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## Prevalence of Diabetes and Patterns of Health Services Utilization: A Comparative Analysis Between a Private and a Health Reform Group of Insureds, 1997-1998

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**Objective.** To compare the prevalence and health services utilization patterns of diabetes mellitus in a group of insureds under the Puerto Rico Health Reform Act and the private sector of the same insurance company.

**Methods:** The medical claims of the public sector insureds whose main diagnosis was diabetes mellitus (ICD9-250.0-9) were selected for analysis. Prevalence and medical utilization rates were estimated. General characteristics and services utilization were compared by age and sex using the chi-square distribution.

**Results.** A total of 38,139 diabetic cases were identified during the study period. Overall prevalence was 6.23% (95% CI: 6.17%-6.29%); 5.22% among males (95% CI: 5.14-5.30) and 7.09% among females (95% CI: 7.00%-7.18%). The proportion of cases was larger in persons aged 65 years or more (60.3%) and females (61.6%). Overall, 84.7% of insured diabetics had medical office visits, while 7.8% had emergency room services and 1.3% had hospital admissions. Female cases had more physician office

visits (62%) and insulin prescriptions (65%) compared to males ( $p < 0.05$ ). The most reported complication was cerebrovascular accident (4.4%). The prevalence of diabetes was higher in the public sector (6.23%) when compared to the private sector (4.73%) ( $p < 0.01$ ). The mean number of oral hypoglycemic ( $32.77 \pm 0.40$ ) and insulin ( $40.99 \pm 0.54$ ) prescriptions were higher in the public sector ( $p < 0.01$ ). Emergency room utilization rate was larger among males in the younger age groups of the private sector. However, hospital admissions were larger in both sexes of the younger age group of the public sector when compared with the private sector.

**Conclusions.** A higher prevalence of diabetes and mean service utilization was observed in the public sector. An in-depth analysis of the health care of patients with diabetes in the public sector is needed.

*Key words:* Diabetes mellitus, Puerto Rico, Prevalence, Health Reform Act, Insureds

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**E**nvironmental factors have been associated with an increased risk for type 2 diabetes (1). Thus, access to health care, and social, cultural and genetic factors could explain differences in diabetes prevalence between groups and communities.

In the United States, the prevalence of diabetes among Hispanics is approximately twice the prevalence among non-Hispanic Whites, and it varies by geographic location and education. Regardless of ethnicity, the age-adjusted

prevalence of diabetes is higher among persons without a high school education than among persons with at least a high school education (2). Among people aged over 35 years, those with diabetes are more likely than those without diabetes to have lower income levels. In the United States, 37% of adults with diabetes have a family income less than \$20,000. This association is an important factor in the prevention and control of diabetes (3).

The Puerto Rico Health Reform was initiated in 1993 with health care delivered through a predominant private system. The medically indigent population now receives private health insurance paid by the government, which provides them access to health care with a provider of their choice. Some of the reported risk factors associated with diabetes such as income adequacy and low educational level may suggest that people under the Puerto Rico Health Reform may have a higher prevalence of diabetes as compared with other socioeconomic groups.

Therefore, we analyzed the prevalence of diabetes in a group of insureds under the Puerto Rico Health Reform

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and compared the patterns of healthcare utilization with the private health sector of the same health insurance company.

The Triple-S (SSS) health insurance company offers services in various sectors of Puerto Rico including: corporate, individual, government employees, federal employees, individuals 65 years and older with Medicare (Medigap) and the Health Reform. The Health Reform sector is particularly watched over by the Division of Triple-C (CCC), created exclusively to care for this segment of the population.

### Methods

A diabetic patient was defined as an active insured in the CCC insurance company receiving medical services under the Health Reform whose main diagnosis in the service claims was for diabetes (ICDC 250.0-9). In addition, persons with more than one glucose test or receiving related drugs (oral hypoglycemics or insulin) for the treatment of diabetes were also included. Persons with only one visit to a medical office or one claim for drugs or laboratory tests were excluded. This was done to minimize

the possibility of including persons with non-reliable or suspected diagnosis of diabetes. Personnel of the CCC Branch of the SSS Insurance Company was responsible for identifying medical claims meeting the inclusion criteria of the study and to provide the information to the researchers. The same type of data was available from the private sector of the insurance company. Figure 1 summarizes the flowchart utilized for the study group selection. Prevalence of diabetes and its 95% confidence intervals were estimated using as denominator an average of the population of insureds during the two-year study period. General characteristics and service utilization between the private and the Reform sector were compared using the chi-square distribution. Data analysis was performed using SAS version 8 (4).

