Adherence to American Diabetes Association and Centers for Medicare & Medicaid Services Guidelines for Diabetes Management in Puerto Rico's Medicaid Population

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Objective: This retrospective analysis aimed to assess compliance with the diabetes mellitus (DM) treatment guidelines published by the American Diabetes Association and the Centers for Medicare and Medicaid Services (United States) among Puerto Rican patients enrolled in Medicaid.

Methods: In this retrospective analysis of 2019 encounter data, we identified 128,065 patients with a diagnosis of type 1 or type 2 DM. The initial population of patients was assessed based on criteria including sex, age, insurance provider, type of medical provider (primary care or specialist), type of procedures and medical complications.

Results: Of the 128, 065 detected patients, only 44.4% had been seen by a primary care provider. Among all these patients, 4,346 (3.4%) were aged 0–18 years and had type 2 DM. Only 4.1% of the patients had been evaluated by an endocrinologist, and 1.3% by a nephrologist. Moreover, only 48% of the patients had an A1C test performed at least once in 2019; 26% had had a test for microalbumin determination; and 44% had undergone an estimated glomerular filtration rate assessment (as part of a comprehensive metabolic panel). Tests for the early detection of eye and kidney complications were very infrequently conducted. Individual health insurers showed similar levels of (low) compliance with the national recommendations for DM management.

Conclusion: Limited patient and physician engagement are 2 primary factors contributing to poor adherence to national diabetes care guidelines among Medicaid patients in Puerto Rico. This lack of adherence can lead to an increase in patient mortality (diabetes is the third highest cause of mortality in Puerto Rico) and morbidity from both macro- and microvascular complications.

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I n 2004, we published (in the medical journal Endocrine Practice (1)) a comparative analysis that measured compliance with national guidelines on the treatment of diabetes mellitus as established by the American Diabetes Association (ADA). The study compared a private model and a public model, for the provision of health services to the diabetic population of Puerto Rico. The findings showed that a significant effort was required to bridge the gap between private- and public-sector treatment for patients of diabetes under the Puerto Rico Health Reform, which prompted various adjustments. First, providers were required to update their existing management guidelines for treating patients with diabetes. Second, all active diabetes treatment providers were required to take a compulsory triennial course on how to properly treat the condition. Lastly, a YouTube channel (Alerta Diabetes) was established as a virtual resource for providers and patients alike to learn (or continue learning) about proper diabetes management and the prevention of chronic complication.

A wealth of diabetes research has detailed the importance of timely, evidence-based treatment for this condition. Proper treatment can enable providers to rapidly detect and mitigate possible complications, a critical consideration considering the systemic effects of glucose complications, especially considering that virtually all the organs in the human body are affected by glucose dysregulation. The existence of established treatment guidelines allows us to measure the degree of compliance with those guidelines by not only providers but also patients with diabetes mellitus.

In this study, we evaluated compliance with preventive guidelines for chronic diabetes-related complications, such as chronic kidney disease and retinal disease, as well as other conditions that contribute to long-term morbidity in this population (2).

Diabetes mellitus impacts a substantial portion of the Puerto Rican population (3)—17.5% of those over 18 years of age as of 2019—and is the leading cause of end-stage kidney disease requiring dialysis in Puerto Rico. Thirty-five percent of the total population of Puerto Rico in 2019 belonged to the Puerto Rican government health plan (Plan Vital). This health plan included and still includes Medicaid patients of Puerto Rican population. Given the variability among health insurers participating in Puerto Rico's Health Reform (Plan Vital), this study compared compliance

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with ADA and Centers for Medicare and Medicaid Services guidelines for diabetes management, first across all. Insurers and then separately for each participating insurer (4–6).

Methods

Patient selection

For this analysis, we obtained patient data from the archives of the Plan Vital data center corresponding to the year 2019. This year was selected to avoid bias caused by the reduced utilization of medical services during the COVID-19 pandemic. The patients' protected health information was safeguarded by the system administrator in accordance with HIPAA (US Health Insurance Portability and Accountability Act) guidelines. The initial population of patients was assessed based on criteria including sex, age, insurance provider, type of medical provider (primary care or specialist), *International Classification of Diseases*, 10th edition (ICD-10), diagnostic codes, and Current Procedural Terminology codes; the ICD-10 codes E10.xxx and E11.xxx were used to select study participants with diabetes mellitus.

