What factors can predict re-admission to a hospital?

Surabhi Damle, Manasa Tandri,
Nandini Gupta, Girija Joshi

AGENDA

- Background
- Initial Data Analysis
- Modeling
- Findings
- Limitations
- Future Recommendations
- Questions

Background

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Dataset: interactions with diabetes patients

- 1999-2008
- Represents 130 US hospitals and integrated delivery networks
- Captures “encounters”: patient stayed for up to 14 days, underwent labs & medications

01

Arbitrary/poor diabetes management

02

High rates of patient readmission:

46.08 %

03

- Higher risk of death
- Higher patient costs & hospital expenditures

Understand systemic causes of readmission ➡ reduce readmission in the future.

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Initial Data Analysis

Variables explored through visualization:

- Readmitted Status of Patient Encounters in the Dataset, by **Race**
- Readmitted Status of Patient Encounters in the Dataset, by **Gender**
- Readmitted Status of Patient Encounters in the Dataset, by **Age**
- Readmitted Status of Patient Encounters, by **Discharge Type**
- Readmitted Status of Patient Encounters, by **Time Spent in Hospital**

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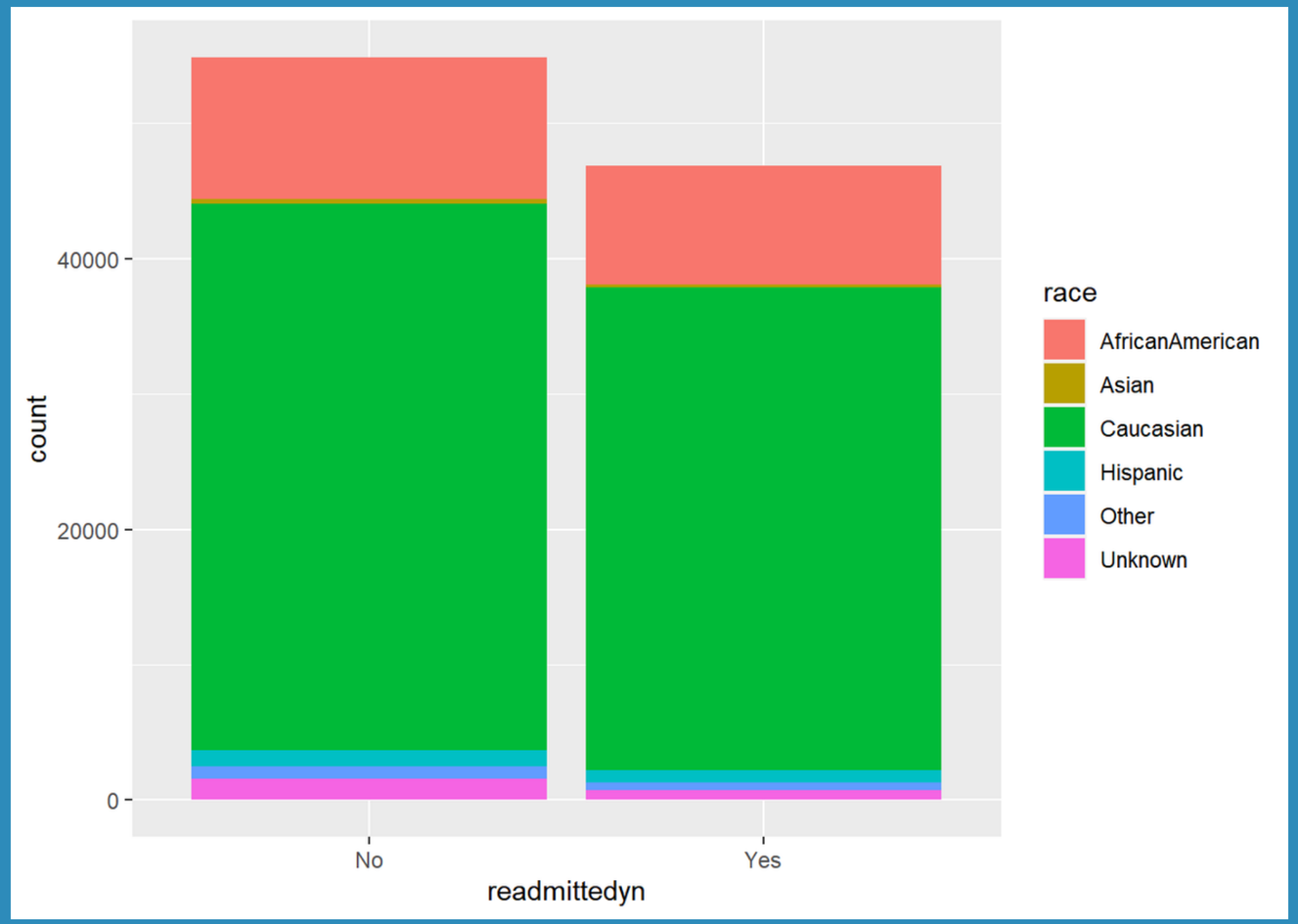
Initial Data Analysis

