

Is More Always Better? A Real-World Data Analysis of Hemoglobin A1C Data in Patients with Diabetes

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Study Summary

Research Question
How does the number of hemoglobin A1c (HbA1c) results impact predictive value of the association between HbA1c and hospitalization among a cohort of patients with diabetes?

Study Design

Study Results
A patient's first HbA1c result was strongly correlated with future HbA1c lab result ($r=0.69$, $p<0.001$). Adding an additional HbA1c test result into the multivariate logistic regression model did not improve model fit ($p=0.868$).

Conclusions
Study findings suggest a single HbA1c result is highly predictive of hospitalization among patients with diabetes; the incremental gain in model fit with the inclusion of additional results is marginal.

Background

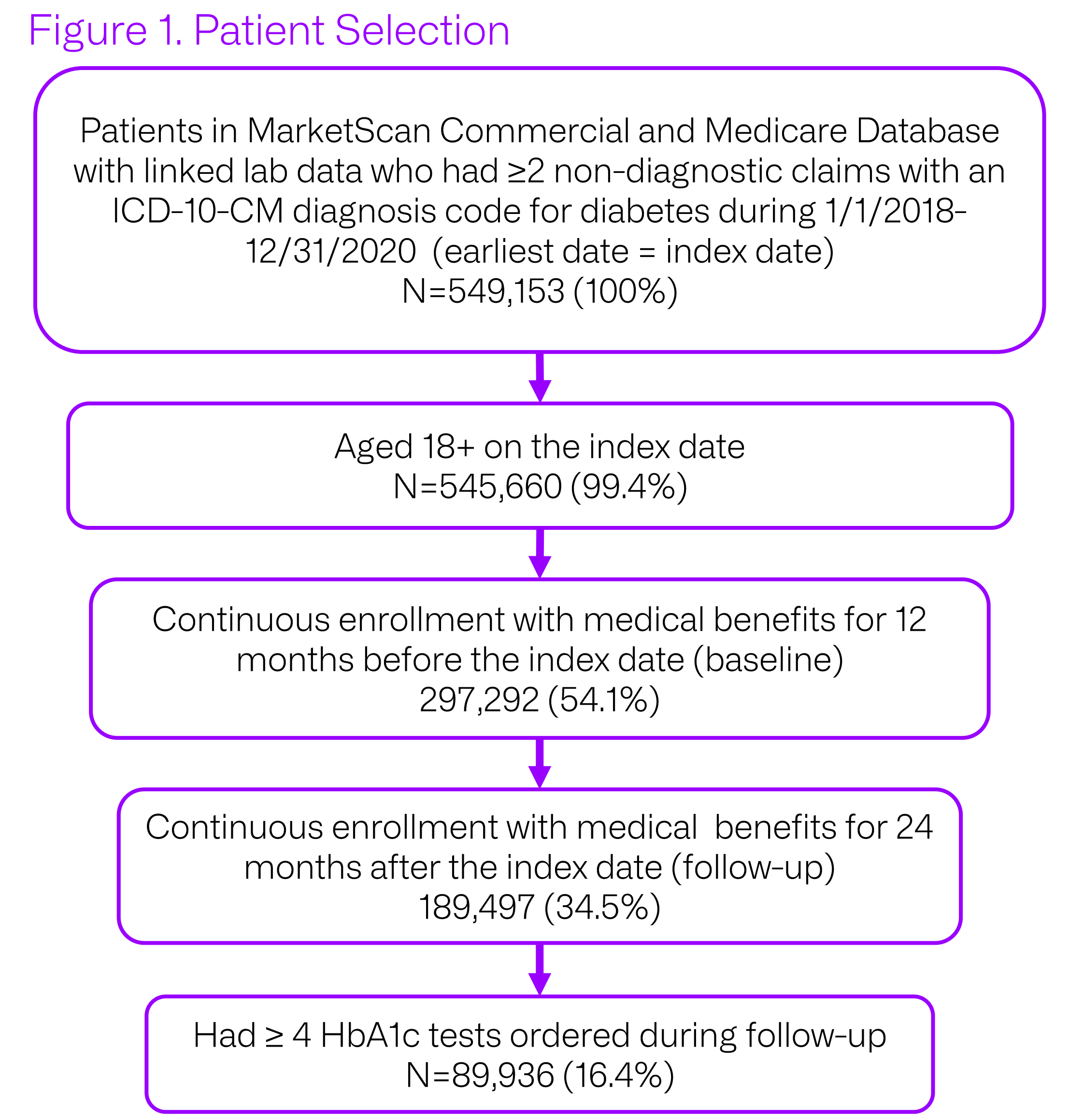
- Laboratory data derived from real-world data (RWD) are necessary for analyses where test results are indicators of disease severity, progression, or treatment plans.
- Diabetes mellitus imposes a substantial economic burden on society. HbA1c has been shown to be a good surrogate measure of diabetes control. Previous studies using claims data have suggested that improved glycemic control is associated with fewer primary care visits and inpatient admission.^{1,2} However, to investigate this association in RWD studies, there is a reliance on the completeness of laboratory data.

