Healthcare Costs for Diabetes Associated with Health Disparities in Puerto Rico

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Objective: This study compared the healthcare utilization of and costs for adults (18–64 years) with diabetes mellitus (DM) by plan type in Puerto Rico in 2013. This study is important because understanding disparities in healthcare access and expenditures can inform public health policy decisions aimed at improving diabetes care in Puerto Rico.

Methods: Puerto Rico public and private medical insurance paid claims and enrollment data from 2013 were used to calculate the diabetes prevalence and medical care expenditures associated with this disease for total enrollers and by type of health insurance. This cross-sectional analytic study analyzed healthcare claims from 96% of the insured population in Puerto Rico, providing a comprehensive assessment of diabetes-related healthcare costs.

Results: The total expenditure for patients with DM for 2013 was $388,536,735, with 58.0% attributed to the private sector. In the public sector, the largest expenditure was for hospital services (53.8%), while in the private sector, the highest spending occurred in outpatient services (54.6%). After adjusting for sex, age, Charlson comorbidity index, and percent of copayment, public insurance beneficiaries were more likely to use hospital services (PR=3.23, 95% CI: 3.13-3.33, p<0.001) and emergency services (PR=1.61, 95% CI: 1.56-1.64, p<0.001), while private insurance beneficiaries used more ambulatory services (PR=0.91, 95% CI: 0.89-0.93, p<0.001).

Conclusion: The findings of this study suggest disparities in access to primary health services for people with DM between public and private insureds, and that there is no continuity of care, leading to high costs for such services.

[P R Health Sci J 2025;44(2):95-98]

Key words: Healthcare Access, Puerto Rico, Diabetes, Cost, Health Disparities

Diabetes mellitus (DM) is of particular concern as it represents a significant global public health problem with substantial mortality and morbidity rates worldwide. As the worldwide prevalence of DM continues to increase, so does the demand and cost of medical attention for this disease. Approximately 415 million (8.8%) adults worldwide have DM, with close to 75.0% living in countries of average and low income. The mortality rate associated with diabetes varies across regions globally, with higher rates generally observed in low and middle-income countries where healthcare access is limited and complications from diabetes are more prevalent due to delayed diagnosis and suboptimal treatment (1). In Puerto Rico, 15 of every 100 adults has DM, with self-reported prevalence increasing from 10.8% in 1996 to 15.7% in 2014 (2). In 2013, DM was the third leading cause of death in Puerto Rico, representing 10.7% of all deaths (3). According to the CDC (2012), Puerto Rico had the highest DM prevalence of all the states and territories of the United States for the period 1995–2010 (12.8% versus 8.2%, respectively) (4). Some studies have demonstrated that the type of health insurance is associated with the quality of health services (5,6). These differences can be partly explained by the mechanisms through which different insurance types reduce the financial burden of diabetes care through varying coverage policies, copayment structures, and provider networks. Puerto Rico has one of the higher incidence rates of DM compared with the other US states and territories, and the costs related to this disease are escalating. Therefore, this study aimed to compare the health care utilization and cost for adults (18-64 years) with DM, according to their plan type in Puerto Rico during 2013.

Methods

An analytic dataset that consisted of the healthcare claims of 96% of the insured population in Puerto Rico was provided by the Assistant Secretary of Planning and Development of the Puerto Rico Department of Health. This dataset included a comprehensive representation of the territory's insured population, allowing for robust analysis of healthcare utilization patterns. The study population included individuals aged 18 to 64 with health insurance, including privately insured individuals and those with Medicaid, who had health service claims for DM in 2013. Cases with DM were restricted to adults with 2 or more medical claims for

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The authors have no conflict of interest to disclose.