Readmitted Status of Patient Encounters in the Dataset, By Race



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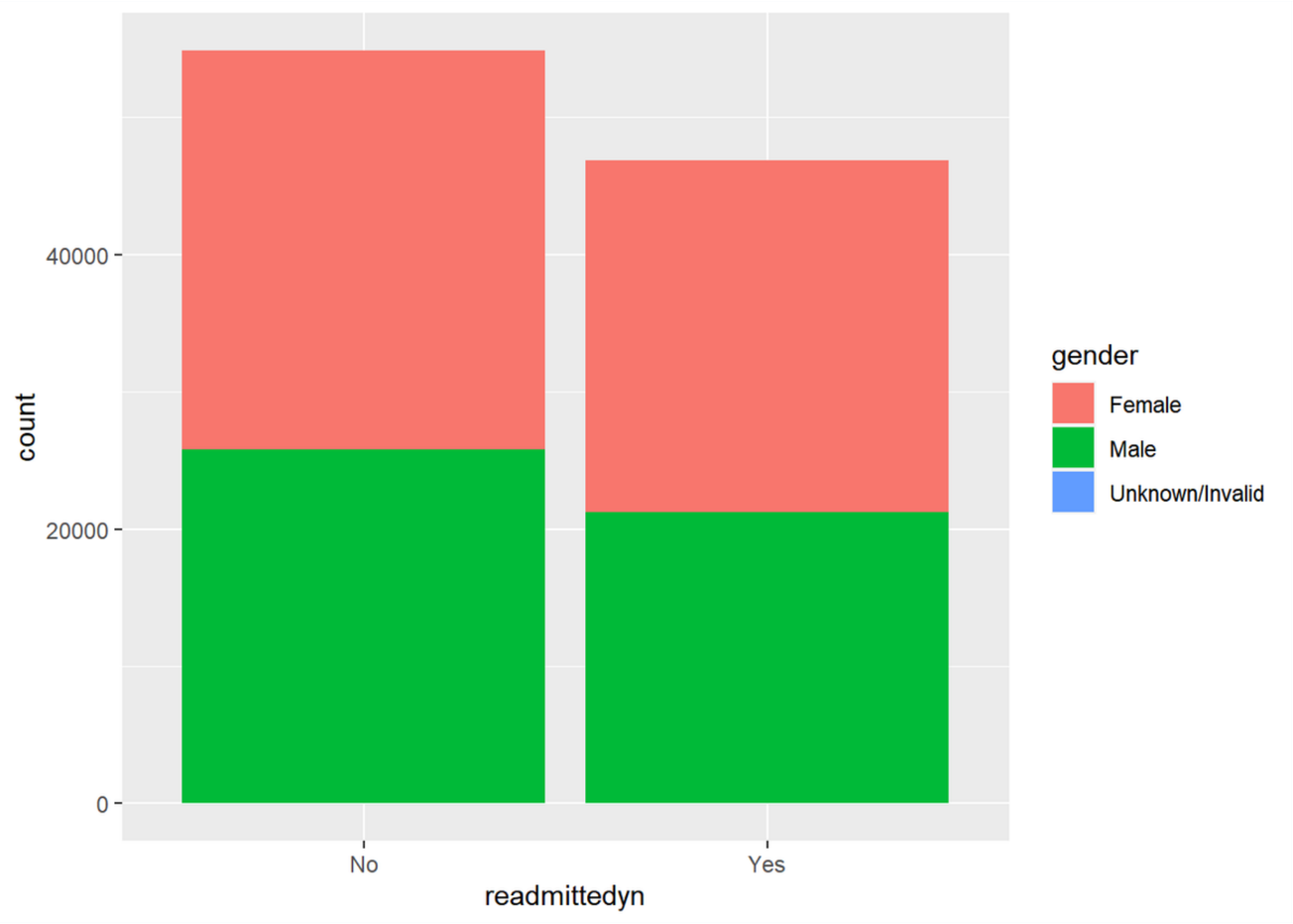
Initial Data Analysis

