Personalised Diabetes Self-Management with Reinforcement Learning: An In-Silico Validation for Insulin-Treated Individuals

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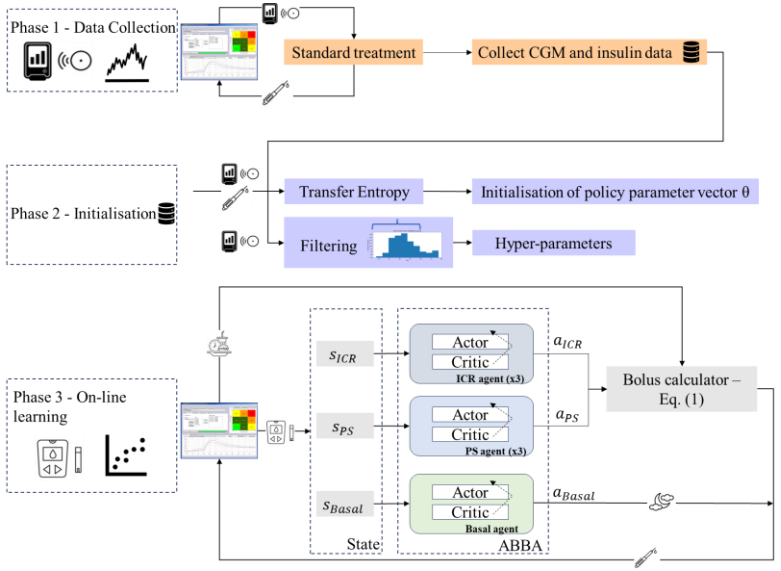
Background

- **Self-learning AI-driven system**, ABBA continuously adapts to individual needs, delivering personalized and adaptive insulin recommendations for both individuals with type 1 (T1D) and type 2 diabetes (T2D)
- **Device-agnostic and optimized for low-resource devices** like smartphones, expanding access to advanced diabetes management
- Addresses healthcare inequalities and biases by ensuring effective insulin optimization across diverse real-world scenarios
- **Co-created with people with diabetes and key stakeholders**, leveraging a novel algorithmic approach to refine basal-bolus therapy through continuous learning

Methods

ABBA is based on reinforcement learning.
Pipeline:

- **Phase 1: Data Collection**
  Standard treatment data is gathered over two weeks to establish a baseline
- **Phase 2: Initialization**
  The collected data is used to configure ABBA's parameters for personalized insulin recommendations
- **Phase 3: Online Learning**
  ABBA continuously adjusts insulin doses in real-time based on glucose levels and carbohydrate intake



The validation was conducted using the US FDA-approved diabetes simulator

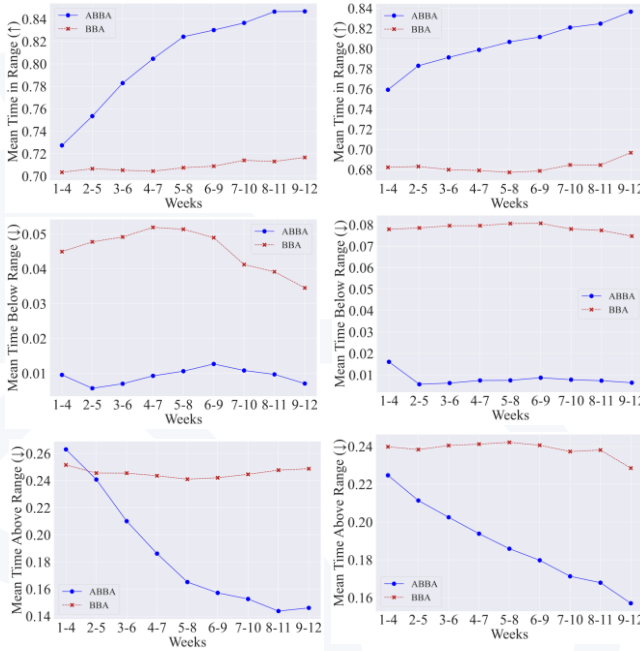
Results

- ABBA outperforms standard basal-bolus advisor

Metric	ABBA (n=101)	BBA (n=101)
Adults – T1D		
TIR, %	80.1 ± 10.8†	70.6 ± 13.8
TBR, %	0.9 ± 0.9†	4.4 ± 4.8
TAR, %	19.0 ± 10.2†	25.0 ± 12.1
# Hypo events	10.9 ± 10.7†	35.1 ± 34.0
# Hyper events	199.5 ± 58.5	199.4 ± 51.3
LBGI, %	0.27 ± 0.22†	1.28 ± 1.38
Adults – T2D		
TIR, %	80.1 ± 16.6†	68.3 ± 19.7
TBR, %	1.0 ± 1.4†	7.9 ± 12.6
TAR, %	18.9 ± 16.5†	23.8 ± 21.5
# Hypo events	11.7 ± 19.2†	52.8 ± 98.2
# Hyper events	189.7 ± 93.2	177.0 ± 95.7
LBGI, %	0.35 ± 0.38†	2.05 ± 3.30

In-silico results with the full cohort over a 3-month *duration. Data are mean ± std. † indicates statistical significance with p < 0.01. TIR: time in range; TBR: time below range; TAR: time above range*

- After 2 months, TIR increased by **11.9 ± 8.4**% in T1D and **7.7 ± 5.5**% T2D



ABBA vs BBA for T1D *ABBA vs BBA for T2D*

Conclusions

- ABBA, powered by RL, enhances diabetes self-management
- Clinical validation is ongoing
- Upcoming international multi-center trial with 400+ adults