### Results

A total of 38,139 diabetic persons had used medical services under the CCC insurance company during 1997-1998. The proportion of cases varied by age, being larger in the 65 or more age group. The percentage of diabetes cases was larger among females (61.5%) than among males:

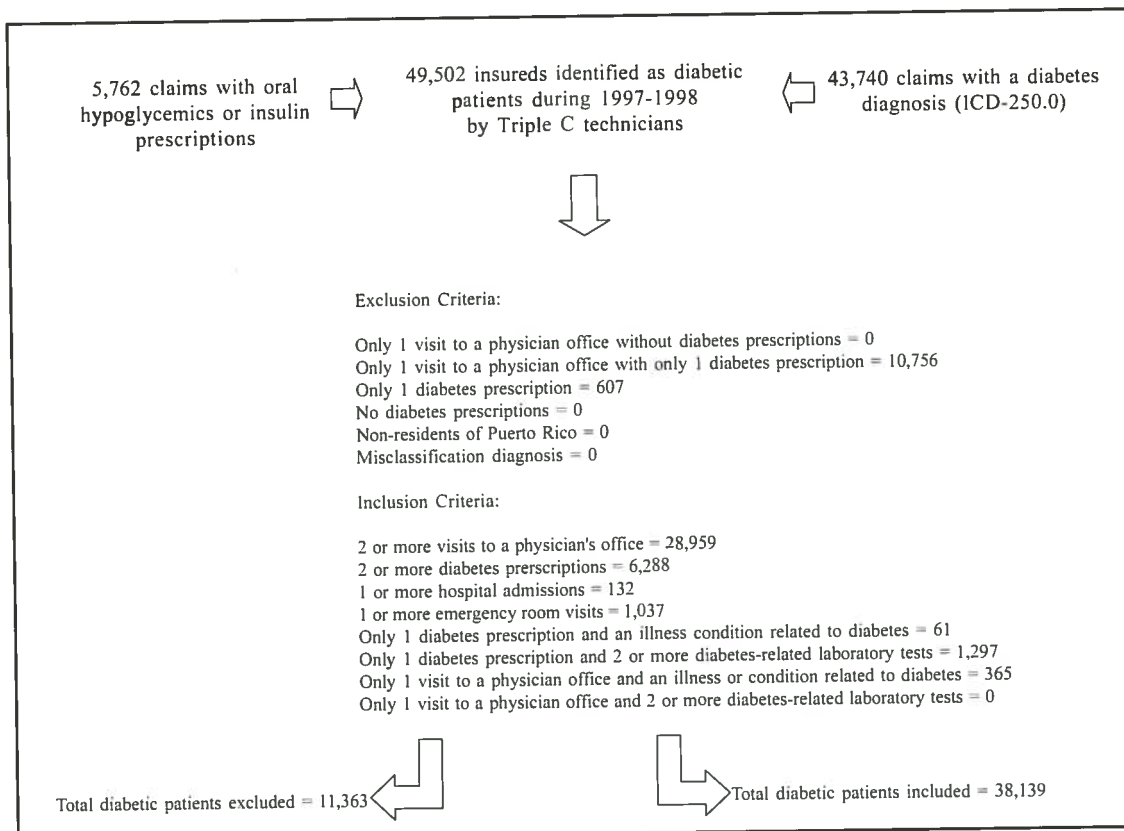


Figure 1. Diagram for the Selection Process of CCC Insureds

(38.4%) and in the  $\geq 65$  years age group compared with those aged less than 65 years (61.6% and 58.4%) (Table 1).

A total of 32,113 (84.7%) people with diabetes had at least one visit to a physician office during the study period, with 47.1% having 5 visits or more. There were 2,972 (7.8%)

cases with visits to emergency room attributed to diabetes, with 83.9% of cases having 1 or 2 visits. A total of 510 (1.3%) cases had hospital admissions, of which, 96.1% had 1 or 2 admissions (Table 1).

