

# Costs of Caring for the Diabetic-Hypertensive Patient in Primary Care

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**Objective.** To determine the cost of caring for the diabetic-hypertensive patient in primary care.

**Design.** A cost analysis carried out in family medicine units in Mexico.

**Setting.** Family medicine units in Mexico.

**Participants.** Patients with diabetes and hypertension.

**Measurements.** Include the profile of use of the services and the cost of the care. The profile is defined as the average annual use of primary care services, the unit cost is calculated by reason for use in each of the services used, taking the fixed and variable consumables into account; the average cost by reason for care is calculated from use-cost ratio and the mean annual cost from the total average cost by reason for the care.

**Results.** The mean annual cost in the family doctor clinic was €180.65 (95% confidence interval [CI], 168.31-193), in the laboratory, €48.99 (95% CI, 44.85-53.18), and in the rest of the primary care services, €41.33 (95% CI, 30.19-52.46). The mean annual primary care cost per patient was €271 (95% CI, 243.36-298.65).

**Conclusion.** The primary care costs of the diabetic-hypertensive patient are concentrated in the family doctor and laboratory services.

**Key words:** Cost. Use. Diabetes-hypertension.

COSTE DE LA ATENCIÓN AL PACIENTE DIABÉTICO-HIPERTENSO EN EL PRIMER NIVEL DE ATENCIÓN

**Objetivo.** Determinar el coste de la atención en el primer nivel de atención del paciente diabético-hipertenso.

**Diseño.** Se trata de un análisis de coste realizado en unidades de medicina familiar en México.

**Emplazamiento.** Medicina familiar en México.

**Participantes.** Pacientes con diabetes-hipertensión.

**Medición.** Incluye el perfil de uso de los servicios y el coste de la atención. El perfil se definió como el promedio anual de uso de los servicios de primer nivel, el coste unitario se calculó por motivo de uso en cada uno de los servicios utilizados, considerando los insumos fijos y variables; el coste promedio por motivo de atención se integró a partir de la relación uso-coste y el coste promedio anual de la suma de los costes promedio por motivo de atención.

**Resultados.** El coste promedio anual en la consulta de medicina familiar fue de 180,65 € (intervalo de confianza [IC] del 95%, 168,31-193), en el laboratorio de 48,99 € (IC del 95%, 44,85-53,18) y en el resto de los servicios de primer nivel de 41,33 € (IC del 95%, 30,19-52,46). El coste promedio anual por paciente en primer nivel de atención fue de 271 € (IC del 95%, 243,36-298,65).

**Conclusión.** El coste de la atención del paciente diabético-hipertenso en primer nivel se concentra en la medicina de familia y el laboratorio.

**Palabras clave:** Coste. Utilización. Diabetes-hipertensión.

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## Introduction

The rising costs of health care and the changing demographic and epidemiological profile represents a challenge to the health system. The increase in the prevalence and the diagnosing of chronic degenerative diseases at an earlier age has led to a costly reason for care that competes with the budget assigned to health; hence the need to establish strategies for the efficient use of resources.<sup>1-3</sup>

Diabetes mellitus and systemic arterial hypertension have been identified as making a much greater use of the health services and economic resources.<sup>4</sup> In this respect, information on the costs of caring for the patient with diabetes or hypertension have been published.<sup>5-8</sup>

The association between diabetes mellitus and arterial hypertension has been described from an epidemiological point of view, and it has been found that the prevalence of hypertension in a population of diabetics varies between 66% and 71%.<sup>9,10</sup>

In this context, the objective was to determine the cost of caring for the diabetic-hypertensive patient in primary care in Mexico.

