

Direct Health Care Costs of Diabetic Patients in Spain

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OBJECTIVE — The goal of this study was to estimate the health care resources spent by type 1 and type 2 diabetic patients in Spain during the year 2002.

RESEARCH DESIGN AND METHODS — This is a cost-of-illness study focusing on direct health care costs estimated from primary and secondary sources of information. A prevalence of diabetes ranging from 5 to 6% of the adult population was determined. Total cost is composed of six items: insulin and oral hypoglycemic agents, other drugs, disposable and consumable goods (glucose test strips, needles, and syringes), hospitalization, primary care visits, and visits to endocrinologists and dialysis.

RESULTS — The estimated direct cost of diabetes in 2002 ranges from €2.4 to 2.67 billion. Hospital costs were the most (€933 million), followed by noninsulin, nonhypoglycemic agent drugs (€777–932 million). Much lower are the costs of insulin and oral hypoglycemic agents (€311 million), primary care visits (€181–272 million), specialized visits (€127–145 million), and disposable elements (€70–81 million). Expenditures for all drugs and consumable goods ranged between €1.16 and 1.3 billion, representing 48–49% of total cost, which is 15% higher than hospital costs.

CONCLUSIONS — The direct health care costs of diabetic patients are high (6.3–7.4% of total National Health System expenditure). Their average annual cost is €1,290–1,476. For individuals without diabetes, the average annual cost is €865.

The goal of this study was to estimate the direct health care costs of patients with diabetes, including chronic complications. Diabetes is a high-incidence, chronic, globally occurring disease that increases morbidity and mortality, seriously diminishing quality of life. The World Health Organization estimated that in 1995, 135 million adults had the disease, and it forecasts that 300 million (a 120% increase) (1) will have it in the year 2025. Resources allocated to diabetes prevention and treatment are

growing, but prevalence also grows steadily. Acute decompensations that are chronic complications, such as cardiovascular problems, renal disease, neuropathy, foot ulcer, and loss of vision, are frequently associated with diabetes. The risk of having these conditions is higher for diabetic patients compared with nondiabetic patients in the same age-group (2–4).

Chronic complications are the main cause of death among diabetic patients and account for the highest costs in hos-

pitalization and drugs, and the costs of drugs for these complications are 2.5 times higher than those for the general population. Even after adjustment by age and exclusion of insulin and oral hypoglycemic agents, expenditures for other drugs are higher among diabetic patients (5,6). Given the relevance of diabetes complications (7–12), particularly chronic complications, cost-of-illness studies based only on acute complications result in underestimations. A key contribution of this study is to account not only for the direct costs of diabetes itself but also for the consumption of resources to prevent and treat complications.

In Spain the National Health System (SNS) is a public health care insurance system, with universal coverage of the population of 41 million. Administered by the 17 “autonomous communities” (states), it is coordinated by the national government and fully financed by the general tax fund. Hospitals and primary health care centers are publicly owned, with some contracting out to private hospitals. Medical doctors are paid by salary. Primary care doctors act as gatekeepers. There are private health insurance companies and private practices, particularly of specialists, with a complementary role, although some activities are totally private (i.e., dental care). The national health expenditure is 7.5% of gross domestic product: 71% public and 29% private.

In Spain, only three studies have measured the direct health care costs of diabetes. In the study by Hart et al. (13), total costs associated with diabetes in 1994 were ~€544.8 million, with an average annual cost of €381 per diabetic patient. Hospitalizations represent the main portion of all costs (36%), followed by doctor and hospital outpatient visits (14.1%), antidiabetes drugs (13.2%), laboratory tests (10%), and dialysis (9.4%).

The CODE-2 study (14) analyzed 1,004 type 2 diabetic patients. The mean annual direct health care cost per patient was €1,304, indicating a total annual cost for Spain of €1.96 billion. The highest expenditures were drugs (42.4%), hospital care (32%), and ambulatory care (25.6%).

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Abbreviations: CMBD, Conjunto Mínimo Básico de Datos; DRG, diagnosis-related group; SNS, Spain's National Health System.

A table elsewhere in this issue shows conventional and Système International (SI) units and conversion factors for many substances.

