

How to Choose the Right Insulin in Patients with Type 2 Diabetes: A Joint Modeling Method

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Introduction

- Heterogeneity of treatment effect (HTE) is the variation in how individuals respond to a treatment, which justifies the need for patient-centered care.
- We present a joint modeling method developed to help patients with type 2 diabetes mellitus (T2DM) initiating injectable therapies choose between basal insulin and premixed insulin.

Method

Population	Adults (≥ 18) T2DM patients initiating injectable therapies
Intervention	Basal insulin vs. Premixed insulin
Outcome	HbA1c $< 7\%$ at 6 months after initiation



1287 Patients 2019-01-01 ~ 2021-12-31

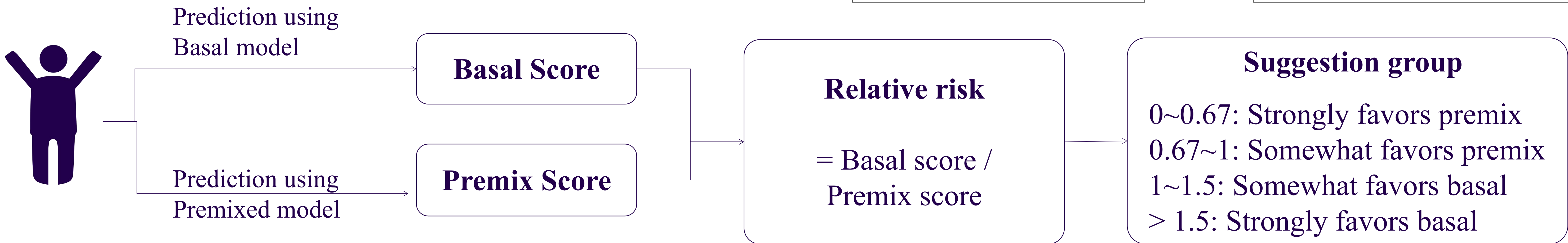
Data from Chinese regional electronic medical records of 68 hospitals in Tianjin, a Northern metropolis

821 Basal insulin

Basal model
fitted with logistic regression

466 Premixed insulin

Premixed model
fitted with logistic regression



Results

- Both basal and premixed models had similar discrimination (AUC: 0.65; Figures A1 and A2) and good calibration (Hosmer-Lemeshow $P > 0.05$; Figures A3 and A4).
- Patients who somewhat or strongly favors basal were older, had longer duration, treated with more prior OADs, with lower HbA1c and FPG, with higher percentages of coronary artery disease and diabetic neuropathy compared with patients who somewhat or strongly favors premixed insulin ($P < 0.001$; Table).
- A decision tree model was also fit to classify the patients into recommendation groups using baseline characteristics, which showed an accuracy of 0.69. The results showed that patients with baseline HbA1c $< 9.7\%$ can achieve a better outcome with basal insulin, especially those older than 57 years. Patients with baseline HbA1c $\geq 9.7\%$ can achieve a better outcome with premixed insulin, especially those with HbA1c $\geq 12\%$ or those with hypertension but without coronary artery disease.