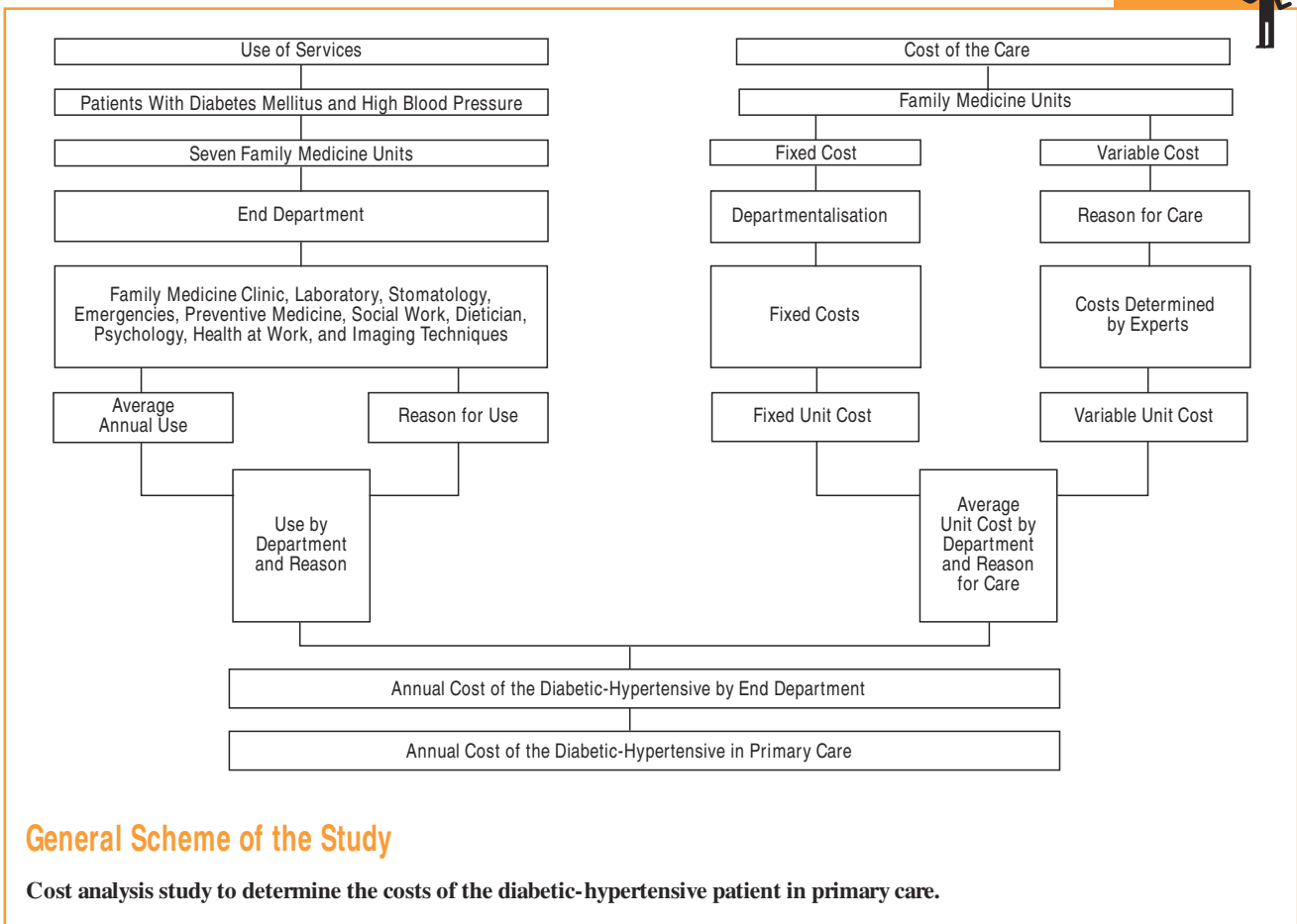
## Methods

A cost analysis of health care in a population with diabetes-hypertension was carried out in the largest Social Security institution in Mexico. The study included the profile of use of the service and the cost of the care. During the period August-November 2004, the clinical histories of the population belonging to 7 primary care units in the metropolitan area of the city of Querétaro, México, were analysed. All those who were registered at the primary care unit for 1 year or more were included, with diabetes and hypertension for 1 year or more and at least 1 consultation recorded in this period.

The sample size was calculated from the formula of means for an infinite population,  $z=1.64$ , standard deviation (SD) =0.8 and  $d=0.1$ . The estimated number (N=172) was distributed proportionally between the 7 primary care centres, and within each one a simple randomisation technique was applied, using the list of diabetic-hypertensive patients as the reference sample.