A total of 15,178 (39.8%) diabetic cases had claims for a

**Table 1. General Characteristics of DM among Triple C Insureds by Sex, Puerto Rico, 1997-1998**

Characteristic	Sex					
	Male		Female		Total	
	Cases	%	Cases	%	Cases	%
<b>Age group (years)*</b>						
$\leq 19$	227	1.6	228	1.0	455	1.2
20-44	957	6.5	1,246	5.3	2,203	5.8
45-64	4,917	33.5	7,548	32.1	12,465	32.7
$\geq 65$	8,563	58.4	14,453	61.6	23,016	60.3
Total	14,664	100.0	23,475	100.0	38,139	100.0
<b>Number of physician's office visits*</b>						
1-2	3,827	31.1	5,921	30.0	9,748	30.4
3-4	2,787	22.6	4,441	22.4	7,228	22.5
$\geq 5$	5,709	46.3	9,428	47.6	15,137	47.1
Total	12,323	100.0	19,790	100.0	32,113	100.0
<b>Number of Emergency Room visits</b>						
1-2	907	85.1	1,585	83.2	2,492	83.9
3-4	99	9.3	223	11.7	322	10.8
$\geq 5$	60	5.6	98	5.1	158	5.3
Total	1,066	100.0	1,906	100.0	2,972	100.0
<b>Number of hospital admissions</b>						
1-2	215	94.7	275	97.2	490	96.1
3-4	9	4.0	5	1.8	14	2.7
$\geq 5$	3	1.3	3	1.0	6	1.2
Total	227	100.0	283	100.0	510	100.0
<b>Number of glucose tests*</b>						
1-2	2,937	54.9	4,900	49.8	7,837	51.6
3-4	1,238	23.2	2,458	25.0	3,696	24.4
$\geq 5$	1,169	21.9	2,476	25.2	3,645	24.0
Total	5,344	100.0	9,834	100.0	15,178	100.0
<b>Number of oral hypoglycemic prescriptions</b>						
1-2	503	9.1	796	9.5	1,299	9.3
3-4	557	10.1	798	9.5	1,355	9.8
$\geq 5$	4,463	80.8	6,784	81.0	11,247	80.9
Total	5,523	100.0	8,378	100.0	13,901	100.0
<b>Number of insulin prescriptions</b>						
1-2	389	10.5	659	9.5	1,048	9.9
3-4	266	7.2	455	6.6	721	6.8
$\geq 5$	3,058	82.3	5,792	83.9	8,850	83.3
Total	3,713	100.0	6,906	100.0	10,619	100.0
<b>Related conditions**†</b>						
Cerebrovascular accident	747	5.1	891	3.8	1,638	4.3
Retinopathy	318	2.2	429	1.8	747	2.0
Renal failure	340	2.3	255	1.1	595	1.6
Others	46	0.3	51	0.2	97	0.2

\*p < 0.05

†Categories are not mutually exclusive

glucose test. The number of glucose test claims among females was 1.66 higher than that of males (Table 1). In addition, females had a larger proportion of having 5 or more glucose tests than males (25.2% and 21.9%).

The distribution of oral prescription claims showed that 80.9% of patients receiving medications had 5 or more oral hypoglycemic prescriptions, with females having more oral prescription claims than males (8,378 (60.3%) vs. 5,523 (39.7%)). The percentage of diabetic cases having 5 or more insulin prescription was 83%, being similar between males and females. But overall, females had more insulin prescriptions than males (6,906 (65%) vs. 3,713 (35%)). Significant differences among sexes ( $p < 0.05$ ) were observed in the proportion of physician office visits, the number of glucose tests, and diabetes related conditions. The diabetes-related complication that accounted for the largest percentage was cerebrovascular accident (4.3%) (Table 1).

The prevalence of diabetes in CCC varied within the health regions covered by the insurance company. The largest prevalence was in the Mayagüez region (10.61%; 95% CI: 10.41%-10.80%) followed by Arecibo (7.95%; 95% CI: 7.85%-8.06%). Overall prevalence was 6.23% (95% CI: 6.17%-6.29%), with 5.22% (95% CI: 5.14%-5.30%) among males and 7.09% (95% CI: 7.00%-7.18%) among females (Table 2).