Objective

- To investigate the impact of the number of HbA1c lab results among patients with diabetes on the association between HbA1c and hospitalizations.

Methods

- Data Source and Study Design**
- This retrospective analysis utilized US administrative claims data from the Merative™ MarketScan® Commercial and Medicare Database between 01/01/2017 - 12/31/2022, which contain data on the full healthcare experience for individuals with employer sponsored insurance.
 - The MarketScan Lab Database adds outpatient laboratory results to the data elements contained in the Commercial and Medicare Databases.



- Study Measures:**
- HbA1c values were identified by Logical Observation Identifiers Names and Codes (LOINC) and matched with the corresponding HbA1c order (defined as a value within 45 days of the order).
 - Completeness of HbA1c results was defined as the percent of HbA1c orders with corresponding lab results during follow-up period.
 - Patient demographic characteristics were assessed on the index date and clinical characteristics were assessed during the baseline period.
 - Hospitalization rates were assessed during the follow-up period.
- Data Analysis:**
- Descriptive analysis and logistic regression models were conducted to assess the impact of completeness of matched lab result and the association between HbA1c values and hospitalization, while adjusting for baseline patient characteristics.

Results

- A total of 89,936 were eligible for analysis (mean age 57.6, mean CCI score of 1.8 (Table 1)).

Table 1. Patient Characteristics

	N = 89,936
Age; mean (SD)	57.6 (11.8)
Female; n (%)	41,331 (46.0%)
Geographic region; n (%)	
Northeast	10,374 (11.5%)
North Central	26,741 (29.7%)
South	47,447 (52.8%)
West	5,355 (6.0%)
Unknown	19 (0.0%)
Urban; n (%)	78,804 (87.6%)
Commercially insured; n (%)	68,148 (75.8%)
Diabetes mellitus type; n (%)	
Type 1	12,051 (13.4%)
Type 2	77,885 (86.6%)
Charlson Comorbidity Index; mean (SD)	1.8 (1.7)
Number of A1c tests during follow-up; mean (SD)	5.2 (1.2)

- 47,620 patients (52.9%) had at least one matched HbA1c result, and 18,005 (37.8%) had complete matched HbA1c results (Figure 2)
- Although the difference was small, the mean HbA1c test value were lower among patients with more complete laboratory results, ranging from 7.2 to 7.5 overall (Figure 3).

