

### BACKGROUND

Diabetes Mellitus (DM) is a silent pandemic and one of the most impactful non-communicable diseases worldwide, representing a major global public health challenge. More than 530 million adults are currently living with DM, with projections indicating continued growth in the coming decades. In Brazil, prevalence has increased alongside population aging and lifestyle changes, placing the country among those with the highest number of affected individuals. Estimates from the International Diabetes Federation and VIGITEL indicate a prevalence around 12,9%, reinforcing the magnitude of the problem.

The economic burden of DM is substantial and well documented. Individuals with DM incur healthcare costs three to five times higher than those without the disease, primarily driven by microvascular and macrovascular complications, frequent hospitalizations, and intensive use of healthcare resources. These costs reflect not only disease prevalence but, more importantly, the consequences of inadequate disease control.

Beyond the financial dimension, poorly controlled DM leads to significant clinical and social consequences, including reduced quality of life, disability, decreased life expectancy, and loss of productivity. The progression of complications—such as retinopathy, nephropathy, cardiovascular disease, and stroke—represents a major driver of both morbidity and healthcare utilization, often resulting in recurrent and prolonged hospitalizations.

From a management perspective, DM requires a multidisciplinary and proactive approach. Adequate glycemic control is the cornerstone of preventing complications and reducing costs. Healthcare system sustainability increasingly depends on the ability to identify high-risk populations and implement structured interventions, including risk stratification, care coordination, adherence programs, and chronic disease management strategies.

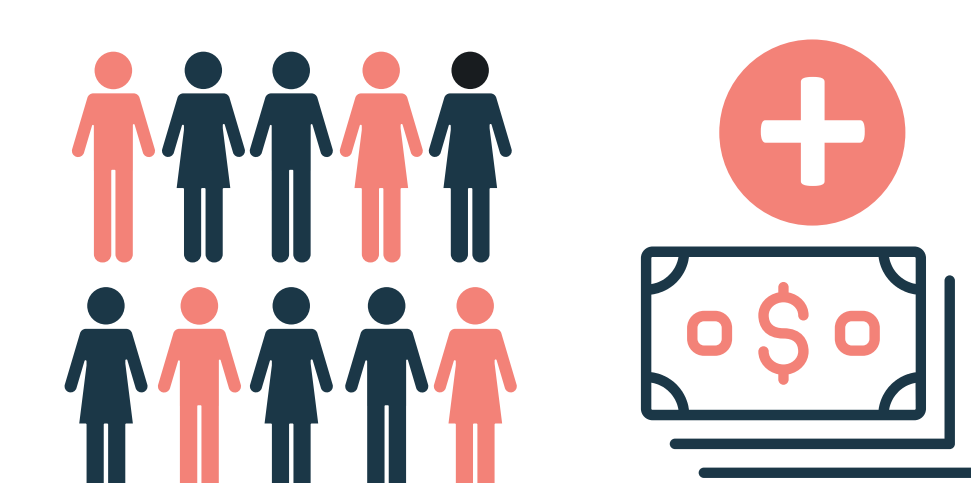


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Diabetes Mellitus driven healthcare costs up to **5x higher** per individual

Effective glycemic control is the key lever to prevent complication and contain costs



### OBJECTIVES

This study aims to quantify the financial impact of DM in a health plan cohort, correlating healthcare utilization and costs with comorbidities and complications, and providing evidence to support strategic decision-making focused on prevention and glycemic control.

### METHODS

An observational, retrospective cohort study based on administrative data from a self-managed health plan, covering the period from January 1, 2019, to December 31, 2024. Data were obtained from structured databases, including (age, sex, eligibility status, claims data (costs by event), and healthcare utilization (consultations, diagnostic tests, therapies, emergency department visits, hospitalizations, and length of stay). Clinical information was derived from ICD-10 codes (E10–E14), including comorbidities, micro- and macrovascular complications, and critical events such as renal replacement therapy, amputations, myocardial infarction, stroke, and severe hypoglycemia. Glycemic monitoring was assessed through HbA1c testing. Only structured data were analyzed.

