mg/L level, the specificity remained at 71% (sensitivity 87%).

CONCLUSIONS

A sensitivity of 3 mg/L is needed to detect the 10-mg amount of albumin in a 3000-ml volume, which was the maximum volume observed in our diabetic patients. Thus, screening methods with sensitivities of 20 mg/L will miss a considerable number of early cases with marginally elevated N-AER. The fraction of missed new cases is higher in the clinical follow-up of patients (where dipstick-positive cases become excluded and are then followed by quantitative measurements) than in the initial cross-sectional surveys—usually published in the literature—because the N-AER values of the new cases are lower on average than those of all pathological cases at any given time point.

The sensitivity of a dipstick method with a 20-mg/L albumin concentration limit would be ~60–70% in detecting increased N-AER (Fig. 1). We cannot accept a loss of ~30–40% of early nephropathy cases if an effective, although somewhat more cumbersome, measurement can be adapted. Others have recommended rapid tests for albumin concentrations, proposing that the sensitivities and specificities have been acceptable (5,6). However, although Coonrad et al. (5) stated that they achieved a sensitivity of 85% for an overnight sample, they also included macroalbuminuric cases (53% were Multistix positive) in their evaluation.

If an attempt was made to improve a dipstick by increasing its sensitivity to 10 mg/L albumin, 87–91% of our pathological cases would become detected (Fig. 1). However, false positives would reduce the predictive value of a positive test to 60% in the IDDM group (Fig. 1*A*). Thus, after screening with a sensitivity of 10 mg albumin/L, a positive test would always be followed by quantitation of the actual excretion rate. In our patient material, a 100% sensitivity was reached at a 5-mg/L level, which would give an even lower predictive value for a postive test if applied. As a result, maintenance of double-test procedures for a considerable part of urinary samples would increase laboratory work. Thus, we recommend quantitative measurements of N-AER from timed urine collections for both IDDM and NIDDM patients.

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Received for publication 9 July 1990 and accepted in revised form 9 August 1990.

ACKNOWLEDGMENTS

Technical assistance of the staff of the protein laboratory at the central laboratory of Turk University Hospital is gratefully acknowledged.

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Costs of Temporary and Permanent Disability Induced by Diabetes

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Objective: To evaluate the indirect costs of diabetes and show their relationship to the chronic complications of diabetes. Research Design and Methods: The cost of temporary and permanent disability for diabetic patients was studied in a group of La Plata University employees and in a second group at the government institutions of the Buenos Aires Province during 3 consecutive yr (1984–1986). Results: Absences due to temporary disability were similar for the diabetic group without chronic complications and an age- and sex-matched nondiabetic control group. Conversely, diabetic patients with chronic complications had major increases in absences compared with the control subjects. Diabetes mellitus was the third leading cause of permanent disability mainly due to macrovascular and retinal lesions. This disability resulted in an average of 11 yr of work production loss per patient. Conclusions: These results suggest that diabetic individuals without

complications incur few additional costs compared with nondiabetic individuals. However, once complications appear, the indirect costs are very high, suggesting that secondary preventions of the diabetic complications might be an optimal approach for reducing the health-care burden of diabetes. *Diabetes Care* 14:593–96, 1991

Diabetes is a major and increasing cause of chronic ill health and premature mortality in almost all countries (1). This results in rising costs, related to both loss of man power resources (2,3–8) and medical care (2,4–6). These costs could be potentially reduced through an effective prevention program of the chronic complications of diabetes and the improvement of diabetes health care. To establish priorities for the allocation of limited resources, it is necessary to evaluate the costs of diabetes.

This study evaluated the indirect costs of diabetes health-care services and the indirect costs of morbidity resulting from lost work production. The limited information on costs of diabetes comes from a very small number of studies performed in the United States and Europe. This is the first report on costs of diabetes in Latin America.

RESEARCH DESIGN AND METHODS

Two populations were used for cost analysis. To evaluate temporary disabilities, 7946 La Plata University employees were studied. To assess permanent disability, >250,000 employees of the Buenos Aires government were studied.

In the La Plata University group, 42 diabetic individuals (5.3%) were identified in the university health records (18 with insulin-dependent diabetes [IDDM] and 24 with non-insulin-dependent diabetes [NIDDM]). The individuals were contacted for a clinical evaluation. Diabetes was classified according to World Health Organization (WHO) criteria, and complications were identified according to standardized guidelines (1,9–13).

