Predicting the Success of ESA in EUMDS Patients Using XAI

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Introduction

ESAS ARE EXPECTED TO ENHANCE THE QUALITY OF LIFE FOR MDS PATIENTS BY INCREASING HAEMOGLOBIN LEVELS AND REDUCING ANAEMIA SYMPTOMS.

Objectives

- Determine ESA Effectiveness

- Factors Influencing ESA Effectiveness

- Duration of Individualised Treatment Response

- Exploring ESA Treatment Resistance

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ORIGINAL RESEARCH
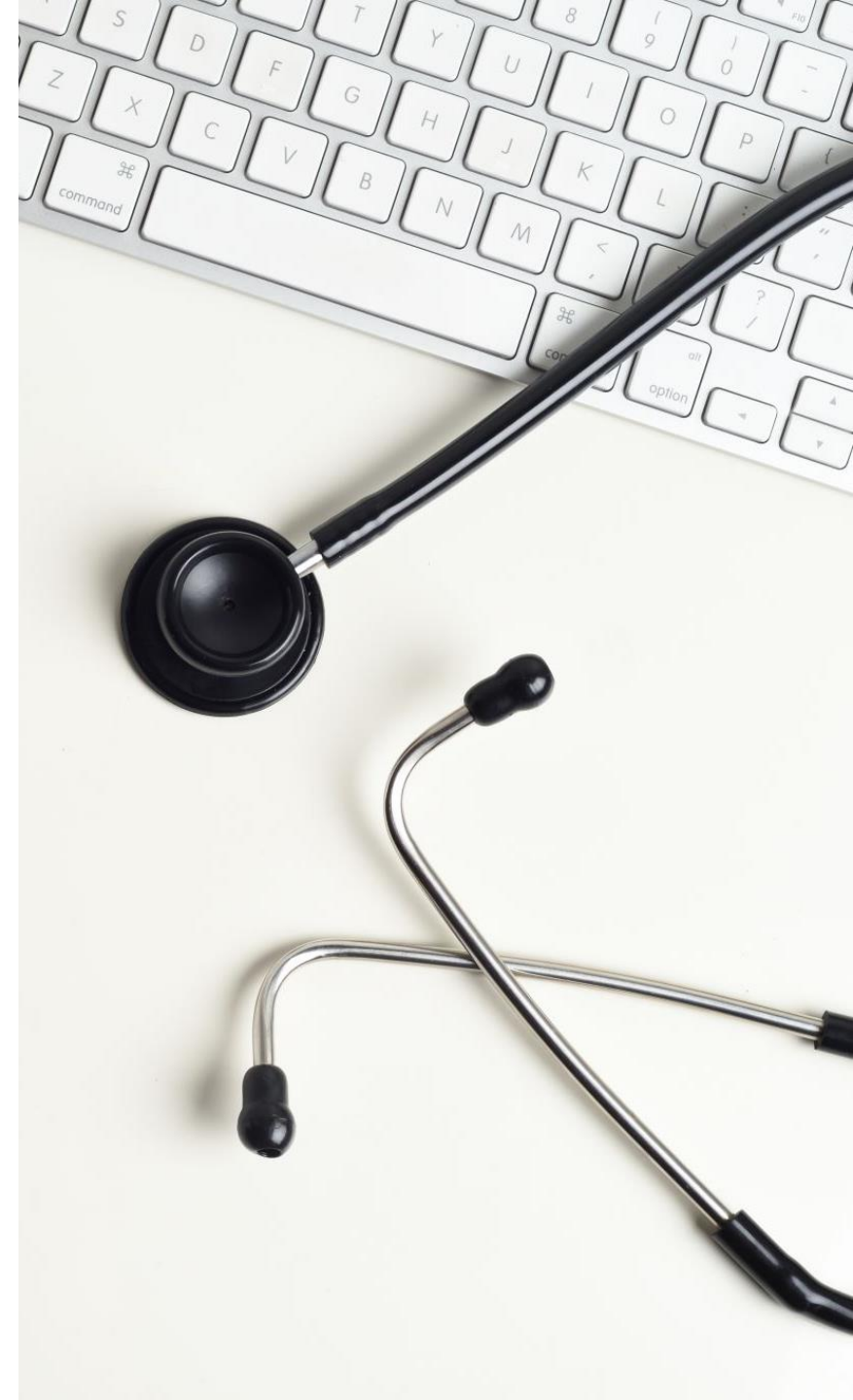
Data-Driven Identification of Long-Term Glycemia Clusters and Their Individualized Predictors in Finnish Patients with Type 2 Diabetes