Table 1—Source of information for health resources considered

| Item | Source | Reference |
|---|-----------|---|
| Cost of insulin (A10A) and oral hypoglycemic agents (A10B)* | Primary | General directorate of pharmacy of the Ministry of Health, 31, 32 |
| Other drugs | Secondary | 14 |
| Consumable goods (test strips + needles and syringes) | Secondary | 33–37 |
| Visits to specialists + dialysis* | Secondary | 15, 38–40 |
| Primary care visits | Secondary | 15, 34, 35* |
| Hospital costs* | Primary | 46 |

*Cost per visit in primary care: refs. 13, 41–45.

López Bastida et al. (15) considered the direct and indirect costs of diabetes in the Canary Islands. Their findings show that the direct health care costs were €24 million, or €470 per known diabetic patient per year (62% of the total cost of a diabetic patient). The indirect costs were €14.8 million (38% of the total). Because prevalence in this area is by far higher than the national average, it is a study that is difficult to extrapolate.

RESEARCH DESIGN AND METHODS

This study focuses on the prevalence of diabetes and is aimed at estimating total and per patient direct health care costs of diabetic patients cared for by the SNS in the year 2002. Because of lack of data, we do not consider private health care costs.

In accordance with the most recent epidemiological data for prevalence, we have selected an interval of 5–6% (16–29). The variety of sources, methodologies, and estimations made it difficult to select only one value; 5% is the figure from the 1997 Spanish National Health Survey (28) for adults (18 years and older) who reported that they had diabetes, had high blood glucose levels, or used antidiabetes drugs. In more recent studies, prevalence was near 6% or even higher (18,26,27,29). The interval selected is rather conservative, given that it is well established that a significant percentage of diabetes is not diagnosed (18,30), whereas prevalence of diabetes is increasing. Another assumption is that 90% of cases were considered type 2 diabetes and 10% type 1 diabetes (30).

The rate of prevalence determines the cost per patient. However, in our study, the total costs of some important items (e.g., hospitalizations, insulin, or oral hypoglycemic agents) were obtained from

primary sources, with total coverage of the event under measurement (census technique, not survey). For this reason, these costs are not estimations but rather are recorded universal data and are not dependent on prevalence. Table 1 shows sources of information for resources considered.

Total expenditures on insulin and oral hypoglycemic agents were obtained directly from the databases of the General Directorate of Pharmacy of the Ministry of Health (31,32). These databases (ALHAQUEM and RHAZES) accurately compile comprehensive information on the consumption of medicines by all outpatients in the SNS. These data are obtained after processing all prescriptions for payment purposes to the pharmacies.

It is extremely important to consider the fact that diabetic patients are treated with additional medications to prevent or treat complications associated with diabetes. Age-adjusted consumption of hypolipidemic, antihypertensive, and platelet antiaggregating drugs is significantly higher in these patients than in the general population (6,14,33). Figures for noninsulin, nonoral hypoglycemic drugs come from the CODE-2 study (14), updated for the year 2002.

Expenditures on test strips were calculated using data from four available sources. INSALUD (the central government agency still providing health care to 14 million people before devolution to the states was completed in 2002) compiled the primary data. Studies by Oliveira and Carral (33) and Clua and colleagues (34,35) were secondary sources of information.

The pattern of use and the costs of needles and syringes were drawn from studies by Costa and colleagues (36,37). We assumed that only type 1 diabetic patients use these items, which is a conservative hypothesis because a number of

type 2 diabetic patients are treated with insulin.

For outpatient visits to endocrinologists (including overhead costs and laboratory tests), we relied on the following information: 1) expertise from the department of analytical accountancy of the Hospital of Getafe, 2) secondary sources (15,39), and 3) data from INSALUD (38) on cost per visit in a section of endocrinology.

Another cost item is dialysis for diabetic patients. The prevalence of diabetic patients undergoing dialysis was obtained from a study by Amenabar et al. (40).

It should be noted that there is no information about visits to specialists other than endocrinologists (such as neurologists, cardiologists, and ophthalmologists). For this reason, we do not include these in our analysis.

Data for primary care are from secondary sources. In a study by López Bastida, Serrano Aguilar, and Duque González (15), the frequency of primary care visits was 11 per patient per year for patients receiving insulin and 9 for those receiving oral hypoglycemic agents or being treated by diet only. Clua and colleagues (34,35) found a frequency of 10 visits per patient per year in the area they analyzed. No primary data on costs per visit in primary care are available. We reviewed previous works published in Spain and found wide variations among different authors (13,41–45). Therefore, we drew on the mid-range values.