Forty-two nondiabetic control subjects were selected from the same records and matched with the diabetic group by sex, age, and type of job. The diabetic population was divided into patients who were without complications and patients with chronic complications. The complications consisted of different localizations of macroangiopathy (42% peripheral, 22% coronary, and 5% cerebral) followed by peripheral neuropathy (33%), retinopathy (25%), and kidney lesions (11%). Hypertension was the most frequent morbid association, followed by obesity (19%) and hyperlipemia (17%). Comorbidity was a common feature, with hypertension and peripheral manifestations of macroangiopathy being the most frequent association detected.

The overall sample consisted of 31 men (mean ± SE age 55.2 ± 1.7 yr) and 11 women (mean age 44.7 ± 2.7 yr). Sixty-nine percent of the population had chronic complications. The ages were similar in patients with and without complications.

The number and causes of working days lost during the calendar year were determined for each individual during 3 consecutive yr (1984–1986). The information was available from the university medical records.

Indirect costs of illness, represented by the value of those goods and services that could have been produced if the person were not ill, proceed from the concept of income (4,6,8,14). Such income was considered equal to the average salary of the government institutions plus some fixed costs as described by Cooper and Rice (14). The final value obtained was converted to U.S. dollars at an exchange rate of 1 U.S. dollar to 15 australes. Regarding the burden of these values on the local economy, it has to be considered that at the time the study was performed, minimum monthly wage was approximately $100.

The absentee index represents the percentage of days absent as a percentage of the total number of working days. It was established with the equation used by the Bureau of Employment Security of the U.S. Labor Department (15).

In addition to the evaluation of the university employees, a second population was assessed for the costs of permanent disabilities. This population, which consisted of 2763 individuals who had early retirement pensions, was selected because the government records every premature retirement granted in the Buenos Aires Medical Registry Department.

The costs of permanent disability were estimated by calculating the expected number of years to retirement age for each early retiree. The final value of the work production loss was obtained by multiplying the number of work production years lost by the average annual earnings at different ages (65 yr for men and 60 yr for women). Work production loss was discounted at a 6% rate to convert future earnings into their present value (4,8).

Statistical analysis was performed with Wilcoxon's rank-sum test (2-tailed) for independent samples.

RESULTS

For temporary disability, the average days per year lost in the group of diabetic patients without complications was not significantly different from that for the control group (Table 1). Not unexpectedly, the diabetic patients with chronic complications had a considerably higher rate ($P < 0.05$) than the other two groups. Illness directly related to diabetes produced a low absenteeism rate in the diabetic patients without complications, whereas in the group with complications, illness di-

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TABLE 1
Costs of absenteeism

			Diabetic subjects without complications				Diabetic subjects with complications			
	Control subjects		General		Diabetes related		General		Diabetes related	
Yr	Days	Cost	Days	Cost	Days	Cost	Days	Cost	Days	Cost
1984	6.2	58.9	11.1	91.1	1.8	8.2	86.0	706.9	29.4	241.8
1985	12.6	103.4	9.5	78.4	0.4	3.1	94.1	773.4	38.8	318.7
1986	9.4	77.7	19.1	156.8	2.2	18.3	137.8	1133.0	64.7	531.9
Mean ± SD	9.4 ± 3.2	77.3	13.2 ± 5.1	108.8	1.2 ± 0.9	9.9	106 ± 27.9	871.1	44.3 ± 18.3	364.1

Values are estimates. Cost is in U.S. dollars in thousands.

rectly related to diabetes was the main cause of absenteeism.*

For the diabetic employees without complications, absences from illness related or not related to diabetes were slightly more common than those of the control group ($P > 0.05$; Table 1). However, in the group of diabetic employees with chronic complications, these figures were significantly greater than in the control group, particularly those caused by diabetes-related illness ($P < 0.01$).

There were no significant differences between the absenteeism index values obtained either in the control subjects (2.69) or the diabetic subjects without complications (3.64). These values increased significantly ($P < 0.005$) in the diabetic subjects with complications (26.98). The values corresponding to the diabetes-related illness were again minimal in the diabetic subjects without complications (0.34) and higher in the diabetic subjects with complications (12.4; $P < 0.005$).