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outpatient services or 1 or more medical claims for hospitalization and emergency department visits (International Classification of Diseases, Ninth Revision, Clinical Modification, codes 250.xx). This case definition is consistent with validated methods for identifying diabetes cases using administrative claims data, as demonstrated in previous research (7). This study was approved by the Committee of Human Rights (protocol #A3420315). The independent variables included were age (categorized as 18-44 and 45-64 years), sex, health plan type (private, public (Medicaid)), Charlson comorbidity index (calculated using ICD-9-CM codes and dichotomized as 0-1 and ≥2), and the level of copayment. The dependent variables included hospitalizations, visits to the emergency room, and ambulatory medical visits.

Statistical analysis

Categorical variables were described using frequency distributions. Prevalence of DM was calculated overall and stratified by sex, age and plan type, estimated as the total number of insureds with DM divided by the number of insureds in the population aged 18-64 years. Differences in demographic characteristics and healthcare utilization according to plan type were tested using the chi-squared test. Statistical significance was set at $p<0.05$, and 95% confidence intervals (CIs) were calculated for all prevalence ratios to assess the precision of our estimates. Log-binomial regression was used to estimate adjusted prevalence ratios (PRs) for the use of services for private and public insureds with DM adjusting for sex, age, Charlson comorbidity index, and percent of copayment. Poisson regression was used to estimate the rate and intensity of health care utilization. This model was selected because healthcare utilization count data typically follows a Poisson distribution and allows for appropriate modeling of count data while controlling for exposure time. A gamma generalized linear model was employed to compare the average medical expenditures between public and private plan, adjusting for sex, age, Charlson comorbidity index, and percent of copayment. The gamma distribution was chosen due to the typically skewed nature of healthcare cost data, which violates the normality assumption of standard linear models. All analyses were performed using STATA version 12.

Results

The study population comprised 102,507 people, of whom 71.5% had public health insurance (Table 1). The average age was 50.0 (±11.6) years; more than half (58.2%) were women, and 33.8% had a Charlson Comorbidity Index of 2 or higher. Significant differences were observed in demographic characteristics according to plan type, with privately insured individuals more likely to be male, older, and with more comorbidities. Prevalence of DM was 6.8% overall. When compared by plan type, the prevalence in the public sector was significantly higher at 11.3% compared to 3.4% in the private sector ($p<0.001$).. By age group, the prevalence of DM was higher in individuals aged 45 to 64 years than in those aged 18 to 44 years (Table 1). The total healthcare expenditure was $388,536,735, of which 58.0% occurred in the private sector. While the most significant expenditure in the public sector was related to hospital services (53.8%), outpatient services (54.6%) were the highest expenditure in the private sector.

The use of hospital services among public insureds was 3.23 times more frequent compared to private insureds after adjusting for sex, age, and Charlson comorbidity index (PR=3.23, 95% CI: 3.13-3.33, $p<0.001$). Similarly, the intensity of use of hospital services was slightly more frequent in the public sector compared to the private sector (PR=1.02, 95% CI: 1.01-1.03, $p<0.001$). However, the average cost for hospital services claims among public insureds was 46% lower compared to private insureds after adjustment (PR=0.54, 95% CI: 0.53-0.54, $p<0.001$) (Table 2).

The use of emergency services among public insureds was 1.61 times more frequent compared to private insureds (PR=1.61, 95% CI: 1.56-1.64, $p<0.001$), while the intensity of use was 17% lower in the public sector (PR=0.83, 95% CI: 0.82-0.84, $p<0.001$). The average cost for emergency services claims among public insureds was 19% lower compared to private insureds (PR=0.81, 95% CI: 0.81-0.81, $p<0.001$) (Table 2).