For the estimation of fixed unit costs, the departmentalisation adjusted for the productivity for 1 year was used, end and gene-

### Material and methods



ral departments were identified. Material resources considered as consumables were (furniture, equipment, and instruments), physical (infrastructure), human (personnel costs), and consumables (office material, telecommunications, fuel, electricity, and water). To assign the resources used in general departments a weighting was given to each end one, depending on the specific weight of each end department for each type of consumable.

The estimation of the variable unit cost was carried out using the micro-costing technique. To define the type and amount of consumables required for each intervention—reason for consultation, laboratory analyses or radiodiagnostics—a group of experts in the respective areas were consulted. Drugs, cure materials and reagents were considered as consumable variables.

The unit cost by reason for care was determined by adding the fixed unit cost and the variable unit cost.

In each department the mean use by reason for the care was added to the respective unit cost to obtain the mean cost per department. The annual mean cost per patient was obtained by adding the mean costs of each department included.

The socio-demographic variables and the health characteristics were also studied. The analysis included percentages, means and confidence intervals (CI) for the use, which were associated with the mean cost.

## Results

The mean age of the population studied was 61.31±9.90 years, the majority being female (80.8%) and with a primary education or less in 80.6% of cases.

The time of having the diabetes was 11.10±7.24 years and arterial hypertension 10.97±6.23 years.

The mean glucose levels were 175.28±70.16 mg/dL, with 41.3% of the values <140 mg/dL; the diastolic blood pressure was 83.79±5.07 mm Hg, with 57.6% <85 mm Hg; 28.0% were overweight and 52.9% were obese.

The annual average use of the diabetic-hypertensive patient in family medicine was 11.36±3.94 care sessions. The annual cost was €180.65 (95% CI, 168.31-193.00), that corresponding to monitoring care was €157.60 (95% CI, 151.77-163.46), followed by urinary tract infections, €4.61 (95% CI, 3.63-5.59). The reasons for care of the diabetic-hypertensive patient, the average use and cost per reason are presented in Table 1.

The number of laboratory studies was 13.17±5.47, with an annual cost of €49.02 (95% CI, 44.86-53.18); of this, €12.45 (95% CI, 11.64-13.27) corresponds to blood glucose analysis.

Table 2 shows the reasons for the laboratory test, the use and cost per reason.

Of the rest of the primary care services, the most used was preventive medicine, with an annual average of 1.05±1.06 visits; the highest cost was for stomatology, with €15.13 (95% CI, 10.90-19.36). Table 3 shows the use and the annual cost per type of service.

The annual cost of care for the diabetic hypertensive patient is €271 (95% CI, 243.36-298.65); the highest cost is for family medicine, with €180.65 (95% CI, 168.31-193.00). The annual cost per type of service in primary care is shown in Table 4.

## Discussion

In Mexico, the market structure of primary care health services is dominated by oligopoly, and the Mexican Institute of Social Security is the company with the greatest power in the market (49%).<sup>11</sup> In the study carried out, the sample comes from this institution, which tends to a population that, in accordance with the regulations for the treatment of degenerative chronic diseases, leads to the possibility of induced demand.<sup>12-14</sup>

However, in reality a percentage of the population make no demand on health services, even in the case of chronic diseases. In this study, the inclusion criteria was at least one consultation during the study period, consequently the results must be interpreted in that context.

The estimation of fixed unit cost using the departmentalisation technique adjusted for productivity allows all the