**Table 2.** Diabetes Prevalence among CCC Insureds by Region, Puerto Rico, 1997-1998

Age group (years)	CCC			
	Mean population*	DM cases	Prevalence (%)	95% Confidence interval
Arecibo	262,324	20,874	7.95	7.85-8.06
Aguadilla	122,458	2,308	1.89	1.81-1.96
Mayaguez	98,271	10,424	10.61	10.41-10.80
Bayamón	129,014	4,533	3.51	3.41-3.61
Total	612,067	38,139	6.23	6.17-6.29

\*Mean population of insureds by region.

Note: Overall prevalence among males was 5.22% (95% CI: 5.14%-5.30%) and 7.09% (7.00%-7.18%) among females.

### Comparison Between SSS and CCC

The overall diabetes prevalence was higher in CCC (6.23%; 95% CI: 6.17%-6.29%) when compared with SSS (4.73%; 95% CI: 4.67%-4.79%) (Table 3), and this difference was statistically significant ( $p < 0.01$ ). In both insureds' groups (SSS and CCC), the prevalence of diabetes increased with age. But, CCC had a higher prevalence in the 45-64 age group ( $p < 0.01$ ). However, cases aged 18 years or more had a larger prevalence in CCC compared with SSS sector (9.10% and 6.64%). Differences in prevalence by age groups were statistically significant

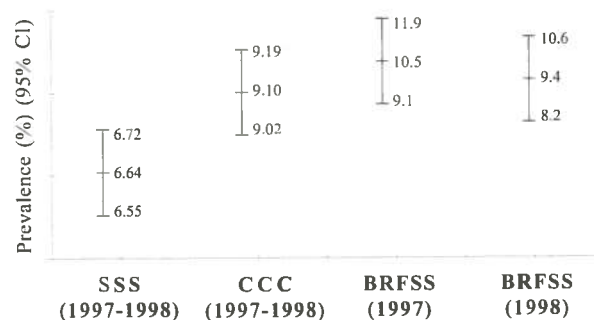
**Table 3.** Diabetes Prevalence by age group among Insureds from SSS and CCC, Puerto Rico, 1997-1998

Age group (years)	SSS			CCC		
	Mean	DM cases	Prevalence (%)	Mean	DM cases	Prevalence (%)
≤ 17	141,846	393	0.28	197,187	365	0.19
18-44	199,836	3,758	1.88	211,059	3,732	1.77
45-64	112,837	12,821	11.36	124,017	16,424	13.24
≥ 65	19,124	5,452	28.51	79,808	17,618	22.08
≥ 18	331,797	22,031	6.64	414,884	37,774	9.10
Total	473,642	22,424	4.73	612,071	38,139	6.23

Note: Both sectors (public and private) combined prevalence was 5.58%

( $p < 0.01$ ).

Figure 2 shows the prevalence of diabetes in Puerto Rican adults ( $\geq 18$  years) during 1997-1998 using the various data sources available. The prevalence of diabetes ranged from 6.6% among SSS insureds to 10.5% among adults who participated in the 1997 BRFSS. The lower prevalence in SSS insureds probably reflects differences in population characteristics such as age composition, annual income and educational attainment.