Results

In 2019, a total of 1,115,339 patients insured under Plan Vital (representing 35% of Puerto Rico's general population of 3,193,694) were identified. Of this population, 128,065 patients (11.5%) were identified as having diabetes. In this sample, 5,608 (4.38%) were diagnosed with type 1 diabetes, and 122,457 (95.6%) were diagnosed with type 2 diabetes (Table 1). As observed in Table 1, most of the patients were 50 years and older (77,153 patients in this age group account for 60% of the diabetic population under Plan Vital in Puerto Rico).

Table 1. Patient distribution by age

Age (y)	Female		Male		
	Type 1	Type 2	Type 1	Type 2	Total
0–18	643	2,265	619	2,081	5,608
19–29	743	5,509	608	2,837	9,697
30–39	607	7,829	481	4,334	13,251
40–49	661	12,458	465	8,772	22,356
50–59	886	21,045	557	13,316	35,804
60–69	694	17,268	348	9,918	28,228
>70	277	8,600	113	4,131	13,121

Of the population of patients under 18 years of age with diabetes, 4,346 (77%) were diagnosed with type 2 diabetes. Across all age groups, diabetes was more prevalent in women than in men.

Service by type of provider

Data from patients who visited cardiologists, endocrinologists, pediatricians, family physicians, general practitioners, internists, ophthalmologists, nephrologists, and podiatrists were evaluated. A total of 703,464 medical visits were identified among 64,320 patients.

Table 2 shows the number of visits made by patients with diabetes to each type of specialist and the number of patients per specialist. The type of provider could not be identified for some procedures as these were categorized as visits to polyclinics or health centers or were attributed to providers who did not report a specialty. Many patients (56,830) were treated by primary care physicians; 63,746 patients obtained their medical services from providers who were not considered to be primary care physicians.

Table 2. Evaluation of patients with Diabetes Mellitus by Specialist

Specialty	Number of patients	% of patients/ specialist	Number of visits
Cardiology	547	0.43	6,404
Endocrinology	5,217	4.70	56,040
Family Medicine	7,924	6.20	74,105
General Medicine	42,014	32.80	380,194
Internal Medicine	5,713	4.5	66,051
Nephrology	1,640	1.30	22,283
Ophthalmology	7,825	6.10	88,367
Pediatrics	1,179	0.90	3,552
Podiatry	596	0.46	6,368
Optometry	453	0.035	973
Unknown*	6,792	5.30	27,697

*Patients with diabetes mellitus = 128,065.
*The specialty of the provider was not identified.

Laboratory tests

According to the guidelines for the management of diabetes mellitus, certain clinical laboratory tests should be performed at least once a year to assess diabetes control and for the early detection of chronic complications such as chronic kidney disease and retinopathy. The following guidelines have been copied directly from *Standards of Medical Care Diabetes—2019* (4).

Kidney evaluation

At least annually, urinary albumin (e.g., spot urinary albumin-to-creatinine ratio) and estimated glomerular filtration rate should be assessed in people with type 1 diabetes with duration of ≥5 years and in all people with type 2 diabetes regardless of treatment. In people with established diabetic kidney disease, urinary albumin (e.g., spot urinary albumin-to-creatinine ratio) and estimated glomerular filtration rate should be monitored 1–4 times per year depending on the stage of the disease.

Glucose control evaluation

Assess glycemic status by A1C and/or appropriate continuous glucose monitoring (CGM) metrics at least two times a year.

Assess more frequently (e.g., every 3 months) for individuals not meeting treatment goals, with frequent or severe hypoglycemia or hyperglycemia, changing health status, or growth and development in youth. Assess glycemic status at least quarterly and as needed in individuals whose therapy has recently changed and/or who are not meeting glycemic goals.

