Welcome!
Single and Dual Hormone Closed-loop Glucose Control with Automated Exercise Detection to Prevent Hypoglycemia in Type 1 Diabetes

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Disclosures

• Peter G. Jacobs and Jessica R. Castle have a financial interest in Pacific Diabetes Technologies Inc., a company that may have a commercial interest in the results of this research and technology.

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Objective

- Objective was to alleviate the risk of exercise-related hypoglycemia in type 1 diabetes (T1D) using automated insulin and glucagon delivery.

- Compare performance across different therapies:
  - OHSU Dual hormone CL + exercise
  - OHSU Single-hormone CL + exercise
  - PLGS
  - Current Care (adjustments allowed)

- Both AP systems used:
  - A wearable heart rate and accelerometer sensor to automatically detect exercise to inform the CL algorithms
  - Dexcom CGM and t:slim pumps
# Method: 4-way Randomized Cross-over

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*Current care: patient’s usual regimen

**PLGS: predictive low glucose suspend system

***In clinic exercise: running at 60% of VO2max for 45 min

****Home exercise: exercise of subjects choice for 45 min
Outcomes

• **Primary outcome measures**: % time in hypoglycemia and % time in euglycemia from start of in-clinic exercise to next meal (4 hours)

• **Secondary outcome measures**: total number of rescue carbohydrates given, total insulin and glucagon consumed, % time in hyperglycemia
Results: Glucagon ↓ Hypoglycemia During Exercise

- After exercise, 6.3% time in hypoglycemia (<70 mg/dL) when using insulin only CL system, 1.0% time in hypo when using insulin + glucagon AP (p=0.01)

\[ \* p<0.05 \]
Results: Closed-loop $\uparrow$ time in range during physically active free living conditions

- Insulin only and insulin + glucagon closed loop systems increased time in euglycemia vs PLGS under 4 days of free-living with high amounts of physical activity

Euglycemia = 70-180 mg/dL
Conclusion

• Automated glucagon delivery reduces exercise-related hypoglycemia compared with single-hormone AP and PLGS

• Wearable activity tracking sensors can be used to automatically detect aerobic exercise and adjust dosing: 85% of exercise events were automatically detected

• Both dual and single hormone APs increased time in euglycemia relative to PLGS

• Glucagon reduced but did not eliminate hypoglycemia. May need to be delivered sooner at exercise onset
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