Table 1. Demographic characteristics, diabetes prevalence and healthcare expenditure by insurance type in Puerto Rico, 2013

Characteristics	Public N (%)	Private N (%)	Total N (%)	p-value
Sex				<0.001
Female	45,777 (62.5)	13,888 (47.5)	59,665 (58.2)	
Male	27,514 (37.5)	15,328 (52.5)	42,842 (41.8)	
Age				<0.001
18-44 years	23,615 (32.2)	3,020 (10.3)	26,635 (26.0)	
45-64 years	49,676 (67.8)	26,196 (89.7)	75,872 (74.0)	
Charlson Comorbidity index				<0.001
0-1	48,682 (66.4)	19,162 (65.6)	67,844 (66.2)	
≥ 2	24,609 (33.6)	10,054 (34.4)	34,663 (33.8)	
Total	73,291 (71.5)	29,216 (28.5)	102,507 (100)	
Diabetes Prevalence				
Female				
18–44 years	14,727 (5.7)	1,335 (0.6)	16,062 (3.2)	
45–64 years	31,050 (22.2)	12,553 (5.3)	43,603 (11.6)	
18–64 years	45,777 (11.5)	13,888 (2.9)	59,665 (6.8)	
Male				
18–44 years	8,888 (5.6)	1,685 (0.9)	10,573 (3.0)	
45–64 years	18,626 (20.9)	13,643 (7.3)	32,269 (11.7)	
18–64 years	27,514 (11.1)	15,328 (4.0)	42,842 (6.8)	
Overall	11.3%	3.4%	6.8%	<0.001
Mean Health Care Expenditure ($) per capita				
Hospital	1209.8 (53.8%)	2995.5 (39.1%)	1730.5 (43.1%)	<0.001
Emergency room	263.7 (11.8%)	431.3 (5.6%)	313.0 (7.8%)	<0.001
Ambulatory services	771.4 (34.4%)	4181.9 (54.6%)	1973.4 (49.1%)	<0.001
Overall	2250.5 (100%)	7653.2 (100%)	4016.9 (100%)	<0.001

In contrast, the use of ambulatory services among public insureds was 9% lower compared to private insureds (PR=0.91, 95% CI: 0.89-0.93, p<0.001). The intensity of use of ambulatory services was 78% lower in the public sector (PR=0.22, 95% CI: 0.22-0.22, p<0.001). The average cost for ambulatory services claims among public insureds was 37% lower compared to private insureds (PR=0.63, 95% CI: 0.63-0.63, p<0.001) (Table 2).

Table 2. Prevalence rates for use, intensity of use, and average cost of healthcare services for private insureds with diabetes mellitus compared to public insureds with diabetes mellitus, Puerto Rico, 2013

Type of Service	PR*	95% CI	*P* value
Hospital (n = 74,423)			
Use of service	3.23	3.13-3.33	<.05
Intensity of use of service	1.02	1.01-1.03	<.05
Average cost per claim	0.54	0.53-0.54	<.05
Emergency room (n = 50,867)			
Use of service	1.61	1.56-1.64	<.05
Intensity of use of service	0.83	0.82-0.84	<.05
Average cost per claim	0.81	0.81-0.81	<.05
Ambulatory services (n = 95,916)			
Use of service	0.91	0.89-0.93	<.05
Intensity of use of services	0.22	0.22-0.22	<.05
Average cost per claim	0.63	0.63-0.63	<.05

Abbreviation: PR, prevalence rate.
*Adjusted by sex, age, Charlson Comorbidity Index, and percent of copayment.
Reference Group: Private Health Insurance

Discussion

Of 1,503,424 adults, 6.8% met the case definition of diabetes. Prevalence was significantly higher (11.3%) in public than in the private health insurance (3.5%, p<0.001). This finding is consistent with BRFSS data showing that individuals with higher income or educational level have lower diabetes prevalence (2).

Hospital and emergency department utilization rates in public insureds with DM are higher than in private insureds, while outpatient services use is lower among public insureds. The observed disparities could be explained through several mechanisms. At the systems level, decreased hospital services use from individuals with private health insurance may be due to better access to outpatient services, stemming from more robust provider networks, shorter wait times, and fewer transportation barriers. Studies show that integrated care and adequate disease management programs often lead to better glycemic control and fewer hospitalizations (8,9).

A study by AHRQ reported that hospitalization rates in patients with DM decreased as patient income increased.10 DM ranked third among the ten most frequent diagnoses for super-users of Medicaid services (11). The higher usage of outpatient services and decreased usage of hospitalizations among private insureds found in this study suggests better continuity of treatment and more effective DM management.