**TABLE 1** Average Annual Cost and Use of Diabetes-Hypertensive Care in the Family Medicine Unit\*

Reason	Use			Cost	
	Average	95% CI	Unit	Average	95% CI
Control of the diabetes-hypertension	9.70	9.34-10.06	16.25	157.61	151.77-163.46
Urinary tract infections	0.33	0.26-0.40	13.97	4.61	3.63-5.59
Pharyngoamylgdalitis	0.24	0.18-0.30	14.47	3.47	2.61-4.34
Request for other speciality	0.22	0.16-0.28	13.47	2.96	2.16-3.77
Peptic acid disease	0.17	0.12-0.22	13.98	2.38	1.68-3.07
Degenerative joint disease	0.12	0.07-0.17	13.86	1.66	0.97-2.36
Gastroenteritis	0.09	0.05-0.13	13.64	1.23	0.68-1.77
Consultations due to incapacity	0.08	0.01-0.15	13.47	1.08	0.13-2.02
Collitis	0.07	0.04-0.10	13.71	0.96	0.55-1.37
Low back pain	0.05	0.02-0.08	13.67	0.68	0.27-1.09
Others	0.29	0.28-0.30	13.81	4.00	3.87-4.14
Total average cost				180.65	168.31-193.00

\*CI indicates confidence interval.

The average cost is for 1 year, it includes fixed and variable costs and is expressed in euros (12.82 Mexican pesos/euro).

Taken from: <http://www.banamex.com.mx/esp/finanzas/divisas/divisas.jsp>

**TABLE 2** Average Annual Cost and Use of Diabetes-Hypertensive Care in the Laboratory Services\*

Reason	Use			Cost	
	Average	95% CI	Unit	Average	95% CI
Blood glucose	3.50	3.27-3.73	3.56	12.45	11.64-13.27
Routine urine analysis	2.24	2.09-2.39	3.36	7.54	7.03-8.04
Blood cholesterol	1.63	1.52-1.74	3.66	5.96	5.56-6.37
Blood triglycerides	1.62	1.51-1.73	3.66	5.93	5.52-6.33
Blood creatinine	1.31	1.22-1.40	3.56	4.66	4.34-4.98
Haematology screen	0.83	0.74-0.92	4.19	3.48	3.10-3.86
Blood urea	0.53	0.44-0.62	3.56	1.89	1.57-2.21
Glycosylated haemoglobin	0.29	0.21-0.37	6.23	1.81	1.31-2.31
Urine culture	0.16	0.09-0.23	5.63	0.90	0.51-1.29
Others	1.06	1.03-1.09	4.16	4.41	4.28-4.53
Total average cost				49.02	44.86-53.18

\*CI indicates confidence interval.

The average cost is for one year, it includes fixed and variable costs and is expressed in euros (12.82 Mexican pesos/euro).

Taken from: <http://www.banamex.com.mx/esp/finanzas/divisas/divisas.jsp>

**TABLE 3** Average Annual Cost and Use of Diabetes-Hypertensive Care in the Rest of the Primary Care Services\*

Type of Service	Use			Cost	
	Average	95% CI	Unit	Average	95% CI
Stomatology	0.68	0.49-0.87	22.25	15.13	10.90-19.36
Emergencies	0.20	0.15-0.25	48.10	9.62	7.21-12.02
Preventive medicine	1.05	0.92-1.18	5.73	6.02	5.28-6.77
Social work	0.38	0.28-0.48	14.66	5.57	4.11-7.04
Dietician	0.20	0.13-0.27	8.70	1.74	1.13-2.35
Psychology	0.06	0.03-0.09	28.84	1.73	0.87-2.60
Health in work	0.04	0.02-0.06	34.97	1.40	0.70-2.10
Imaging techniques	0.01	0.00-0.02	11.81	0.12	0.24
Total average cost				41.33	30.20-52.47

\*CI indicates confidence interval.

The average cost is for 1 year, it includes fixed and variable costs and is expressed in euros (12.82 Mexican pesos/euro).

Taken from: <http://www.banamex.com.mx/esp/finanzas/divisas/divisas.jsp>

consumables used to be incorporated. The resulting value is applicable to any patient attended to in the end department. From this perspective, the difference is not observed within the department, but it is seen between end departments. The theory assumed in this approach is the average duration of the medical care, independent of the reason for which it is received, as happens in practice.

What determines the difference of the unit cost is the variable unit cost. This is estimated for an average patient and is applied to all those who may have the same reason for care. The advantage of the method resides in the systematisation which is achieved by calculating the costs.