Readmitted Status of Patient Encounters in the Dataset, By Gender



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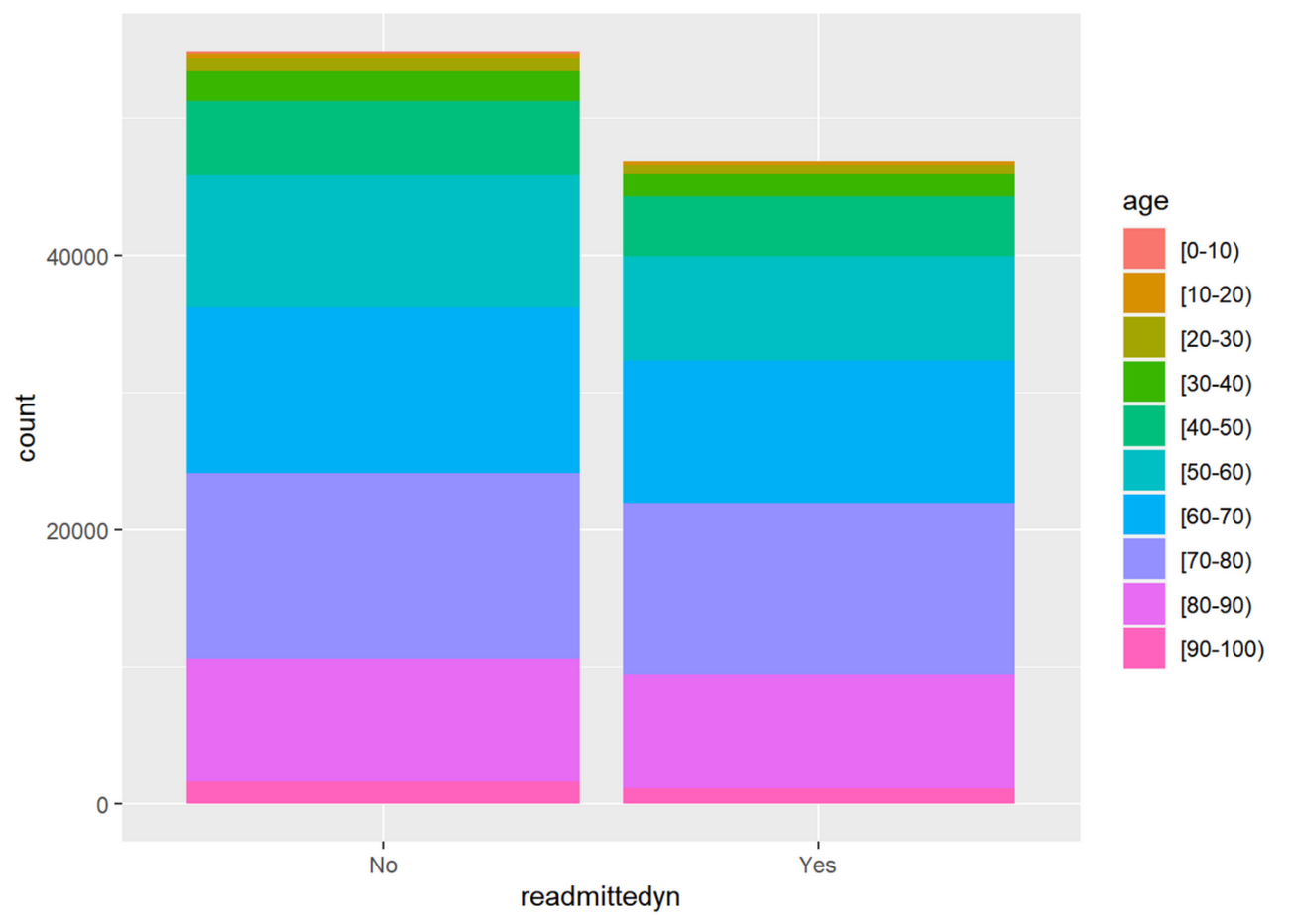
Initial Data Analysis