**Figure 2.** Prevalence of Diabetes in Puerto Rican Adults ( $\geq 18$  years) using Various Data Sources: 1997-1998

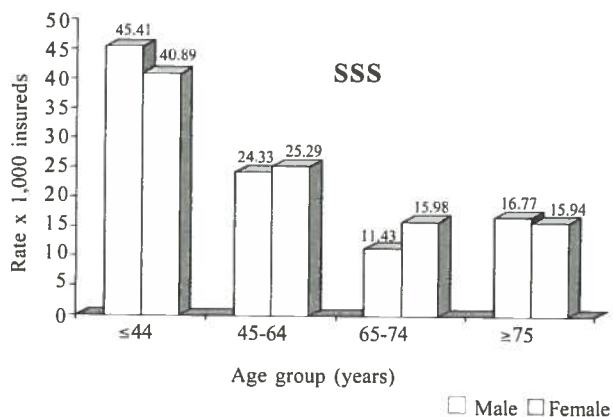
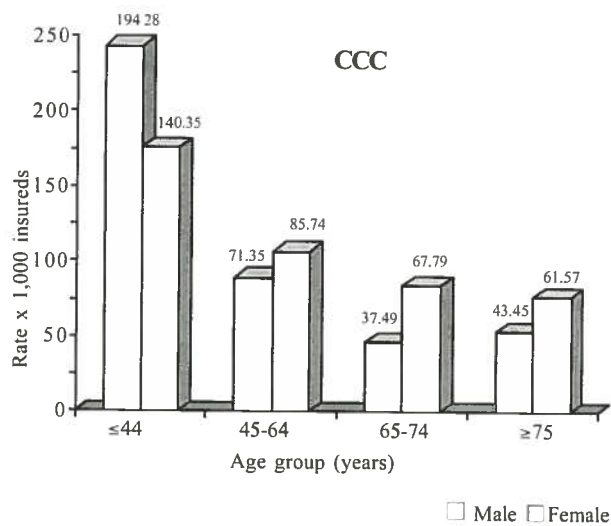
Significant differences ( $p < 0.05$ ) were observed in the mean number of visits to a physician office, emergency room visits, and number of glucose tests, oral hypoglycemics and insulin prescriptions. Overall, the mean number of oral hypoglycemic claims were almost three times higher in CCC than in SSS ( $32.73 \pm 0.40$  vs.  $11.09 \pm 0.09$ ), while the mean number of insulin claims were more than four times higher in CCC ( $40.99 \pm 0.54$  vs.  $9.07 \pm 0.10$ ) (Table 4).

The number of diabetes cases in CCC and in SSS varied by age and sex regarding their utilization rates of hospital admissions and emergency room services. In both groups,

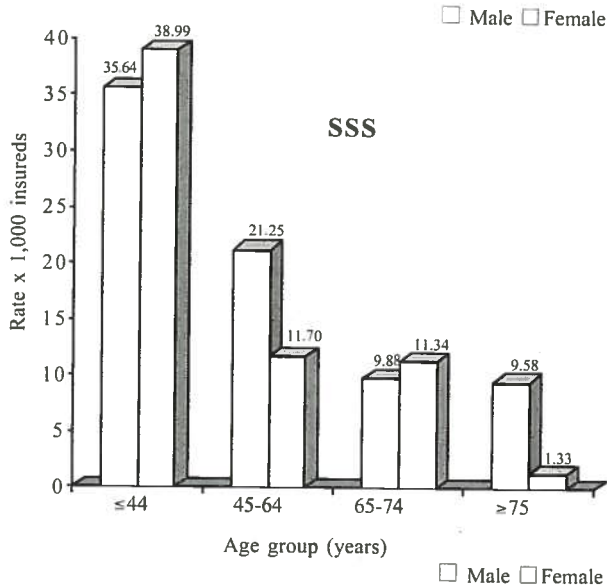
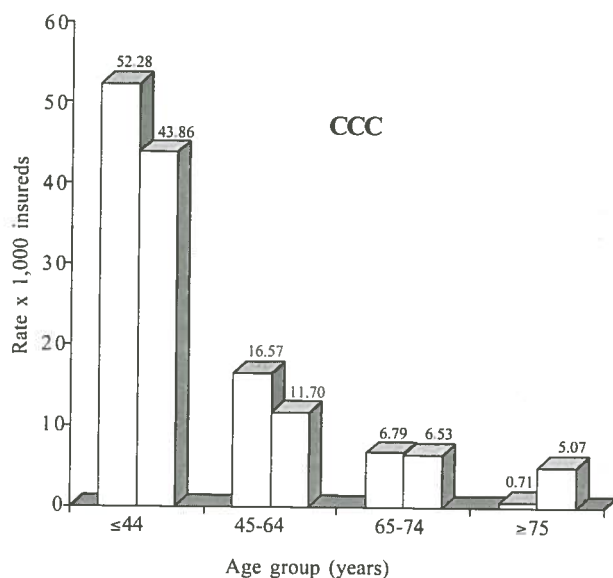
emergency room utilization rates were larger in males aged less than 44 years; however, it was four times higher in the CCC group (195 x 1,000 insureds and 45.4 per 1,000 insureds). In the older age group, females had a larger utilization rate in CCC (Figure 3). Hospital admissions rates were higher in the 44 years or less age group in both sexes of CCC (52.28 per 1,000 insureds and 43.86 per 1,000 insureds) as compared with SSS (Figure 4). However, SSS had larger hospital admissions rates in males aged 45 to 64 years (21.25 per 1,000 insureds).