The cost of family medicine services differs from that reported in other diabetes<sup>7,15-18</sup> or hypertension studies.<sup>19,20</sup> In this case, the cost of diabetes-hypertension care includes, as well as the cost of care directly originating from the disease itself, the cost of the rest of the reasons for care in the family medicine clinic and primary care services, therefore the idea of estimating the costs is integral for primary care.

When the estimated cost of care in the family medicine clinic (€180.65) or in primary care (€271) is compared with other studies (€1290-€1476)<sup>18</sup> and (€758.28),<sup>6</sup> one of the biggest limitations is the diversity of the methods used in the estimation and the consumables considered in each case. To this is added that it deals with a diabetes-hypertension population, which differ to that included in publications associated with diabetic or hypertensive patients, for example the cost of primary care in India is (€263.78),<sup>14</sup> and the costs in other countries such as the United States (\$100 000 million per year),<sup>2</sup> or the cost of hypertension in Mexico (\$578).<sup>19</sup>

In the family doctor clinic, the cost of the reasons for care not directly related with the metabolic control is 13% of the total. It might be thought that it corresponds to a pattern of normal behaviour for chronic degenerative diseases, but with the information contained here it cannot be

guaranteed and requires another type of approach.

There is no doubt that the highest cost (85%) comes from the family doctor clinic (€229.61) and, within this, the main cost is the glucose analysis and routine urine examination.<sup>5</sup> Again, the hypothesis generated is established around the percentage cost that must be worked out between the end departments in primary care. This involves fixing the discussion around the type of care model required for chronic diseases, including diabetes-hypertension, and implicitly, the integral care approach with the use of all the primary care health services.

The importance of physical activity and nutrition in the control of chronic disease has already been shown. How-

**TABLE 4** Average Annual Cost of Diabetes-Hypertensive Care by Type of Service in Primary Care\*

Type of Service	Average Cost	95% IC	Percentage
Family medicine	180.65	168.31-193.00	66.66
Laboratory	49.02	44.86-53.18	18.09
Stomatology	6.02	5.28-6.77	5.58
Emergencies	15.13	10.90-19.36	3.55
Preventive medicine	5.57	4.11-7.04	2.22
Social work	9.62	7.21-12.02	2.06
Dietician	1.74	1.13-2.35	0.64
Psychology	1.73	0.87-2.60	0.64
Health in work	1.40	0.70-2.10	0.52
Imaging techniques	0.12	0-0.24	0.04
Total	271.00	243.36-298.65	100.00

\*CI indicates confidence interval.

The average cost is for 1 year, it includes fixed and variable costs and is expressed in euros (12.82 Mexican pesos/euro).

Taken from: <http://www.banamex.com.mx/esp/finanzas/divisas/divisas.jsp>

ever, in this population, departments such as preventive medicine, stomatology, nutrition, and social work showed a cost and profile of low use.

However, and although this is not the objective of the article, when it is observed that less than 50% of the population are controlled, the question needs to be raised whether the resources assigned for the care of the diabetes-hypertension patients is being used efficiently. It is worth mentioning that in the case of Mexico, blood glucose is used and not glycosylated haemoglobin for the systematic evaluation of the metabolic control of the diabetic patient.

In conclusion, the cost of diabetic-hypertensive primary care is centred on the family doctor and the laboratory, and 15% is generated in the rest of the services.

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Discussion  
Key points



### What Is Known About the Subject

- It is known that the cost of diabetes patient health care varies between €1305 and €2133.
- It is known that the cost of high blood pressure in primary care is between €305 and €820.
- It has been calculated that these 2 diseases consume between 13% and 15% of the health budget.

### What This Study Contributes

- The average pattern of use of primary care health services.
- The average cost of the diabetes-hypertensive patient in primary care.

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## COMMENTARY

# Diabetes and Hypertension: a Growing and Costly Epidemic

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The number of patients with type 2 diabetes mellitus (DM2) is constantly increasing and is one of the main world health problems, due to its high prevalence, its high economic cost and the number of premature deaths it causes, particularly in the most socially and materially deprived sectors, among other reasons.