To calculate hospital costs, we relied on the Conjunto Mínimo Básico de Datos (CMBD) (set of minimum basic data) (46). The CMBD follows the recommendations of the European Minimum Basic Data Committee and compiles useful information, starting from clinical records and discharge reports from public and private hospitals using ICD-9-CM, in

Table 2—DRG selected

| Clinical classification | ICD-9-CM | DRG |
|-----------------------------|--------------------------------------|---|
| Hyperglycemic episode | 250.0–250.2 | 294, 566 |
| Ketoacidosis | 250.1–250.3 | 295 |
| Neuropathy | 250.6 | 6–18–19 |
| Nephropathy | 250.4 (581.81–583.81) | 304, 305, 315, 316, 317, 320, 321, 322, 331, 332, 556, 568, 569 |
| Ophthalmopathy | 250.5 (362.01–362.02) | 36, 37, 39, 42, 45, 46, 47 |
| Peripheral vascular disease | 250.7, 440.9, 443.8, 785.4 | 113, 114, 124, 130, 131, 209, 225, 269, 270, 285, 292, 796 |
| Cerebrovascular disease | 250.7, 430, 437, 438 | 5, 14, 15, 16, 17, 532, 533 |
| Cardiovascular disease | 250.7, 410, 411, 412, 413, 414–414.8 | 106, 107, 112, 120, 121, 122, 123, 124, 125, 127, 132, 133, 134, 140, 141, 142, 144, 145, 478, 479, 544, 546, 549, 550, 808 |

which diabetes has the main code 250. After the first classification, each patient is assigned to a diagnosis-related group (DRG) (Table 2). The CMBD recovers main and subsequent secondary diagnoses. This is very important because it improves the detection of diabetic patients hospitalized for causes other than acute diabetes complications. We selected all hospitalizations with diabetes as a diagnosis, whether primary or subsequent. When diabetic patients are hospitalized because of decompensation related to diabetes, they are included in either DRG 294 or DRG 295. If hospitalization was caused by a chronic complication, then we grouped the patients according to the primary disease, that is, diabetes. In this way, by grouping DRGs

by disease, all chronic diabetes-related complications are taken into account.

From the aforementioned primary and secondary sources, we estimated the direct health care cost of diabetic patients in Spain. Other direct costs, such as special diets, educational programs, visits to specialist nurses, or emergency room services, were not considered. All figures were updated to the year 2002 by applying the annual inflation rate, unless otherwise specified.

RESULTS— According to data from the General Directorate of Pharmacy, the total cost of insulin and oral hypoglycemic agents (A10A and A10B subclasses) was €311.4 million (Table 3). A large part of the expenditures for type 2 diabetes is

attributable to other drugs. In general, age-adjusted drug expenditures for type 1 diabetic patients are substantially higher than those for type 2 diabetic patients. Nonetheless, the average age of type 1 diabetic patients is younger, making it plausible that their average drug consumption could be similar even without age adjustment. We assumed that the average cost of noninsulin, nonoral hypoglycemic drugs is similar in type 1 and type 2 diabetic patients. Considering a 5% prevalence in the adult population (1,675,304 people), the cost of these drugs is €777.0 million. Assuming a 5.5% prevalence (1,842,835 people), the costs would be €854.7 million. Finally, if prevalence were 6% (2,010,365 people), the resulting cost would be €932.4 million.

Table 3—Costs of diabetic patients in Spain in 2002

| | Prevalence | | |
|---|---------------|---------------|---------------|
| | 5% | 5.5% | 6% |
| <i>n</i> | 1,675,304 | 1,842,835 | 2,010,365 |
| Cost of insulin (A10A) and oral hypoglycemic agents (A10B)* | 311.43 | 311.43 | 311.43 |
| Other drugs | 777.00 | 854.70 | 932.40 |
| Consumable goods (test strips + needles and syringes) | 70.09–80.74 | 70.41–81.06 | 70.73–81.38 |
| Visits to endocrinologists + dialysis* | 127.46–144.69 | 127.46–144.69 | 127.46–144.69 |
| Primary care visits | 181.24–226.55 | 199.36–249.20 | 217.49–271.86 |
| Hospital costs* | 932.99 | 932.99 | 932.99 |
| Total cost | | | |
| Minimum total cost | 2,400.2 | 2,496.3 | 2,592.59 |
| Maximum total cost | 2,473.4 | 2,574.1 | 2,674.7 |
| Per-patient cost | | | |
| Minimum cost per patient | 1,432.7 | 1,354.6 | 1,289.6 |
| Maximum cost per patient | 1,476.4 | 1,396.8 | 1,330.5 |

Cost in millions of Euros, except population and per-patient figures. *Estimated costs do not depend on diabetes prevalence because they come from records and primary sources (see RESEARCH DESIGN AND METHODS).