Permanent disability, as assessed by early retirement in the government population for 1984–1986, represented 2763 individuals (1340 women, mean ± SE age 48 ± 8 yr; 1423 men, mean age 49 ± 8 yr). Those with permanent disabilities caused by diabetic complications were 115 (48 women, mean age 50 ± 8 yr; 67 men, mean age 54 ± 7 yr). Therefore, the percentage of people who retired early because of diabetes was between 3.7 and 4.9%. The mean age in the diabetic group was slightly higher than in the entire group of disabled people.

During the years 1984–1986, diabetes was the third leading cause of disability among 162 identified syndromes (Table 2). The data also demonstrated that for 27% of the early-retired diabetic subjects, the main cause of disability was not recorded (Table 3). Because the average age recorded in the group of early-retired diabetic subjects was 49 yr for women and 54 yr for men, the yr of work production lost was 11 yr for both sexes. The yearly cost for each employee was $23,660. Hence, the cost generated by the 115 early-retired employees was $2,720,900 ($1,135,680 for women and $1,585,220 for men).

*Includes episodes of hypoglycemia, ketoacidosis, small or major surgical interventions connected with foot lesions, and episodes of cardiovascular and cerebral accidents.

CONCLUSIONS

The data show the impact of diabetes on two large groups of Argentinean people and their ability to work. Of interest was that the diabetic individuals without complications and the nondiabetic control group had a similar rate of absenteeism and yearly cost. Thus, diabetes itself does not appear to be related to increased absenteeism. Conversely, both the costs of overall absenteeism and permanent disability were significantly higher in the diabetic subjects with chronic complications. Consequently, the costs of either temporary or permanent disability produced by diabetes are almost exclusivly due to chronic complications. The results obtained by different authors and summarized in a publication suggest that most of these complications can be prevented with a variable degree of effectiveness (16). Maintenance of permanent euglycemic levels in diabetic patients was the main goal in attaining such prevention (17).

Jönsson (4) estimated that the cost of diabetes control represents <25% of the total costs of the disease. Therefore, every policy attempting to improve the control of diabetes represents an investment that might produce fewer complications and reduce direct and indirect health-care costs of diabetes in the future. This decision would improve the use of resources devoted to diabetes

TABLE 2
Ranking of permanent disability causes

Order	*n*	Diagnosis
1	247	Neurotic disorder
2	157	Cardiac ischemia
3	115	Diabetes mellitus
4	107	Hemiplegia
5	101	Osteoarthrosis
6	98	Affective psychosis

Total causes of disability 162; total $n = 2763$.

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TABLE 3
Main causes of disability in diabetic population sample

Cause	*n*	%
Macrovascular disease	30	26.1
Strokes	4	
Heart disease	22	
Peripheral vascular disease	4	
Retinopathy	23	20.0
Hypertension	5	4.5
Liver cirrhosis	5	4.5
Nephropathy	3	2.6
Osteoarthrosis	3	2.6
Psychiatric disorder	3	2.6
Lung tuberculosis	2	1.7
Cardiopulmonary disease	2	1.7
Respiratory insufficiency	2	1.7
Metabolism disorder	1	1.0
Alcoholic polyneuropathy	1	1.0
Macroglobulinemia	1	1.0
Carcinoma	1	1.0
Digestive disorder	1	1.0
Unspecified	32	27.0
Total	115	100.0

health care, the quality of man power forces, and the quality of life for diabetic patients.

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Received for publication 15 March 1990 and accepted in revised form 7 December 1990.

ACKNOWLEDGMENTS

This study was partially funded by Consejo Nacional de Investigaciounes Cientificas y Técnicas and Fundación Bunge y Born of Argentina.

We greatly acknowledge the Ministerios de Salud and Economia, Direcciones de Reconocimientos Médicos and Previsión Social, Provincia de Buenos Aires, Direcciones de Sanidad, and Personal Universidad Nacional de La Plata for the use of records. We thank Drs. R. LaPorte and T. Songer for useful comments and criticisms on the manuscript and S. Lunati for secretarial support.

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Psychological Responses of Obese Type II Diabetic Subjects to Very-Low-Calorie Diet

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Objective: Very-low-calorie diets have been shown to produce dramatic improvements in glycemic control in obese subjects with non-insulin-dependent (type II) diabetes. There have been no studies of the psychological responses of diabetic subjects to these diets. Research Design and Methods: This study examined changes in hunger, depression, and anxiety in 33 obese type II diabetic subjects who were randomly assigned to behavior modification programs that used either a balanced diet of 4185–6277 J/day (1000–1500