Figure 2. Completeness of HbA1c Lab Test Results

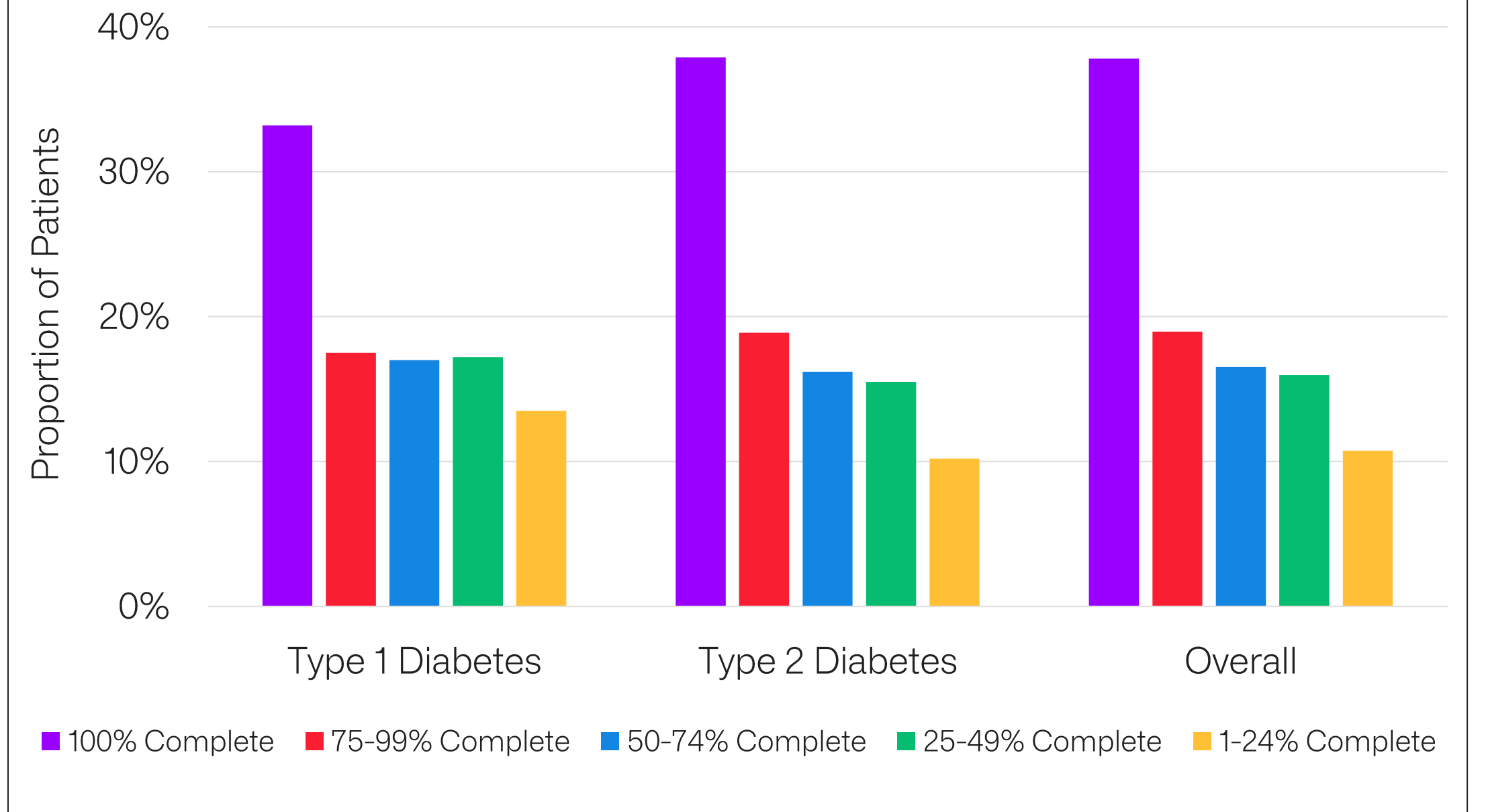
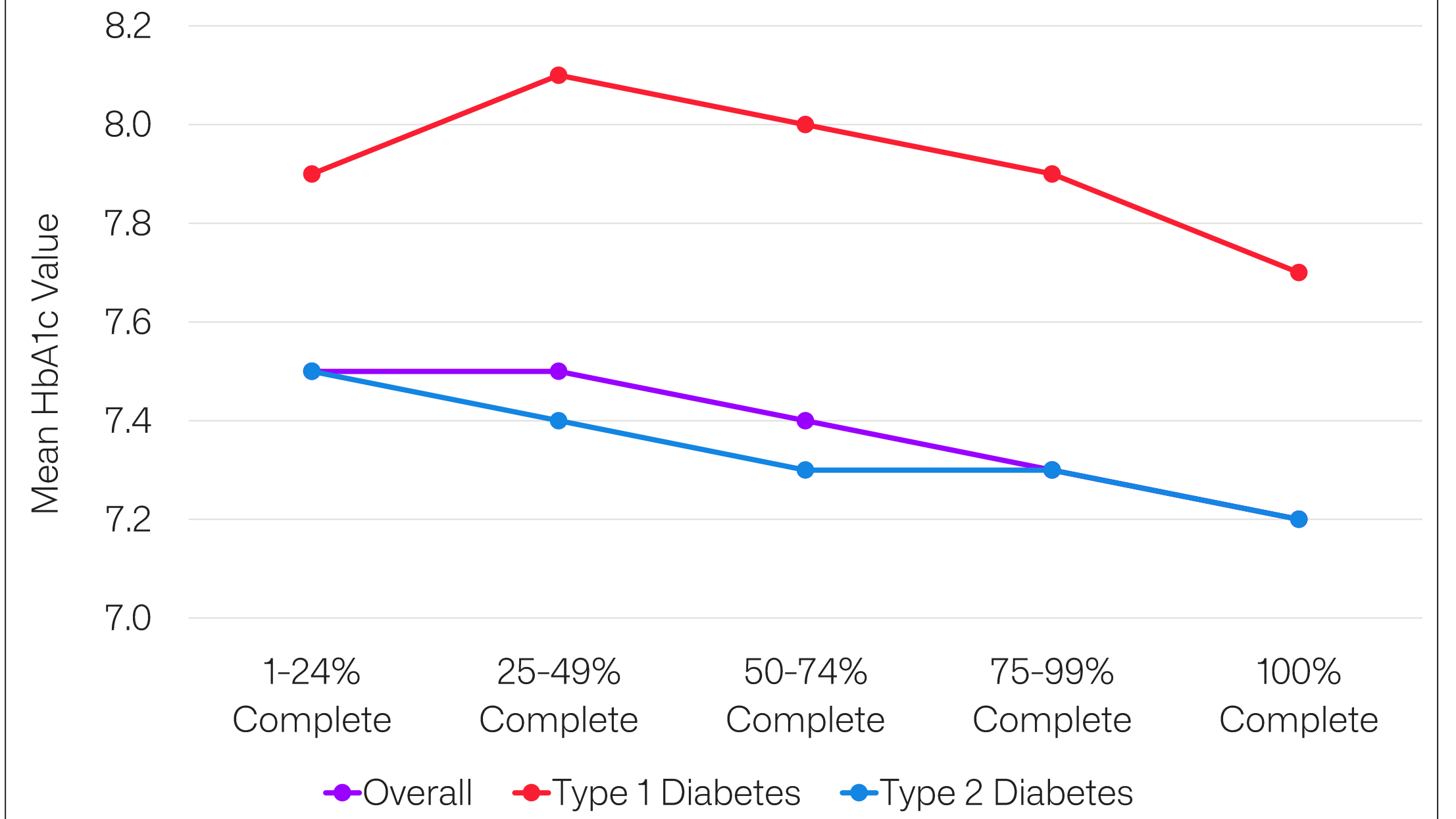