Piia Lavikainen [1],*, Gunjan Chandra [2],*, Pekka Siirtola [2], Satu Tamminen [2], Anusha T Ihalapathirana [2], Juha Röning [2], Tiina Laatikainen [3–5], Janne Martikainen [1]

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Three distinguished HbA1c trajectories over six years
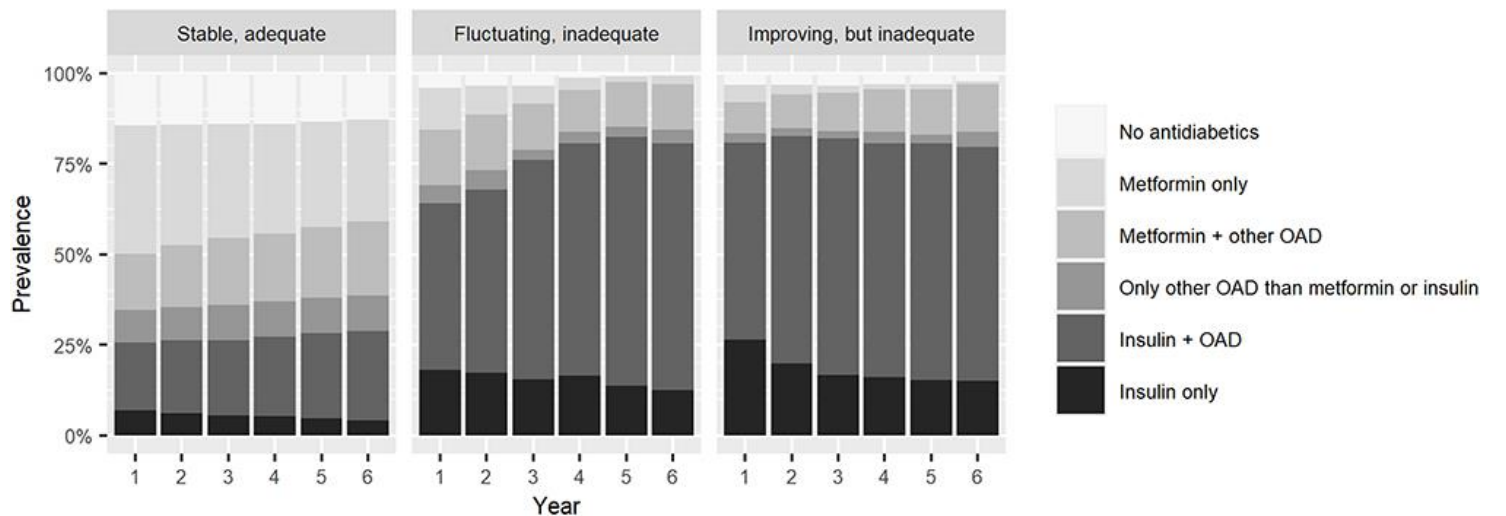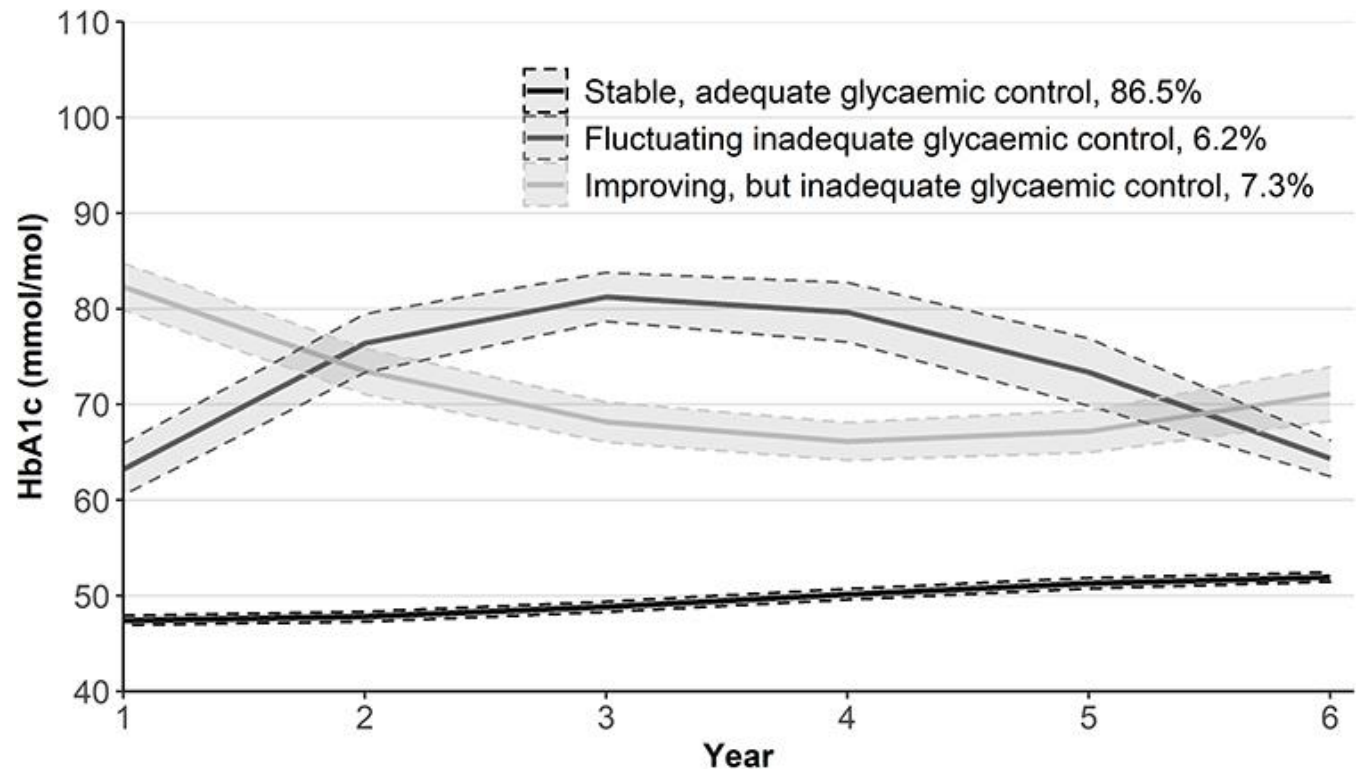
Feature Importance