Readmitted Status of Patient Encounters in the Dataset, By Age



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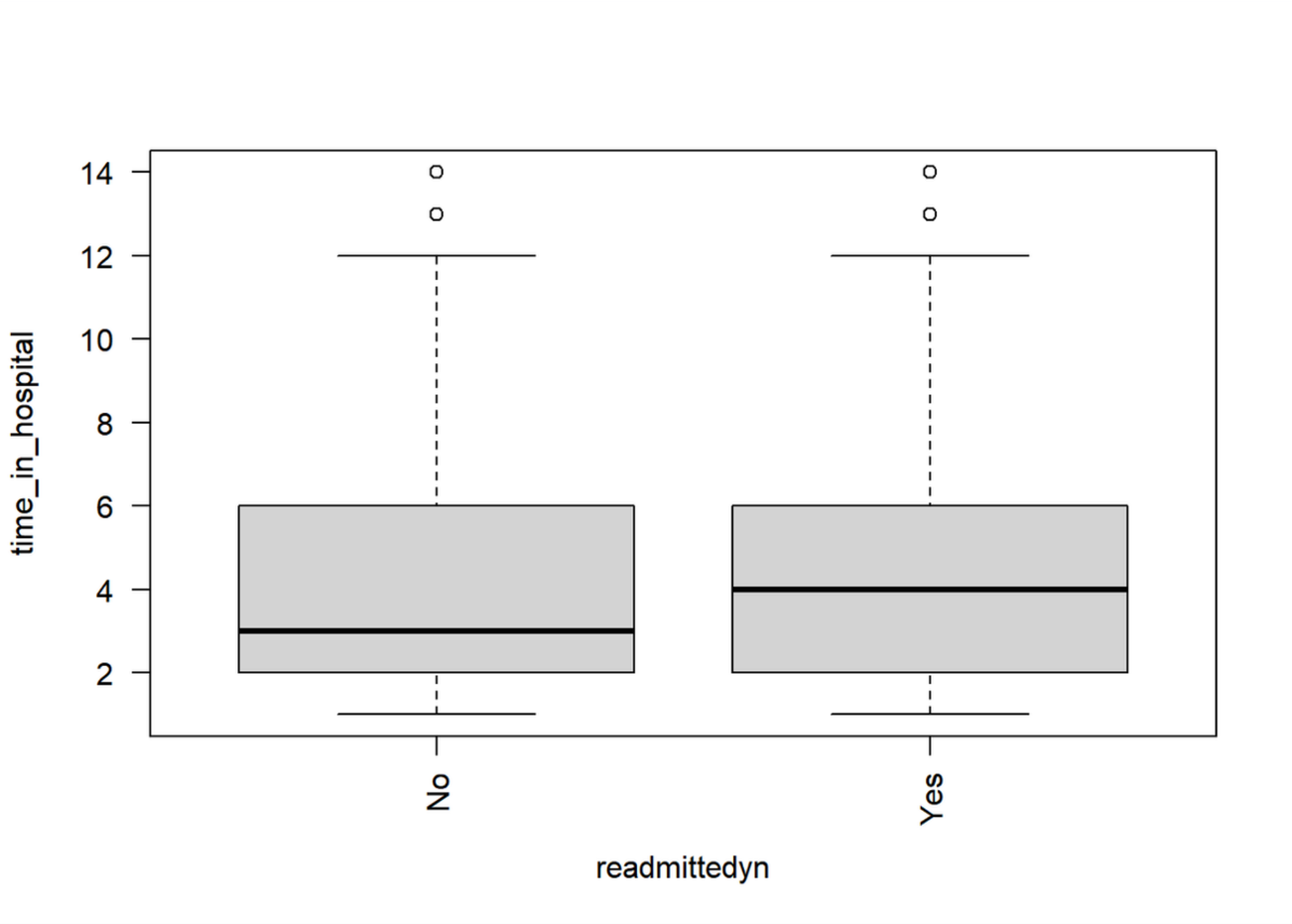
Initial Data Analysis

Readmitted Status of Patient Encounters in the Dataset, By Time in Hospital



Median time in hospital is larger for individuals who were readmitted.

