median fertility variant [4] or, for non-UN members, the CIA World Factbook [57]); (3) total current healthcare budgets in 2005 (C_{as} , obtained from World Health Organization estimates and projections [2]); and (4) ratios (R_{as}) of medical care costs for persons with diabetes compared to persons without diabetes. All these data were divided into age deciles ($a=1-6$), by sex ($s=1,2$). The formula used to calculate the costs of medical care for diabetes in each country was:

$$D = C \left\{ \sum_{s=1}^2 \sum_{a=1}^6 \left(\frac{N_{as}}{N} P_{as} (R_{as} - 1) / [P_{as} (R_{as} - 1) + 1] \right) \right\}, \text{ where}$$

D = the total cost of care for diabetes in a country,

C = the estimated annual budget for all healthcare in the country in 2005,

N_{as} = the total population of persons, in each age and sex subgroup, projected for a country in 2010,

N = the total population of the country of all ages,

P_{as} = the prevalence of diabetes in the country, by age and sex,

R_{as} = the ratios of costs for persons with diabetes to persons without diabetes, by age and sex, and where

a is an indicator for age decile (20-29, 30,39, ...70-79), and

b is an indicator for sex (men, women).

The biggest advantage of using the above approach is its simplicity and ability to use available data. The disadvantages of the approach is that the accuracy of the cost estimates are subject to how well assumptions used in the formula fit the situation of each individual country. For example, the formula assumes that a country's health expenditure estimate contains only these expenditures for which diabetes is a contributing expense. If not, cost estimates derived from this approach may be overestimated. The other critical parameter is the diabetes cost ratio, R. Assumptions have to be made on age- and sex- specific R in each individual country, where such data usually have not been gathered. The accuracy of the final cost estimate is therefore subject to the difference between the "assumed" R and "true" R. In addition, R is derived based on medical expenditures of persons with diagnosed diabetes. Because of lack of data to estimate R for undiagnosed cases, we used the same value of R for both diagnosed and undiagnosed cases. However, R value might well be smaller for persons with undiagnosed diabetes. If so, this will tend to inflate expenditure estimates in low- and middle-income countries, especially, where a large majority of diabetes cases are sometimes undiagnosed.

Projection to 2030. The 2030 estimates differ from the 2010 estimates only as a result of predicted changes in demographics [5]. Age- and sex-specific diabetes prevalences are assumed to remain the same, but increasing urbanization is recognized, and is accounted for by using higher age- and sex-specific diabetes prevalence in urban than rural populations of developing countries. However, no increase in diabetes prevalence due to increased obesity (apart from the increases related to urbanization in developing countries) is factored in, despite the near certainty that this will occur. Increases in medical care expenditures due to economic growth and/or relative inflation in prices for medical care are also ignored. For these reasons, our projections underestimate future diabetes costs.

US and International Dollars. Costs are shown both in US Dollars (USD) and International Dollars (ID), valued as of the year 2005, the most recent year for which national healthcare expenditure data for all countries are currently available. (Projected costs in 2030 are also shown in 2005 dollars.) Costs in USD estimate the amount of internationally traded currency that is spent for diabetes care. These costs can be used to compare how much individuals and institutions *paid or will pay* for diabetes care.

A unit of internationally traded currency can buy many more goods and services in some countries than in others. Converting USD to ID corrects for such differences, which economists call differences in purchasing power. Cost estimates in ID can be used to compare the *amounts* of diabetes care that countries actually produce.

The market-basket studies from which ID multipliers are calculated involve a wide range of products and services. These multipliers might not be accurate for the medical care sectors of some countries. For example, healthcare workers in many poor countries are said to be underpaid relative to workers in other occupations in the same country. If so, the true difference between USD and ID estimates might be greater than we report. On the other hand, medicines and medical supplies are often imported and, in many low-income countries, medicines are taxed upon entry. Some manufacturers of diabetes medicines lower their wholesale prices to poor countries, but shortages and black-market distribution can erode these efforts. Consequently, estimates in ID could overestimate the amount of medicine that can be purchased in poorer countries.

Table A1: Diabetes Cost Ratios (R) by Age and Sex*								
	Women				Men			
Age in Years	KPNW R**	Adj. R=2***	Adj. R=3***	KPNW Sample Size	KPNW R**	Adj. R=2***	Adj. R=3***	KPNW Sample Size
20-49	2.23	2.15	3.15	1145	2.74	2.66	3.66	1108
50-59	2.30	2.22	3.22	1996	2.23	2.15	3.15	2239
60-69	2.11	2.03	3.03	2031	2.03	1.95	2.95	2356
70-79	1.70	1.62	2.62	1774	1.57	1.50	2.50	1901
*Ratio of total medical care costs for persons with diagnosed diabetes divided by total medical care costs of persons not diagnosed with diabetes.								
**Source: Kaiser Permanente Northwest Region, 2004								
***Calculated so that the mean R in all age groups equalled 2 or 3 when weighted by the KPNW population sizes in each age group.								

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