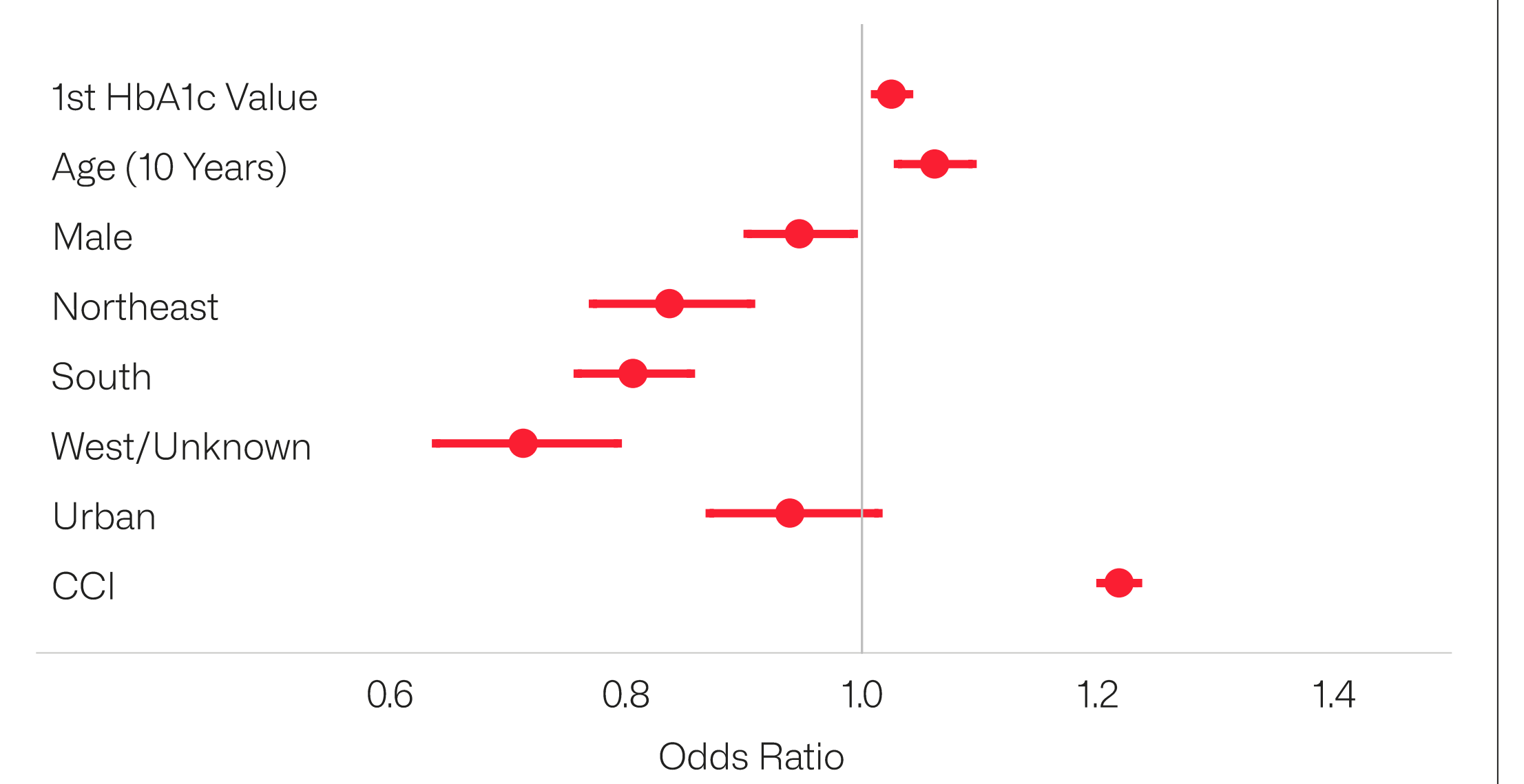
Figure 3. HbA1c Value by Lab Data Completeness