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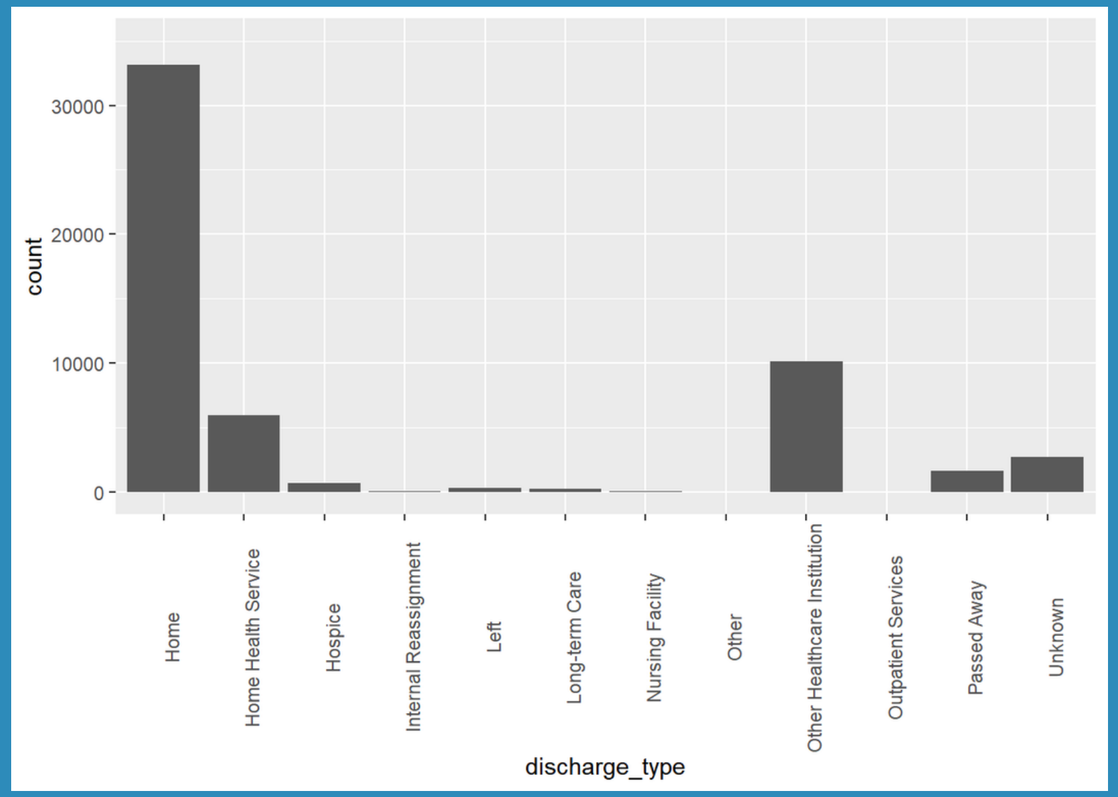
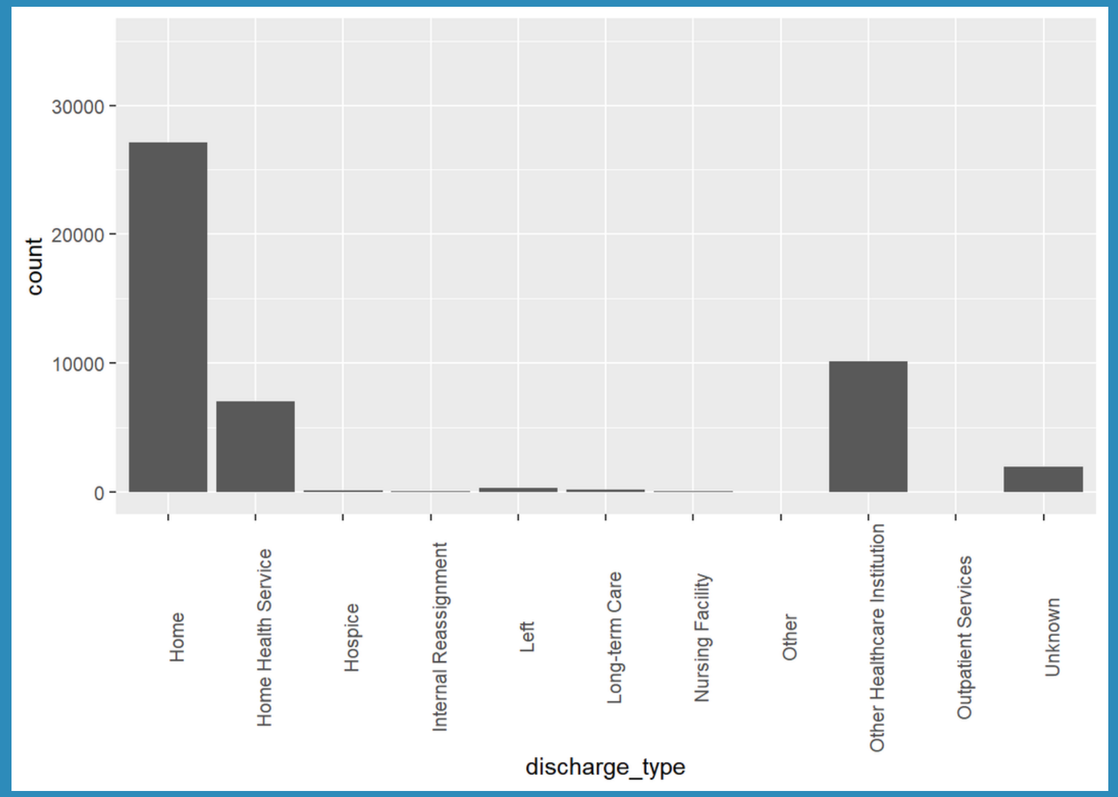
Initial Data Analysis