The study population included beneficiaries with a confirmed diagnosis of Diabetes Mellitus (ICD-10 E10–E14), with at least 12 months of continuous enrollment and complete demographic and clinical data. Patients with incomplete records or follow-up shorter than 12 months were excluded. The final cohort comprised 694 individuals.

Variables analyzed included demographics (age, sex), clinical characteristics (Charlson Comorbidity Index [CCI], complications, severe hypoglycemia, HbA1c monitoring), healthcare utilization (consultations, diagnostics, therapies, emergency visits, hospitalizations, and length of stay), and costs (total annual and category-specific). Patients were stratified into five cost tiers based on annual expenditure (Tier 1: highest cost; Tier 5: lowest cost).

Statistical analysis included descriptive methods, one-way ANOVA ( $p < 0.05$ ) for group comparisons, and multivariate logistic regression to identify predictors of high-cost status. Results were expressed as odds ratios (95% confidence intervals), and model performance was evaluated by overall accuracy.

From January/2019 to December/2024

#### Population

<p><b>Inclusion criteria:</b></p> <ul style="list-style-type: none"> <li>Diagnosis of DM (ICD-10 E10–E14)</li> <li>At least 12 months of continuous enrollment</li> <li>Complete demographic and clinical data</li> </ul>	<p><b>Exclusion criteria:</b></p> <ul style="list-style-type: none"> <li>Incomplete or inconsistent records</li> <li>Follow-up &lt;12 months</li> </ul>
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### RESULTS

The study included 694 patients with Diabetes Mellitus, corresponding to a prevalence of 1.5% within the analyzed population. The cohort was predominantly elderly, with a mean age of 73 years; 65.2% were aged over 70 years, and 54.5% were female.

Healthcare utilization patterns demonstrated a clear association between clinical complexity and cost. A higher comorbidity burden was consistently linked to increased expenditures. Hospitalizations and length of stay emerged as the primary cost drivers, while the use of diagnostic tests and therapeutic interventions increased progressively across higher cost strata, reflecting greater disease severity.

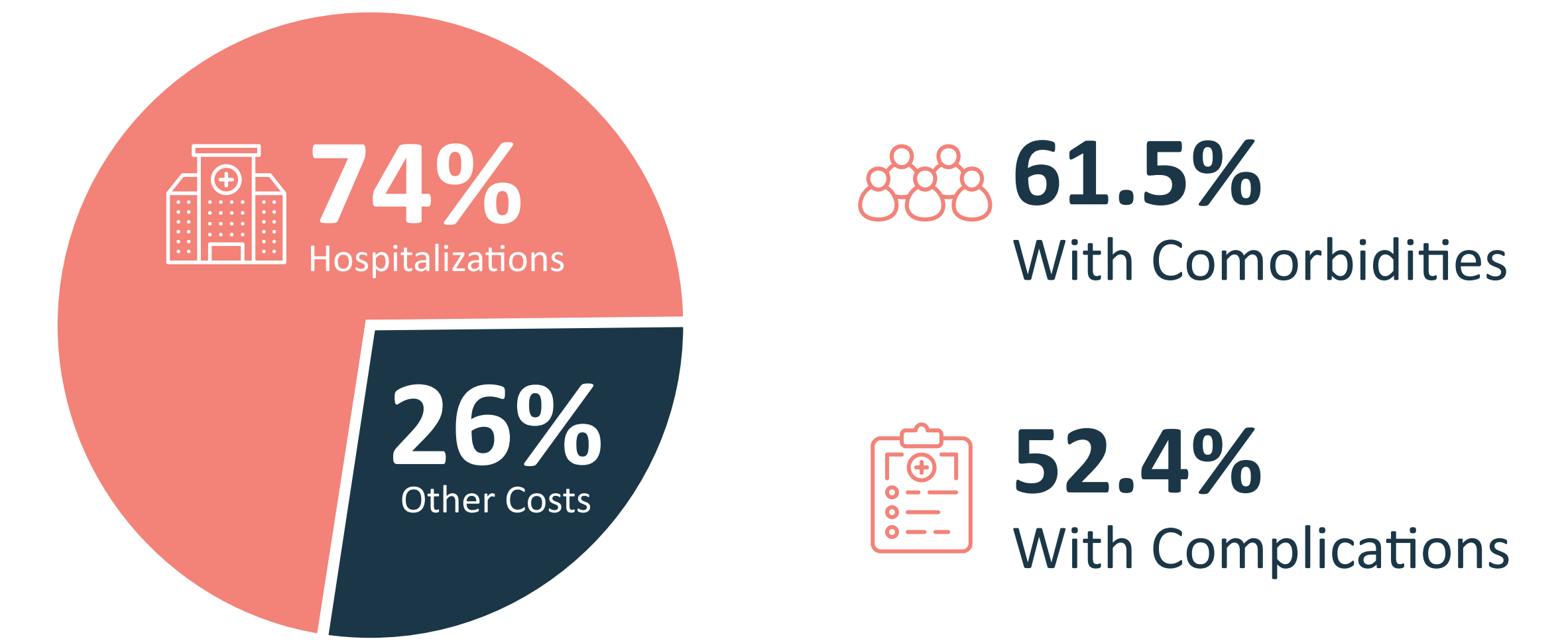
Multivariate logistic regression identified key predictors of high-cost status. Age was associated with a 4% increase in the likelihood of high-cost classification per year (OR = 1.04), while each additional point in the Charlson Comorbidity Index (CCI) increased this probability by 66% (OR = 1.66). Hospitalization was the strongest predictor (OR = 3.3), followed by emergency department utilization, which increased risk by 5% per event. In contrast, glycemic monitoring (HbA1c) demonstrated a protective effect, reducing the likelihood of high-cost classification by approximately 10% (OR = 0.89). The model showed good discriminatory performance, with an overall accuracy of 83%.