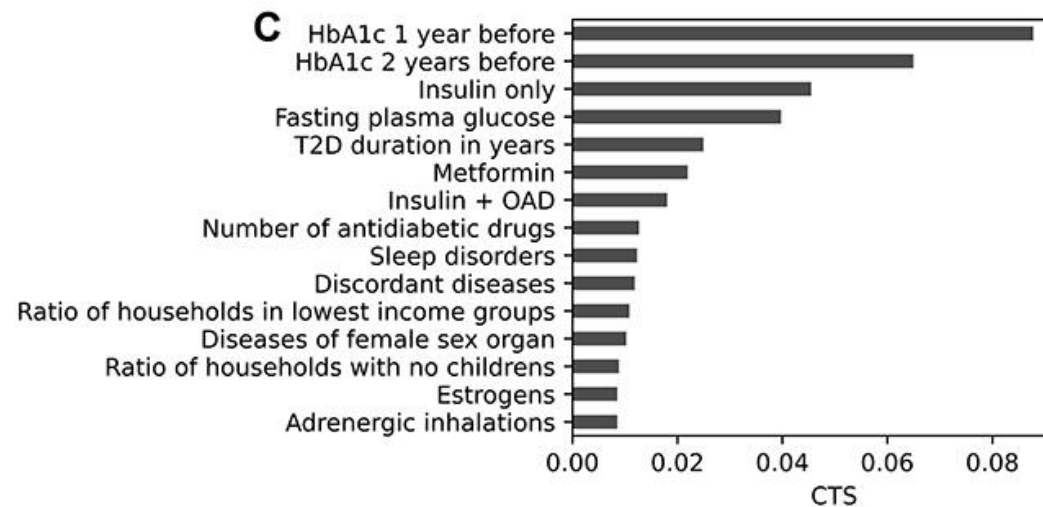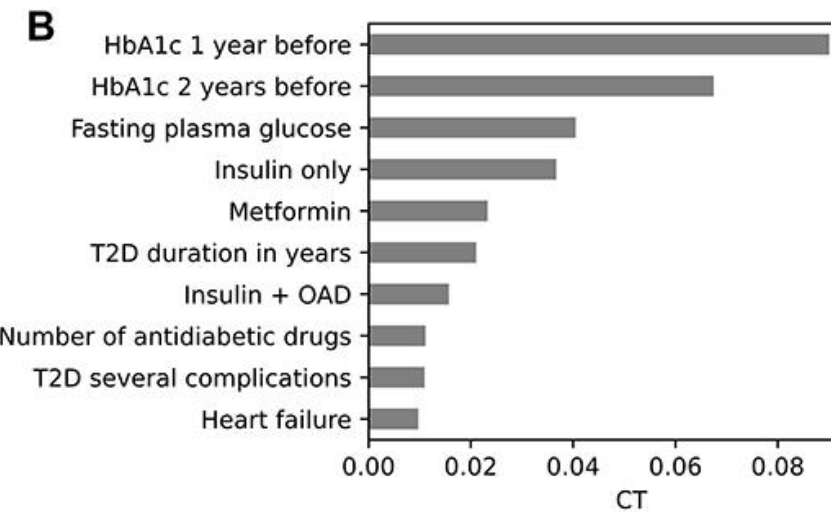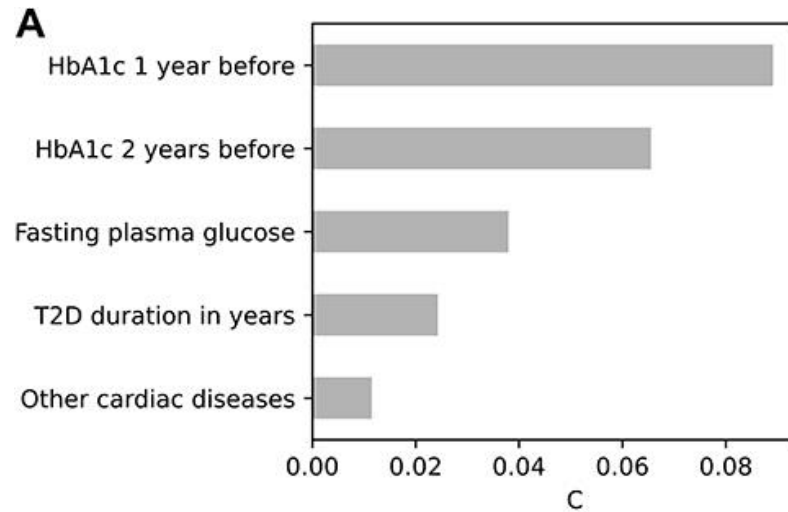| Type of Predictors	Total Number of Predictors	Number of Selected Predictors
Clinical (C)	83	5
Clinical + Treatment (CT)	233	10
Clinical + Treatment + SES (CTS)	299	15