INSALUD's expenditures for test strips reached €23.86 million in 2002. Extrapolating this figure for the whole population (36% of Spaniards were covered by INSALUD in 2000), the result is €66.82 million in 2000. Updated to 2002, the figure would be €70.89 million (hypothesis A). A previous study (33) estimated that 1.3% of the Spanish population, or 531,016 people, used test strips. The per capita annual cost in 1997 was estimated to be €103.6. Adjusting that figure to 2002 and assuming a constant percentage of users, the estimated cost for 2002 is €66.87 million (hypothesis B). If we suppose that the number of test strip users has increased to 1.5% of the population (615,593 people), then the estimated cost increases to €77.52 million (hypothesis C).

According to Costa and colleagues (36,37), the daily cost of needles and syringes ranged between €0.051 and 0.054. Applying our estimated prevalence, the total annual cost of needles and syringes for 2002 would range between €3.22 and 4.04 million.

To estimate the cost of visits to endocrinologists, our starting assumption was that between one-third and one-half of all visits to endocrinologists are because of diabetes (39). The subsequent visit-to-first visit ratio is four to one. The cost of each first visit (38) was €79.4 (updated to 2002), whereas the cost of each subsequent visit was €47.6. Total first visits range between 127,691 and 191,537 per year, and total annual number of subsequent visits range between 510,764 and 766,146. These figures would result in an estimated cost ranging from \$34.46 to \$51.69 million.

Amenabar et al. (40) reported the prevalence of dialysis in Spain and identified diabetes as the main cause of renal failure, responsible for 23% of patients undergoing dialysis in the year 2000. Therefore, the number of diabetic patients undergoing dialysis was 3,994, and 371 underwent peritoneal dialysis in that year. The total annual cost of dialysis for diabetic patients was €93 million in 2002, with €21,308 being the mean annual cost per treatment (47) (€19,500 in 1999, adjusted to 2002).

The frequency of primary care visits was conservatively (15,34,35) estimated to be nine per year. According to our prevalence rate, the number of primary care visits may fluctuate between 15 and

18 million annually. Because of the wide dispersion of costs estimated for primary care visits in Spain, we used an average of intermediate values found in recent literature. These values range between €12 (hypothesis A) and €15 (hypothesis B) per visit. Under these assumptions, the estimated cost ranges from €181.24 million (prevalence 5%, mean cost per visit €12) and €271.86 million (prevalence 6%, mean cost per visit €15), calculating in-between values for the other assumptions.

Finally, using the CMBD (46) we estimated hospital costs. We found 285,013 hospitalizations, a little more than 3 million stays, related to patients with "diabetes" in their diagnoses (main or secondary). Applying the mean tariff per DRG per case, the total cost of stays was €853.74 million in 1999 and €932.99 million in 2002 after adjustment for inflation.

Acute complications were 4.7% of total hospital costs for diabetic patients, chronic complications accounted for 37.4% (32.2% caused by macrovascular problems and 5.2% by microvascular), and hospitalizations apparently unrelated to diabetes accounted for the remaining 57.8%.

Aggregating the items just mentioned, we arrive at a direct yearly health care cost that fluctuates between €2.4 and 2.67 billion. If we compare this with total costs of the SNS, the costs for diabetes range from 6.3 to 7.4%. The annual average cost per diabetic patient is between €1,290 and 1,476, whereas, for nondiabetic individuals in the SNS, it is €860.

Regarding the distribution of these costs, hospitalization and drugs are the most important items. Hospital costs fluctuate, depending on the assumptions involved, between 35 and 39% of the total. Expenditures on insulin and oral hypoglycemic agents range from 12 to 13%, whereas the cost of other drugs is between 31 and 36%. The cost of primary care visits trail far behind, varying from 8 to 10% of the total. The cost of visits to the endocrinologist and dialysis are 5–6%, whereas the cost of test strips, needles, and syringes amount to 3–4% of the total.