Table 3. Patient and visit distribution by insurance provider

Insurance provider (Diabetes type 1)	Number of patients	Number of visits
Health Insurance A	2,147	14,028
Health Insurance B	1,842	14,391
Health Insurance C	1,170	10,467
Health Insurance D	419	2,283
Health Insurance F	3	11
Health Insurance E	2,418	18,977
Insurance provider (Diabetes type 2)	**Number of patients**	**Number of visits**
Health Insurance A.	29,625	186,051
Health Insurance B	30,211	239,281
Health Insurance C	21,277	199,736
Health Insurance D	9,307	44,127
Health Insurance F	6	37
Health Insurance E	33,663	298,309

Ophthalmic evaluation for early retinopathy detection

Adults with type 1 diabetes should have an initial dilated and comprehensive eye examination by an ophthalmologist or optometrist within 5 years after the onset of diabetes. People with type 2 diabetes should have an initial dilated and comprehensive eye examination by an ophthalmologist or optometrist at the time of the diabetes diagnosis. If there is no evidence of retinopathy from one or more annual eye exams and glycemic indicators are within the goal range, then screening every 1–2 years may be considered. If any level of diabetic retinopathy is present, subsequent dilated retinal examinations should be repeated at least annually by an ophthalmologist or optometrist. If retinopathy is progressing or sight-threatening, then examinations by an ophthalmologist will be required more frequently. Programs that use retinal photography with remote reading or the use of U.S. Food and Drug Administration–approved artificial intelligence algorithms to improve access to diabetic retinopathy screening are appropriate screening strategies for diabetic retinopathy. Such programs need to provide pathways for timely referral for a comprehensive eye examination when indicated.

Table 4 shows each selected health insurance provider's compliance with these guidelines. Glucose tests were ordered by providers on more than 1 occasion for 8,339 patients (6%) A1C tests were ordered on more than 1 occasion for 14,230 patients (11%) and microalbumin tests were ordered by providers more than once for only 3,318 patients (2.6).

The assessments performed most frequently in 2019 were blood glucose testing (79%), followed by lipid monitoring (50%) and glycosylated hemoglobin testing (47%). Tests that screen for

chronic kidney disease were the least performed: only 26% of patients underwent urinary albumin testing.

The eGFR measures kidney function considering age, weight, sex, and serum creatinine level. Some multiplex tests (comprehensive metabolic panel, health panel) include an eGFR determination, the results of which are divided into 2 categories: 60 or higher and below 60 mL/min/1.73 m². This type of report includes the patient's race as one of its variables.

Table 4. Number and percentage of patients who underwent each laboratory test at least once in 2019 by selected insurance provider

Insurance Provider	HgA1C	Microalbumin	eGFR*	Lipids
Health Insurance A	3,886	8,050	15,042	13,081
Health Insurance B	16,955	7,295	9,108	16,393
Health Insurance C	12,797	5,564	11,546	13,019
Health Insurance D	6,369	2,597	4,255	2,761
Health Insurance E	19,679	9,454	16,540	18,536
Total patients	59,686	32,960	56,491	63,790
Percentage	(47%)	(26%)	(44%)	(50%)

*Estimated Glomerular Filtration Rate

Identification and Evaluation of Diabetes Chronic Complications

Diabetic neuropathy

Diabetes mellitus virtually affects all the organs of the human body. One of the most reported complications of diabetes is neuropathy (7,8,9). To identify this complication, physicians must evaluate the patient's history for features consistent with diabetic neuropathy, conduct a meticulous physical examination, and rule out other causes of the neuropathy. Data obtained from the analysis of patients with Vital Health Plan coverage shows that, of the 128,065 patients with diabetes, 13,146 (10.3%) had an ICD-10 code indicating diabetic neuropathy.

Diabetic retinopathy

Diabetes mellitus is one of the main medical causes of blindness. Of the 128,065 patients with diabetes in this study, 7,096 (4.7%) were identified as having visited an ophthalmologist or optometrist. A total of 5,984 patients with different types of retinopathies were identified, representing 5% of the total sample of patients with diabetes and 84% of those who had visited an ophthalmologist or optometrist.

Diabetic nephropathy

In Puerto Rico, diabetes mellitus is the leading cause of chronic kidney disease and is a major reason that patients require kidney dialysis. Diagnosis of chronic kidney disease relies on the eGFR, calculated from the patient's weight, age, sex, serum creatinine, and sometimes race, together with evidence of elevated urine albumin (greater than 30 mg/dL) excretion.

