DRIP QUEST: PREDICTING INSULIN DRIP DOSE FOR ICU PATIENTS RECEIVING INTENSIVE INSULIN THERAPY USING MACHINE LEARNING

Arief Purnama Muharram[1], Ahmad Zufar Mantovani[1], Muhammad Ikhsan Mokoagow[1,2,4], M. Sadhyo Prabhasworo[3, 4], M. Azhari Taufik[5], Marina Epriliawati[1,2]

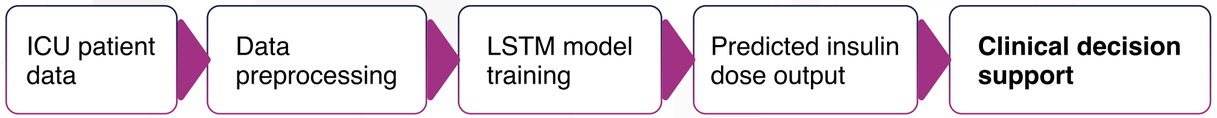
[1]Integrated Diabetes Care Center, Fatmawati Hospital, Jakarta, Indonesia
[2]Division of Endocrinology, Metabolism, and Diabetes, Department of Internal Medicine, Fatmawati Hospital, Jakarta, Indonesia
[3]Department of Internal Medicine, Fatmawati Hospital, Jakarta, Indonesia
[4]Medical High Care unit, Fatmawati Hospital, Jakarta, Indonesia
[5]Department of Anesthesiology and Intensive Care, Rumah Sakit Fatmawati, Jakarta, Indonesia

Background and Aims

Critically ill ICU patients require tight blood glucose (BG) control, as both hypo- and hyperglycemia are associated with poor outcomes. Intensive insulin therapy (IIT) is key to managing BG but is complex and highly dependent on clinician expertise. This study explores a machine learning (ML) approach to predict personalized insulin drip doses, aiming to support clinical decisions in IIT.

Methods

Retrospective data comprising BG-insulin dose pairs were collected from 141 ICU patients at Fatmawati Hospital Jakarta (2019–2024). All data were anonymized and ethically approved, then reviewed by expert clinicians to remove outliers. We employed a Long Short-Term Memory (LSTM) model, with output rounded to the nearest 0.5 unit. Data were split 80:20 into training and testing sets and structured into sequences with a window length of 4. The model was trained with a learning rate of 10e-3 for 100 epochs. Model performance was evaluated using Mean Absolute Error (MAE) and Root Mean Square Error (RMSE). Implementation was done using PyTorch 2.7.1 in Python 3.12



Results

A total of 481 BG-insulin sequences were generated (384 train, 97 test). BG values ranged from 102 to 561 mg/dL; insulin doses from 0.2 to 6 units. The model achieved an MAE of 0.7113 and RMSE of 0.9818, demonstrating reasonable accuracy in predicting insulin doses.

Conclusions

ML, particularly LSTM, shows promise in assisting insulin drip dosing for ICU patients undergoing IIT. Further development is needed to improve model generalization, especially by expanding the dataset and increasing its diversity.

Keywords: *Insulin, Intensive Care, Machine Learning*

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