CONCLUSIONS — It has been estimated that diabetic patients consume at least ~5–6% of health care expenditures in developed countries and that a diabetic patient consumes more resources (physi-

cian services, drugs, and hospitalizations) than does a nondiabetic patient (11).

In this article, we quantify direct medical costs of diabetic patients for 2002 in Spain, capturing all available data in the National Health System. We found that they range between 6.3 and 7.4% of total public health expenditures. It means that the annual average cost of a person with diabetes is between €1,290 and 1,476 (excluding visits to specialists other than endocrinologists), whereas for individuals without diabetes the cost is €860.

Other attempts to determine the costs of diabetic patients in Spain had not included all relevant costs. It is important to highlight the fact that this is the first time to our knowledge that the CMBD and the General Directorate of Pharmacy databases have been used to estimate the cost of diabetic patients in Spain.

Several limitations of this study must be recognized. First, diabetes prevalence is probably higher than our figures because a significant number of cases go undiagnosed. This fact could change our average cost per patient but not total costs, obtained mainly from primary sources and official accounting records measuring resources spent independently of the number of patients treated. Only our estimations of "cost of other drugs" and "cost per visit in primary care" depend on the prevalence rate.

Second, our hospital cost figures are a conservative estimation of the real cost of diabetic patients. The reason for this is that the CMBD relies on a tariff for each DRG, but several studies show that for identical DRGs the average cost of diabetic patients is higher than the cost of nondiabetic patients (48–50). Therefore, hospital costs related to chronic complications and other hospitalizations of diabetic patients must actually be higher than our figures. The explanation is simple: diabetes makes treating any other disease more expensive because it extends hospital stays. This also makes diabetic patients more expensive than nondiabetic patients, independent of the episode that caused the hospitalization. Actually, the CMBD shows differences in the length of stay for diabetic and nondiabetic patients in the 590 identified DRGs, even after age is factored out. Other international studies reflect similar differences in the age-adjusted mean length of stay for identical DRGs among diabetic and nondiabetic patients (2,8,10,51).

We did not include costs for all possible health care items. Specifically, the number of visits to specialists other than endocrinologists is unknown. For the number and cost of visits in primary care, we had to rely on secondary sources. The fact is that for ambulatory care (primary or specialized), at present, there are no general, homogeneous, high-quality data (whereas data for drugs and hospitalizations are solid).

It also should be underlined that the present work does not consider non-health care direct costs, indirect costs (productivity loss), or informal care costs faced by patients and society as a whole. Estimations of indirect costs are not often performed, and findings diverge, ranging anywhere from 30 to 55% of total costs (4,7,11,52–55). Similarly, intangible costs connected to diabetes were not included. In chronic diseases, these costs are often significant, but quantifying them is very complex.

The relative weight of different items is similar to the findings of other studies (4,8,9,11), with hospital costs being the main item. However, many articles omit data on drugs other than insulin and oral hypoglycemic agents. Polypharmacy is a frequent phenomenon among diabetic patients and becomes widespread with age and the evolution of the disease over time. Almost every diabetic patient requires not only hypoglycemic treatment but also treatment for comorbidities and cardiovascular risk factors linked to diabetes. In fact, if we add up the aggregate costs of insulin, oral hypoglycemic agents, and other drugs, plus the costs of consumable goods, their total value would surpass hospital costs (49 vs. 35% for 6% prevalence). This is our more striking finding. (It should be noted, however, that the relative weight of each item should be considered rather cautiously, given the aforementioned information and data problems.) This finding is a reflection of the fact that almost all diabetic patients will undergo treatment for cardiovascular risks, macrovascular complications, and other complications, with the number of drugs increasing with age and disease progression that will account for a high proportion of overall costs. Therefore, quality management of diabetes and chronic complications should be imperative.

Resources should not be allocated according to the costs of diseases (56) but

rather where interventions benefit the most. As this study has shown, cost-of-illness studies help to illustrate the real dimension of health problems and are suitable to reveal the economic burden of a given disease, quantifying health care and other resources spent that could be allocated to alternative goals (57).

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