**Table 4.** Comparison of Patterns of Health Services Utilization among CCC Insureds vs. SSS Insureds

Health services	SSS		CCC		p-value
	Mean	Standard error	Mean	Standard error	
Physician's office	5.13	0.04	7.55	0.05	0.0001
Emergency Room	1.13	0.02	1.97	0.10	0.0001
Hospital admissions	1.17	0.03	1.20	0.03	0.3984
Glucose tests	11.09	0.09	32.73	0.40	0.0001
Oral hypoglycemics prescriptions	9.07	0.10	40.99	0.54	0.0001
Insulin prescriptions	2.51	0.02	3.44	0.02	0.0001



**Figure 3.** Emergency Room Services Utilization Rates among Diabetic Insureds by Age Group and Sex, Puerto Rico, 1997-1998



**Figure 4.** Hospital Admission Services Utilization Rates among Diabetic Insureds by Age Group and Sex, Puerto Rico, 1997-1998

## Discussion

The findings of the present study demonstrated a higher prevalence of diabetes and a higher mean service utilization among the Health Reform insureds than those of the private sector. The prevalence in those aged 18 years or more in CCC was 9.1%, which is similar to the prevalence reported in the 1999 BRFSS (9.6%).

Diabetes prevalence has been associated with low socioeconomic income as well as with low education (2-3). Thus, it can be postulated that the higher prevalence among the CCC insureds could be partially explained by these two variables. In addition, obesity is considered a strong risk factor for diabetes in Hispanic Americans (5). Thus, it could be postulated that obesity due to inadequate nutrition such as high fat consumption could be a determinant in the CCC insureds group.

Diabetes prevalence was significantly higher among females in CCC while higher among males in SSS. However, this difference was not statistically significant ( $p > 0.05$ ). Diabetes prevalence in Puerto Rico using the Puerto Rico Basic Sample showed a higher prevalence in females (F:M Ratio 3:2) (6). Diabetes difference between sexes has not followed a consistent pattern in all countries. For example, Canada reported a higher prevalence among males due to the higher level of obesity among Canadian males (3). However, females had a higher prevalence than males in the Pacific Populations (7).

The proportion of complications such as retinopathy and neuropathy in the study was low probably due to under-reporting or under-diagnosis. Neuropathy has been reported in about 30 to 40 % of diabetic patients (8).

In the United States, the use of health care services by persons with diabetes is high, and a large proportion of the cost of diabetes has been attributed to inpatient hospital care (9). Therefore, a higher prevalence of the disease in a particular group will increase the amount of health services within that particular group.

In CCC, the average number of visits to physician's office, emergency room visits and hospitalizations were higher than SSS sector. However, the largest differences were observed in the average number of claims of medications (oral hypoglycemics and insulin). It can be postulated that disease severity can be a contributing factor for recurrent health service utilization. If a person in the low socioeconomic group does not follow adequate disease management, he/she will have a higher risk for uncontrolled diabetes. On the contrary, a high education level and a good socioeconomic status might contribute to follow preventive measures and disease management thus reducing service utilization. In a follow-up study conducted in the Netherlands it was found that contact

rates with general practitioners were significantly higher ( $p < 0.05$ ) among those with primary education compared with those with a higher educational level after controlling for disease severity. However, rates of specialist's evaluations were significantly lower among those with a low educational level although the group with the lowest educational level did not always show the lowest rates (10). In our study group, differences in socioeconomic status, a lower education, and decreased access to specialists' care could explain the higher utilization of primary health services among diabetes cases in CCC compared to those in SSS.