Payment structure differences likely contribute to these disparities. The private sector operates with a "fee for service" system versus capitalized systems that reduce payments to suppliers in the public sector (12). This fundamental difference creates divergent incentives: the fee-for-service model may encourage more frequent visits and procedures, while the capitated model may discourage provision of additional services.

Higher spending in the private sector may also be due to higher provider and hospital rates. Cooper et al. found that price variation was the leading cause of private insurance spending differences (13).

Strengths and Limitations

Administrative claims data offer standardized measurement across populations while being cost-effective (14), though limitations include potential diabetes prevalence underestimation and inability to distinguish diabetes types, affecting management findings (15).

Conclusion

This study highlights significant disparities in access to primary health services for diabetes between private and public insureds in Puerto Rico. It is crucial to re-establish the level structure of attention of health by integrating new models to manage and control DM effectively and creating public policies aimed at reducing these (16,17). The public health insurance system in Puerto Rico would benefit from restructuring its payment model from a capitated system to a hybrid system that incentivizes preventive care and effective chronic disease management, particularly for conditions like diabetes that require consistent monitoring and treatment. Additionally, implementing integrated care coordination programs specifically designed for diabetes patients within the public insurance framework could help reduce the over-reliance on hospital and emergency services by improving access to regular outpatient care, diabetes education, and medication management. Future studies are needed to better understand the mechanisms underlying these disparities and to develop targeted interventions that can improve outcomes for all patients with diabetes in Puerto Rico, regardless of insurance type.

Resumen

Objetivos: Este estudio comparó la utilización de servicios de salud y los costos para adultos (18-64 años) con diabetes mellitus (DM) por tipo de plan en Puerto Rico en 2013. Este estudio es importante porque entender las disparidades en el acceso a la atención médica y los gastos puede informar decisiones de política de salud pública dirigidas a mejorar la atención de la diabetes en Puerto Rico. Métodos: Se utilizaron datos de reclamaciones pagadas y de inscripción de seguros médicos públicos y privados de Puerto Rico de 2013 para calcular la prevalencia de diabetes y los gastos de atención médica asociados con esta enfermedad para el total de afiliados y por tipo de seguro de salud. Este estudio analítico transversal analizó reclamaciones de atención médica del 96% de la población asegurada en Puerto Rico, proporcionando una

evaluación integral de los costos de atención médica relacionados con la diabetes. Resultados: El gasto total para pacientes con DM en 2013 fue de $388,536,735, con un 58.0% atribuido al sector privado. En el sector público, el gasto mayor fue en servicios hospitalarios (53.8%), mientras que, en el sector privado, el gasto mayor se produjo en servicios ambulatorios (54.6%). Después de ajustar por sexo, edad, índice de comorbilidad de Charlson y porcentaje de copago, los beneficiarios de seguros públicos tenían más probabilidades de utilizar servicios hospitalarios (PR=3.23, 95% CI: 3.13-3.33, p<0.001) y servicios de emergencia (PR=1.61, 95% CI: 1.56-1.64, p<0.001), mientras que los beneficiarios de seguros privados utilizaron más servicios ambulatorios (PR=0.91, 95% CI: 0.89-0.93, p<0.001). Conclusiones: Los hallazgos de este estudio sugieren disparidades en el acceso a servicios de salud primaria para personas con DM entre asegurados públicos y privados, y que no hay continuidad de atención, lo que lleva a altos costos para dichos servicios.

Acknowledgments

This research, along with the editorial services of Dr. María González-Pons, was supported by the National Institute on Minority Health and Health Disparities and the National Institute of Allergy and Infectious Diseases of the National Institutes of Health under award number U54MD007587. The content is solely the responsibility of the authors and does not necessarily represent the official views of the National Institutes of Health. The data was provided by the Assistant Secretary of Planning and Development of the Puerto Rico Department of Health.

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