Of the 128,065 patients with diabetes in this study, 13,115 (10%; 12,535 type 2 and 580 type 1) were assigned the ICD-10 code for renal disease. Of these, 1,640 (12.5%) were identified as having

seen a nephrologist. The CPT code for comprehensive metabolic panels (which panels include the eGFR test) was recorded in the evaluated sample. As noted earlier, the eGFR is a key element in diagnosing chronic kidney disease, and these panels serve as the mechanism through which that test is obtained

The CPT 4 test code for eGFR is not available; however, this test is included in comprehensive metabolic panels, the code for which was available in the sample. Microalbumin was measured in 26% of the patients with diabetes, determined using the microalbumin test code. Only 1,640 of these patients were evaluated by a nephrologist (13%).

Table 5. Number and percentage of selected laboratory tests performed

Test	Number of tests	Percentage
Glucose in bloodstream	101,365	79
Hemoglobin A1C	59,686	47
Microalbumin	32,960	26
Lipids in bloodstream	63,790	50
EGFR estimate	59,491	44

Abbreviation: eGFR, estimated glomerular filtration rate.

Discussion

The Puerto Rico Health Reform was created by law in September 1993 and now covers approximately one-third of the population of Puerto Rico (35%). Since the inception of Plan Vital, the law has been amended on multiple occasions to provide patients under Medicaid with health services equal to those of patients insured by private health plans. We conducted the first analysis of this model of medical coverage in 2000 when we compared medical service variables—including the type of provider, types of tests performed on patients, types of services provided, and prevalence of diabetes—between the public and private health sectors. At the time of that study, the prevalence of diabetes in the population under the government health plan was 5.4%. Our evaluation found that 75% of the patients diagnosed with diabetes were managed by primary care physicians (general practitioners, internists, pediatricians, and family doctors).

In the current study, conducted 24 years after the first evaluation, we assessed compliance with the regulations and recommendations applicable to patients diagnosed with diabetes mellitus considering the 4 most important elements of diabetes management: the patient, the provider, the insurer, and the government of Puerto Rico (through the Puerto Rico Health Insurance Administration), responsible for the health of the population through public health care, also which administers the public insurance program, Plan Vital.

Regarding patients, the subjects of our concern, we observed an increase in the prevalence of diabetes in patients under Plan Vital (11.5%). In 1998, we reported a 5.4% prevalence of diabetes in the population under the government health plan (1). The present

analysis of the diabetic population under Plan Vital showed an increase in the prevalence of patients with diabetes (11.5%). We must clarify that in our first evaluation, we reported only on patients with diabetes mellitus, without separating type 1 from type 2. In this study, we included all patients aged 0 to 100 years. In addition, the population of Puerto Rico was higher in 1999 than in 2019, and the diabetic population was lower.

Despite efforts to educate patients, many individuals with diabetes still do not visit their primary care physicians for evaluation. This finding raises the question of how these patients obtain their medications and orders for laboratory tests. Within this Medicaid population, patients have yet to achieve adequate control over their condition. Thus, we must create an environment in which patients can feel empowered in seeking appropriate treatment from a physician. Without patient participation, it is impossible to control diabetes and prevent its complications. Educational efforts must begin at the patient's first visit with their physician, using the methods necessary for education, always considering that this group of patients may not be technologically savvy or may have limited health literacy.

Regarding provider utilization, a large dip in the percentage of visits to primary care physicians can be observed between study periods (from 75% to 48%). There was a slight increase in visits to consulting specialists, but the percentage is still very low: under 10% of the patients with diabetes visited an ophthalmologist, endocrinologist, or nephrologist in 2019. There is a shortage of endocrinologists and nephrologists in Puerto Rico, yet referrals to these specialists nonetheless need to increase when clinically warranted, even within the constraints of this shortage.

On their first visit with their provider, patients must be educated about the need for programmed follow-up visits. There is confusion among patients regarding the types of eye evaluations they need. Many patient visits are focused solely on refraction rather than the recommended retinal examination, which is essential for the early detection of diabetic retinopathy. Diabetic retinopathy often does not give warning symptoms until late in its development, so early detection of retinal disease can be slowed if the disease is detected earlier.