Results Cont.

- During follow-up, 19.3% of patients had at least one hospitalization. Having one HbA1c result was strongly correlated with having a future HbA1c result ($r=0.69$, $p<0.001$).
- In the multivariate logistic regression conducted among those with at least one matched HbA1c result, a patient's first HbA1c result was significantly associated with hospitalization (OR=1.03, 95%CI=(1.01, 1.04) (Figure 4). Including additional HbA1c results did not improve model fit ($p=0.868$).

Figure 4. Multivariate Logistic Regression for Inpatient Admission*



*Payer type and diabetes type were included in the multivariate logistic model but are not displayed in the plot.

Limitations

- Administrative claims data may not accurately capture all HbA1c results due to miscoding or misclassification, thereby potentially leading to an underestimation of the patient population size or inaccuracies in HbA1c value.
- There might be unmeasured confounders that are not captured in claims data but can influence both the completeness of HbA1c lab data and the likelihood of hospital admission.

Conclusions

- Study findings suggest a single HbA1c result is highly predictive of hospitalization for patients with diabetes; however, the incremental benefit of having additional results for the same patient is marginal.
- Future studies are needed to evaluate the potential for enhanced robustness of the analysis by leveraging additional sources of lab data to increase the number of patients with at least one matching lab result.

References
 1 Yu D, Simmons D. Relationship between HbA1c and risk of all-cause hospital admissions among people with Type 2 diabetes. *Diabet Med*. 2013 Dec;30(12):1407-11.
 2 Blecker, S, Park, H. & Katz, S.D. Association of HbA1c with hospitalization and mortality among patients with heart failure and diabetes. *BMC Cardiovasc Disord*. 2016 (16), 99.
Disclosures
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