The World Health Organisation (WHO) predictions for the year 2030 are 366 million diabetics in the world, of true epidemic proportions with a proven existence of an inverse socioeconomic gradient in the mortality of patients with DM2, which means that at the lowest social level it is double that of the highest social level.<sup>1</sup>

Currently it is calculated that the population with diabetes consume 4%-14% of total health spending and that a diabetic patient consumes 2-6 times more resources than individuals of similar age and sex with other chronic diseases.<sup>2</sup> In Spain, according to the likelihood estimates, the total mean costs per patient per year varies between €758 and €4348<sup>3-5</sup> and with the presence of macrovascular complications they increase between 5-12 times that of patients without complications,<sup>6,7</sup> with a chosen prevalence of DM2 that is one of the main determining factors of the annual mean cost per patient. The indirect costs are unknown, such as days lost at work or permanently incapacitated.

Its association with high blood pressure, in 40%-70% of cases, increases cardiovascular mortality and speeds up microangiopathy, particularly nephropathy. Although suitable blood pressure control achieves more significant effects than good glucose control<sup>2</sup> on the morbidity and mortality due to diabetes by reducing the incidence of acute myocardial infarction (↓ 63%), cardiovascular complications (↓ 51%), and all the causes of mortality (↓ 62%), the evidence available shows that diabetic patients do not receive the cost effective care available,<sup>8</sup> since around 29% of the hypertensive diabetics do not know they have a high blood pressure and only 43% have adequate levels of control.<sup>9</sup> To achieve the objective of controlling blood pressure in diabetic patients appears to require a higher number of visits, but the economic benefit due to the decrease in cardiovascular complications seems to compensate for the additional costs.<sup>10</sup> There are no relevant studies on this association in the Spanish setting.

The original article published on the care costs of the hypertensive diabetic patient shows 2 deficiencies, normal in these types of results: firstly, a non-validated basic methodology for cost calculation is used that would enable results to be compared and, secondly, it does not describe a minimum standard of care as a reference of the care pro-

## Key Points

- In the combination of DM2 and high blood pressure, adequate control of the blood pressure achieves more important effects on morbidity and mortality for the diabetic than good glucose control, but around 29% of diabetic-hypertensive patients are unaware they have high blood pressure and only 43% are adequately controlled.
- In Spain the annual cost per patient varies between €758 and €4348 and the presence of macrovascular complications is the factor that increases the associated costs even more (5-12 times).
- Homogeneous data bases need to be available to be able to obtain information on the efficiency of the health services in modifying the causes of death associated to DM2 so that they can be compared, as well as being able to use the total costs as a measure of the benefits.
- Hospital costs and drug spending are the most weighted areas. Patients, the health system, and society must accept the challenge to change chronic complications by of proven preventive effectiveness.

vided to the individual diabetic patient. On the other hand, it does provide new data on the cost of a very common association and risk that should enable it to be compared with the possible benefits of the investment in interventions that might reduce the associated morbidity and mortality. The calculation of costs in this environment reduces its value, mainly in regard to the development of quality care and, as regards the significance of chronic complications, it is reasonable to think that cost studies based exclusively on demand may be strongly biased downward in that it does not allow the costs associated with the prevention of the complications of DM2 to be identified or the use of resources in the treatment of these. In any case, homogeneous data bases must be made available to be able to obtain information on the efficiency of the health services in modifying the causes of mortality associated with DM2 and make them comparable, as well as being able to use the total costs as a measure of the benefits of prevention and treatment programmes capable of

altering the increase in cases and reduce the effects of the diabetes on the patient, the health system, and society in general.<sup>11</sup>

Finally, we will consider the known distribution of the costs<sup>3,4,11</sup>: hospitalisation uses up 32%-60%, pharmacy costs are 12%-42%, and 8%-26% to primary care clinics. Hospital costs and spending on drugs are the highest weighted areas. Must we continue like this? Perhaps there is too much interest in continuing to use hospitals to treat conditions with a high variability of use. Patients, health services and society must accept the challenge to change chronic conditions by interventions of proven preventive effectiveness. It would be reasonable to believe that the efforts of the professionals in the practice of cost effective medicine can correct these deficiencies.

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