Chronic kidney disease can be delayed if detected early in a patient. For the early detection of chronic kidney disease, physicians must perform tests that assess kidney function. In the sample analysis, approximately 10% of patients had an ICD-10 code for kidney disease, but only 1.3% had been evaluated by a nephrologist.

Approximately one-quarter of the sample was tested for the presence of albumin in the urine. Furthermore, eGFR testing is performed only in those patients who undergo a comprehensive blood test, the results of which reveal whether the eGFR is greater than or equal to 60 or less than 60. Using comprehensive metabolic panels as a proxy, it can be assumed that the eGFR was ordered in only 44% of the sample, which does not meet the recommended testing guidelines for kidney failure detection. We were unable to determine whether doctors considered the eGFR when making clinical decision so the actual percentage may be even lower.

Because different insurance providers may contract the same physicians to manage diabetic patients, we need to develop a strategy aimed at meeting the criteria for managing this condition. The Health Insurance Administration should require that (insurers

and providers) meet the criteria for quality diabetes care, including services related to diabetes mellitus, high blood pressure, and dyslipidemia as well as preventive visits to ophthalmologists and nephrologists. To achieve equal treatment for all diabetic patients, insurers should use the same strategies used under the Medicare 5-Star quality program.

The administrator of Plan Vital also has significant responsibilities. This agency must re-evaluate the services offered to patients with conditions identified by the Puerto Rico Department of Health as high-risk. It is not enough to receive a database with the information required under contract. It is also necessary to evaluate the quality of the management of these conditions in line with the relevant guidelines. This data must be validated, unlike other non-health-related information, and is necessary to dictate public policy. The reported data must accurately identify with the services actually provided.

The disparity in care and deficiencies in management strategies highlight the urgency of addressing these gaps. The Health Insurance Administration should promote adherence to quality care criteria for diabetes management, emphasizing regular follow-up visits, comprehensive testing, and proper referrals to specialists such as ophthalmologists and nephrologists. Additionally, the administration must validate the data received from insurers and ensure that these data align with public health guidelines.

Limitations of this Study

The data obtained was electronically submitted by the insurance companies contracted by Plan Vital, the government-managed Medicaid program in Puerto Rico. This data analysis, therefore, depended on the accuracy of the information submitted by the medical coders who worked with patient encounters. Human error bias within these data may have undermined the accuracy of the information.

Resumen

Objetivo: En este estudio retrospectivo analizamos el cumplimiento con las guías para el manejo de la diabetes mellitus establecidas por la Asociación de Diabetes Americana y los Centros para Medicare y Medicaid de los Estados Unidos para la población diabética en Puerto Rico. Métodos: Se analizaron los datos de utilización de 128,065 pacientes con diabetes mellitus bajo el Programa de Salud de Medicaid (Plan Vital). Los datos de la población evaluados fueron la edad, sexo, tipo de servicio, tipo de proveedor, aseguradora y las complicaciones crónicas. Resultados: Se encontró que menos de la mitad tuvieron un encuentro con su médico primario. De este total, 4346 pertenecientes al grupo etario de 0–18 años fueron clasificados diabéticos tipo 2. Solo 4.1% de los pacientes tuvieron una visita con el endocrinólogo y 1.3% con el nefrólogo. La prueba de hemoglobina A1c fue documentada solo en 48% de los pacientes, mientras que 26% tuvieron una prueba de micro albumina en la orina. La fracción de filtración glomerular estimada fue calculada en 48% (datos obtenidos de la prueba comprensiva de salud). Las pruebas necesarias para la detección temprana de las complicaciones oftálmicas y renales no fueron ordenadas según la guía de manejo. El comportamiento con el cumplimiento de las guías de manejo por las aseguradoras de servicios de salud fue similar y no alcanzaron el 50% de la muestra. Conclusión: La participación del paciente y de su proveedor de servicios de salud son dos de las razones para explicar el bajo cumplimiento con las guías nacionales por la población de Medicaid, establecidas para el manejo de la diabetes en Puerto Rico bajo esta población de salud. La importancia de este bajo rendimiento en el manejo de la población diabética se traduce en un aumento de las complicaciones crónicas, de su identificación temprana y de la acción correspondiente para evitar la muerte.

Acknowledgments

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