Non-readmitted indivduals, by discharge type



Readmitted indivduals, by discharge type

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Predictive Model

01

Empty Model

02

Elastic-Net Model

03

Full Model

Model	RMSE
Model 1- Empty Model	0.4984711
Model 2- Elastic Net Model	0.4824697
Model 3- Full Model	0.4838008

RMSE (root mean squared error) **~0.5 for all 3 models.**

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Elastic Net Model Predictors

Parameter	Estimate
Int	0.1988289
agenum	0.0156663
time_in_hospital	0.0203041
num_lab_procedures	0.0007664
num_procedures	-0.0002534
num_medications	0.0025298
number_outpatient	0.0176771

Findings

- Variables chosen in models are **not good predictors** of readmittance
- *Empty model* had **similar error** to other models
- *Boxplot* shows that those that were readmitted spent **about 1 more day** in the hospital

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Limitations

Not accounting for past medical history

Missing Data

Categorical data converted into binary

Normalization

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Future Recommendations

Modeling based on individual drugs as predictors

Modeling based on health insurance coverage (known predictor)

Using models accommodating mixed-type data such as KPrototypes Clustering Algorithm

Analyzing dataset based on individuals over encounters

Questions?

References

1. Beata Strack, Jonathan P. DeShazo, Chris Gennings, Juan L. Olmo, Sebastian Ventura, Krzysztof J. Cios, and John N. Clore, “Impact of HbA1c Measurement on Hospital Readmission Rates: Analysis of 70,000 Clinical Database Patient Records,” BioMed Research International, vol. 2014, Article ID 781670, 11 pages, 2014.
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3. Shaw JA, Stiliannoudakis S, Qaiser R, Layman E, Sima A, Ali A. Thirty-Day Hospital Readmissions: A Predictor of Higher All-cause Mortality for Up to Two Years. Cureus. 2020 Jul 21;12(7):e9308. doi: 10.7759/cureus.9308. PMID: 32839677; PMCID: PMC7440272.