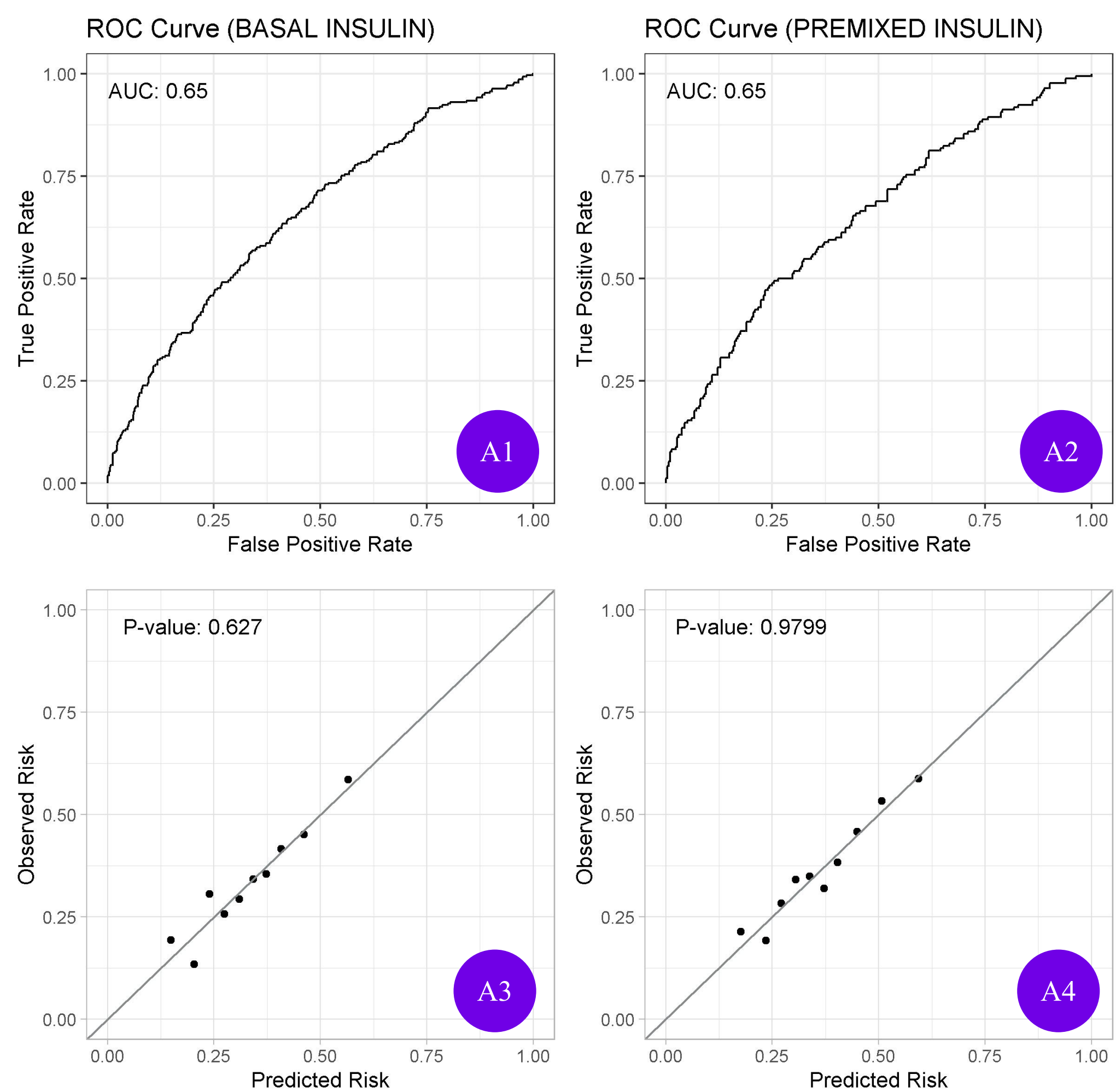


Table Profiling of the suggestion groups

	Strongly favors premix	Somewhat favors premix	Somewhat favors basal	Strongly favors basal	P value
Age (year)	49.50 $\pm$ 12.98	55.00 $\pm$ 11.85	64.01 $\pm$ 9.84	70.46 $\pm$ 8.87	<0.001
Duration of diabetes (year)	3.21 $\pm$ 2.12	3.75 $\pm$ 2.42	4.27 $\pm$ 2.66	4.99 $\pm$ 2.96	<0.001
Number of OADs	1.99 $\pm$ 0.86	2.22 $\pm$ 1.02	2.51 $\pm$ 1.12	3.13 $\pm$ 0.97	<0.001
HbA1c (%)	11.73 $\pm$ 1.81	9.55 $\pm$ 1.44	8.47 $\pm$ 1.08	8.01 $\pm$ 0.79	<0.001
FPG (mmol/L)	13.31 $\pm$ 3.81	11.47 $\pm$ 3.17	9.93 $\pm$ 2.49	9.90 $\pm$ 1.88	<0.001
2h PPG (mmol/L)	22.23 $\pm$ 5.60	20.87 $\pm$ 5.55	18.16 $\pm$ 5.47	19.55 $\pm$ 4.75	0.178
Hypertension (%)	106 (59.2)	339 (54.7)	216 (50.5)	26 (43.3)	0.08
Hyperlipidemia (%)	80 (44.7)	337 (54.4)	238 (55.6)	38 (63.3)	0.032
Coronary artery disease (%)	21 (11.7)	200 (32.3)	277 (64.7)	48 (80.0)	<0.001
Obesity (%)	12 (6.7)	51 (8.2)	40 (9.3)	9 (15.0)	0.231
Diabetic neuropathy (%)	43 (24.0)	143 (23.1)	154 (36.0)	39 (65.0)	<0.001
Diabetic foot (%)	1 (0.6)	9 (1.5)	14 (3.3)	4 (6.7)	0.008

Conclusion

We developed a data-driven joint modeling method to help T2DM patients initiating injectable therapy to choose from basal insulin or premixed insulin. Our method can help with the choice of treatment to facilitate patient-centered care.

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