Model Performance
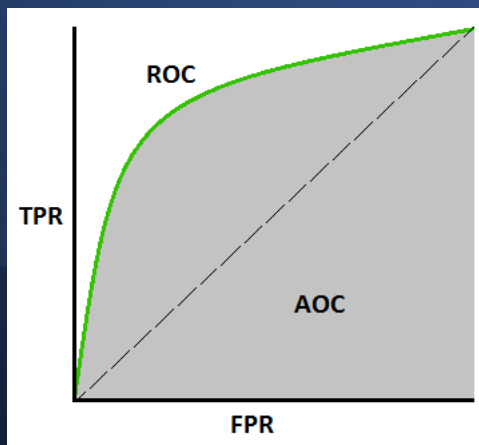
| Predictors	Model			Confusion Matrix		F1 Score	Balanced Accuracy	ROC AUC
Clinical	LDA	True	**Predicted**		**Class**	0.69	0.84	0.92
			4394	726	Adequate			
			68	329	Inadequate			
	NN	True	**Predicted**		**Class**	0.66	0.85	0.91
			4191	929	Adequate			
			47	350	Inadequate			
Clinical + Treatment	LDA	True	**Predicted**		**Class**	0.69	0.85	0.92
			4405	715	Adequate			
			67	330	Inadequate			
	NN	True	**Predicted**		**Class**	0.66	0.85	0.91
			4202	918	Adequate			
			48	349	Inadequate			
Clinical + Treatment + SES	LDA	True	**Predicted**		**Class**	0.69	0.84	0.92
			4402	714	Adequate			
			70	326	Inadequate			
	NN	True	**Predicted**		**Class**	0.66	0.84	0.91
			4249	867	Adequate			
			57	339	Inadequate			

Abbreviations: LDA, linear discriminant analysis; NN, neural network; ROC AUC; receiver operating characteristic area under the curve; SES, socio-economic status.

- Machine learning models that rely only on known risk factors yield moderate prediction accuracy.

- Feature selection methods have the potential to improve the prediction of medical outcomes.

- Boosting machine learning algorithms are more effective at predicting medical outcomes.

- Socioeconomic factors, physical health, and mental health impact the prediction of medical outcomes.

Outcome	Models built using statistically identified prognostic / risk factors	Models built using features selected through ML methods		Statistical model
Relapses (MS)	AUC – 0,67 BA – 0,66 F1 score – 0,71	<u>Male</u> AUC – 0,70 BA – 0,70 F1 score – 0,84		AUC – 0,65
		<u>Female</u> AUC – 0,69 BA – 0,68 F1 score – 0,76		
Severe hypoglycemia (T1D)	AUC – 0.65 BA – 0,66 F1 score – 0,65	<u>Male</u> AUC – 0,88 BA – 0,85 F1 score – 0,84		-
		<u>Female</u> AUC – 0,82 BA – 0,79 F1 score – 0,84		
Diabetic Ketoacidosis (T1D)	AUC – 0,69 BA – 0,68 F1 score – 0,78	AUC – 0,85 BA – 0,83 F1 score – 0,78		-

Explainable Artificial Intelligence to predict clinical outcomes in type 1 diabetes and relapsing-remitting multiple sclerosis adult patients