From an economic perspective, the mean annual cost per patient was US\$12,546. Hospitalizations accounted for 74% of total expenditure, underscoring their central role in cost escalation. Clinically, 61.5% of patients presented comorbidities, and costs increased substantially with higher CCI, ranging from approximately US\$2,000 to US\$14,000 annually. Chronic complications were observed in 52.4% of the cohort.

Cost distribution was highly concentrated, with the top 2% of patients accounting for a disproportionate share of expenditures, with a mean annual cost of US\$133,454, approximately 11 times higher than the cohort average. This subgroup was characterized by prolonged hospitalizations (mean length of stay: 52.7 days), reflecting advanced disease, high clinical complexity, and intensive resource utilization.

<p><b>694</b> patients</p>	<p>65,2% were aged over <b>70</b> years</p>	<p><b>73</b> mean age</p>
<p><b>54.5%</b> Female</p>		

### Costs drivers in diabetes care



### What drives high-cost patients?

Hospitalization	Strongest drives (3,3x higher risk)
Comorbidity burden	66% risk per point
Age	+4% per year
ER visits	Incremental risk

What reduces cost risk? **HbA1c monitoring - ↓ 10% risk**

- Costs are extremely concentrated
- Top 2% -> 11x higher costs
- US\$ 133K per patient/year

### CONCLUSION

Uncontrolled Diabetes Mellitus (DM) emerges as a central driver of healthcare costs, posing a material threat to the sustainability of health systems. The results demonstrate a marked concentration of expenditures in hospitalizations and advanced complications, reflecting a predominantly reactive care model focused on late-stage management rather than prevention. The strong association between comorbidity burden, healthcare utilization, and costs highlights clinical complexity as a key determinant of financial impact.

The high prevalence of preventable chronic complications, including myocardial infarction, stroke, renal failure, and amputations, indicates significant gaps in disease management, adherence, and continuity of care. The highest-cost subgroup represents advanced stages of uncontrolled DM, characterized by prolonged hospitalizations and disproportionate resource consumption. Age, comorbidity burden, hospitalizations, and emergency care utilization were identified as the main cost drivers, whereas glycemic monitoring (HbA1c) demonstrated a consistent protective effect.

These findings support a clear strategic implication: cost containment in DM is fundamentally linked to clinical control. Proactive, structured interventions, centered on glycemic control, population health management, and early identification of high-risk individuals, are critical to modifying disease trajectories, preventing complications, and reducing avoidable costs. Transitioning from a reactive to a proactive risk management model is therefore essential to simultaneously improve clinical outcomes and ensure the long-term financial sustainability of supplementary healthcare systems.

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