The pattern of health care services utilization by persons with chronic diseases such as diabetes could be influenced either by patient characteristics and behavior or by the health provider management practices. The National Diabetes Education Program has developed the Guiding Principles for Diabetes Care for health care providers and people with diabetes (11). Principle two states that persons with diabetes should have on-going care in a supportive, positive environment, without barriers to obtain care. Thus, the use of health care services by persons with diabetes is expected to be high, diverse and therefore costly. Recently, the American Medical Association, the Joint Commission on Accreditation of Healthcare Organizations, and the National Committee for Quality Assurance released a document entitled "Coordinated Performance Measurement for the Management of Adult Diabetes" (12).

To accomplish with proper care, persons with diabetes need to have a good compliance or adherence to their diabetes care. Compliance has been studied from a wide range of scientific perspectives, including medicine, nursing, psychology, and health economics (13); issues such as high number of recommendations, inadequate caregiver support or the ability to transfer themselves independently had been found to be related with poor compliance in diabetes patients (14). Furthermore, poor compliance in diabetes cases had been related to specific activities such as check up of blood pressure, weight monitoring and self-monitoring blood glucose (15-16). Barriers related with self-monitoring of glucose were examined in a group of 44,181 adults with treated diabetes from the Kaiser Permanente. This study reported that longer time since diagnosis, less intensive therapy, male sex, age, belonging to specific ethnic groups, having a lower education, neighborhood income, language barriers, high cost of equipment, smoking and excessive alcohol consumptions are significant independent factors of non-adherence practice of self-monitoring blood glucose. Self-monitoring is considered a corner stone of diabetes control

(15). In addition to patient compliance, health care providers must follow the essential components of quality treatment and continued management. As a consequence, prevention and control of diabetes complications might be accomplished.

In-depth analysis of the health care services offered to patients with diabetes in the Puerto Rico Health Reform is needed to better explain the differences in prevalence, use of therapeutic regimes and utilization of health services when compared with the private sector. This less privileged population is in direct need of education regarding diabetes management and prevention measures to attain an adequate metabolic control. They must be taught the self-management skills which will permit them to take control of their disease. This will definitely decrease their emergency rooms visits and hospitalizations, which will lead to modifications of the health care utilization practices.

## Resumen

El objetivo de este estudio fue determinar la prevalencia de diabetes mellitus en un grupo de asegurados bajo la Reforma de Salud de Puerto Rico y compararlo con el sector privado de la misma compañía de seguros. Las reclamaciones médicas de los asegurados de CCC cuyo diagnóstico principal fue diabetes mellitus (ICD9-250.0-9) fueron seleccionados para el análisis. La prevalencia y las tasas de utilización de servicios médicos fueron estimadas. Las características generales y la utilización de servicios fueron comparadas por edad y sexo utilizando la distribución de ji-cuadrada. Un total de 38,139 casos de diabetes fueron identificados entre los asegurados que utilizaron servicios médicos durante el periodo de estudio. La proporción de diabéticos fue mayor en las personas de 65 años o más (60.3%) y en mujeres (61.6%). En general, 84.7% de los casos tuvieron visitas a oficinas de médicos, 7.8% tuvieron visitas a salas de emergencia y 71.3% tuvieron hospitalizaciones. Las mujeres diabéticas tuvieron una mayor proporción de visitas a oficinas de médicos (62%) y recetas de insulina (65%) ( $p < 0.05$ ). La complicación más reportada fue accidente cerebrovascular (4.3%). La prevalencia de diabetes fue más alta en CCC (6.23%) comparado con SSS (4.73%) ( $p < 0.01$ ). El número promedio de hipoglucémicos orales ( $32.73 \pm 0.40$ ) y de insulina ( $40.99 \pm 0.54$ ) recetados fue mayor en CCC que en SSS ( $p < 0.01$ ). La tasa de utilización de los servicios de sala de emergencia fue mayor entre hombres en el grupo de edad de 44 años o menos de SSS. Sin embargo, la tasa de admisiones hospitalarias fue mayor para ambos sexos en el grupo de 44 años o menos de edad en CCC. El grupo de CCC presentó una mayor prevalencia de diabetes y un

mayor promedio de utilización de servicios. Se necesitan análisis más detallados del cuidado de salud de los pacientes con diabetes en CCC.

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