Global and Local Explaination
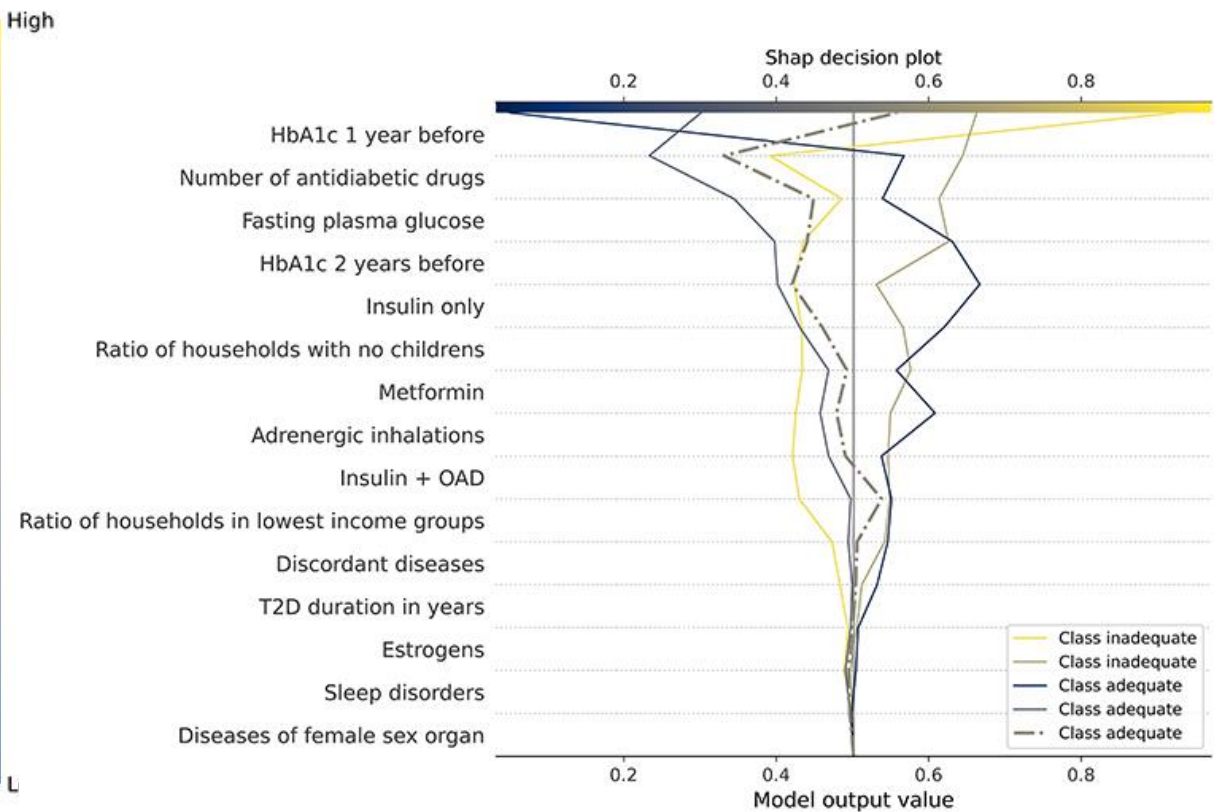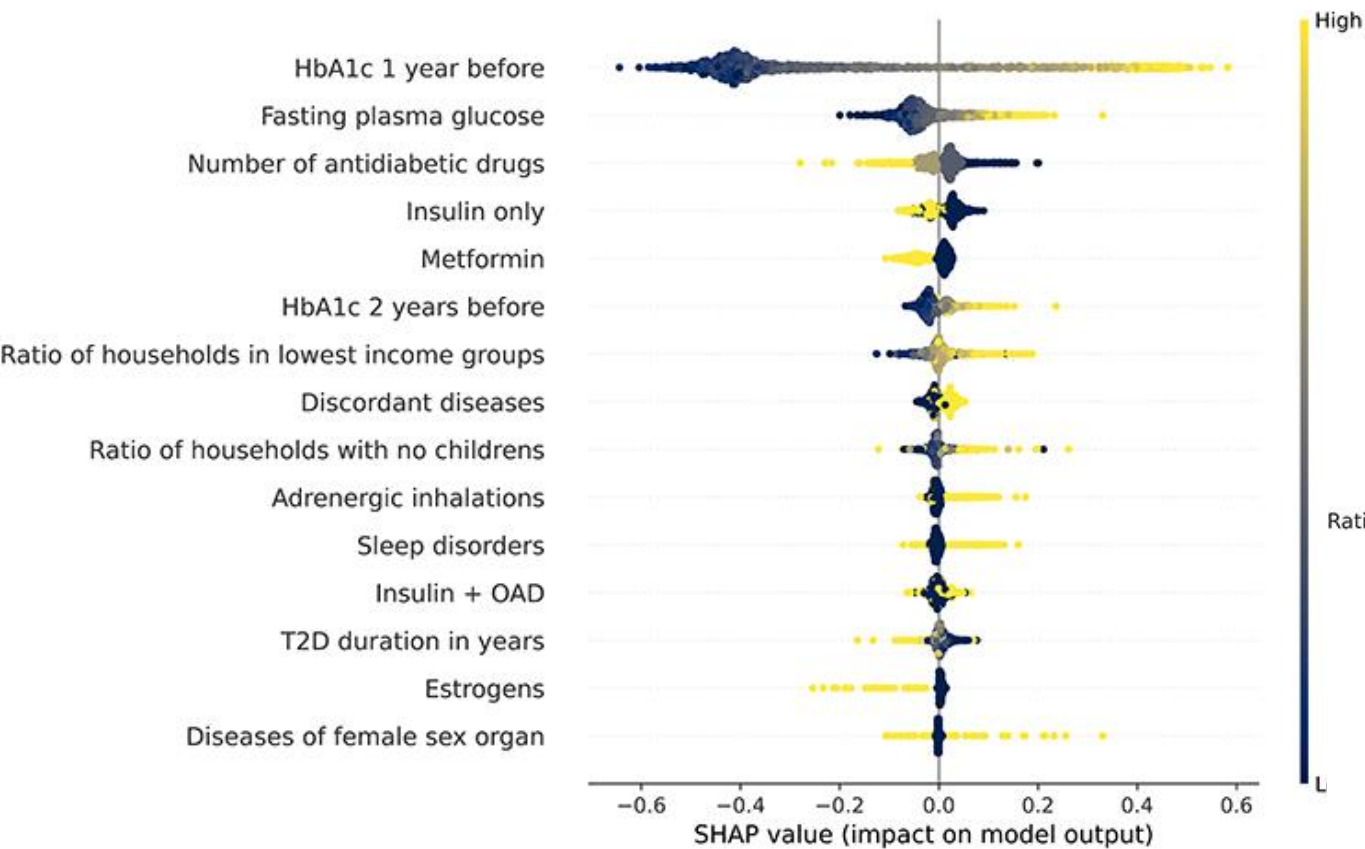
Data Requirements for EUMDS Model Building

- **Success of ESAs:**
  - **Baseline Variables at ESA Decision:** Inclusion of relevant patient characteristics and disease markers at the time the decision to administer ESAs is made.
  - **ESA Administration Timestamps:** Precise records of when ESAs were administered.
  - **Historical Visit Data:** Incorporating older visit data if available to capture the patient's medical history.
  - **Target Variable for ESA Success:** An indicator variable distinguishing successful responses from non-responses.

- **Time to ESAs (for patients with ESA success):**
  - **All of the Above:** Continued monitoring of baseline variables, ESA administration timestamps, and historical data.
  - **ESA Response Timestamps:** The time intervals to successful response, recorded in terms of months, weeks, or days.
  - **Target Variable for Time to ESA Response:** A variable indicating the duration it took for the patient to achieve a successful response.

- **Loss of Response (for patients with ESA success):**
  - **All of the Above:** Maintaining a comprehensive dataset for baseline variables, ESA administration timestamps, historical data, and ESA response timestamps.
  - **Follow-Up Visits Data:** Ongoing data collection post-ESA administration until the loss of response occurs.
  - **Target Variable for Loss of Response:** An indicator variable marking the point at which the patient's ESA response was lost, with reference to time and events.

Questions?