

# Hypoglycaemia Incidence and Recovery During Home Use of Hybrid Closed-Loop in Adults with Type 1 Diabetes

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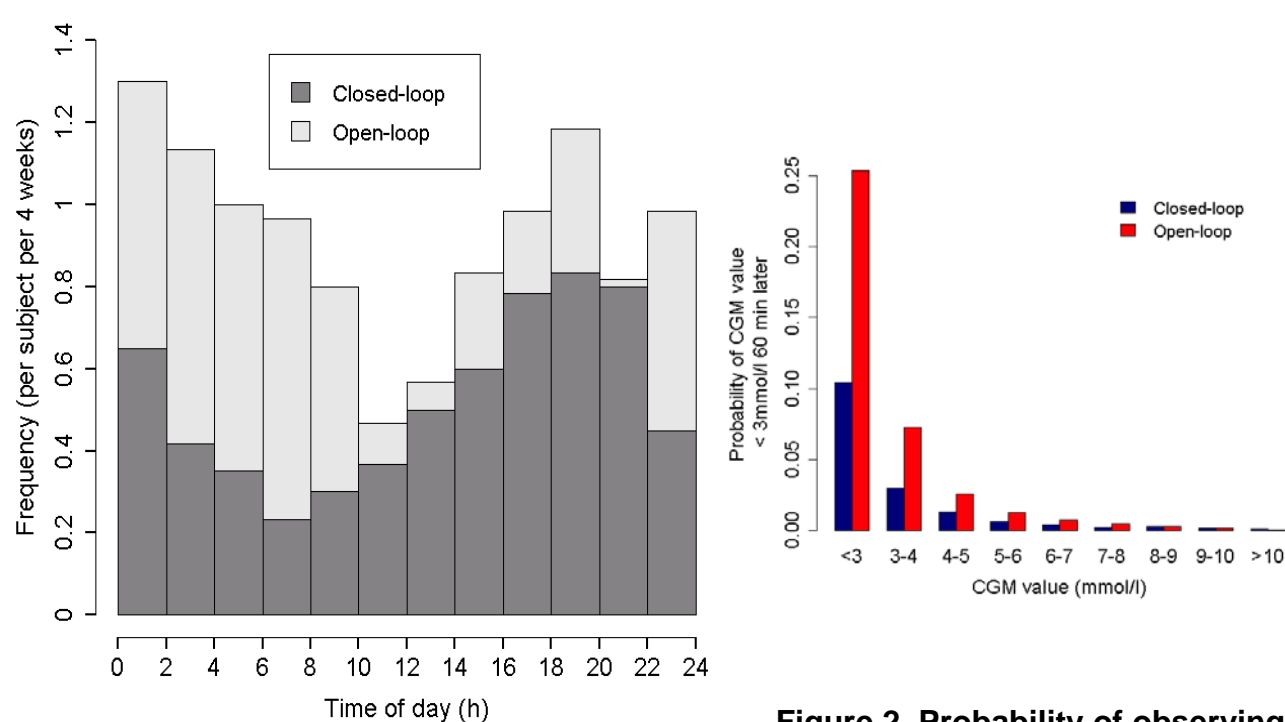
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**Introduction** We assessed glucose excursion around hypoglycaemia to increase understanding of hypoglycaemia incidence and recovery during hybrid closed-loop insulin delivery.

**Methods** We retrospectively analysed data from 60 adults with type 1 diabetes who received in crossover randomised design day-and-night hybrid closed-loop and insulin pump therapy, the latter with or without real-time continuous glucose monitoring. Over 4-week study periods, we identified hypoglycaemic episodes defined as sensor glucose < 3.0mmol/l and analysed sensor glucose relative to the onset of hypoglycaemia.

**Results** We identified 377 hypoglycaemic episodes during hybrid closed-loop versus 662 during control intervention (P<0.001) with a predominant reduction of nocturnal hypoglycaemia. The slope of sensor glucose prior to hypoglycaemia was steeper during closed-loop than during control intervention (P<0.01), while insulin delivery was reduced (P<0.01). During both daytime and night-time, participants recovered from hypoglycaemia faster when treated by closed-loop. At 120 min post-hypoglycaemia, sensor glucose levels were higher during closed-loop compared to control period (P<0.05).

**Conclusion** Closed-loop reduces the risk of hypoglycaemia particularly overnight with swift recovery from hypoglycaemia leading to higher 2-hour post-hypoglycaemia glucose levels.

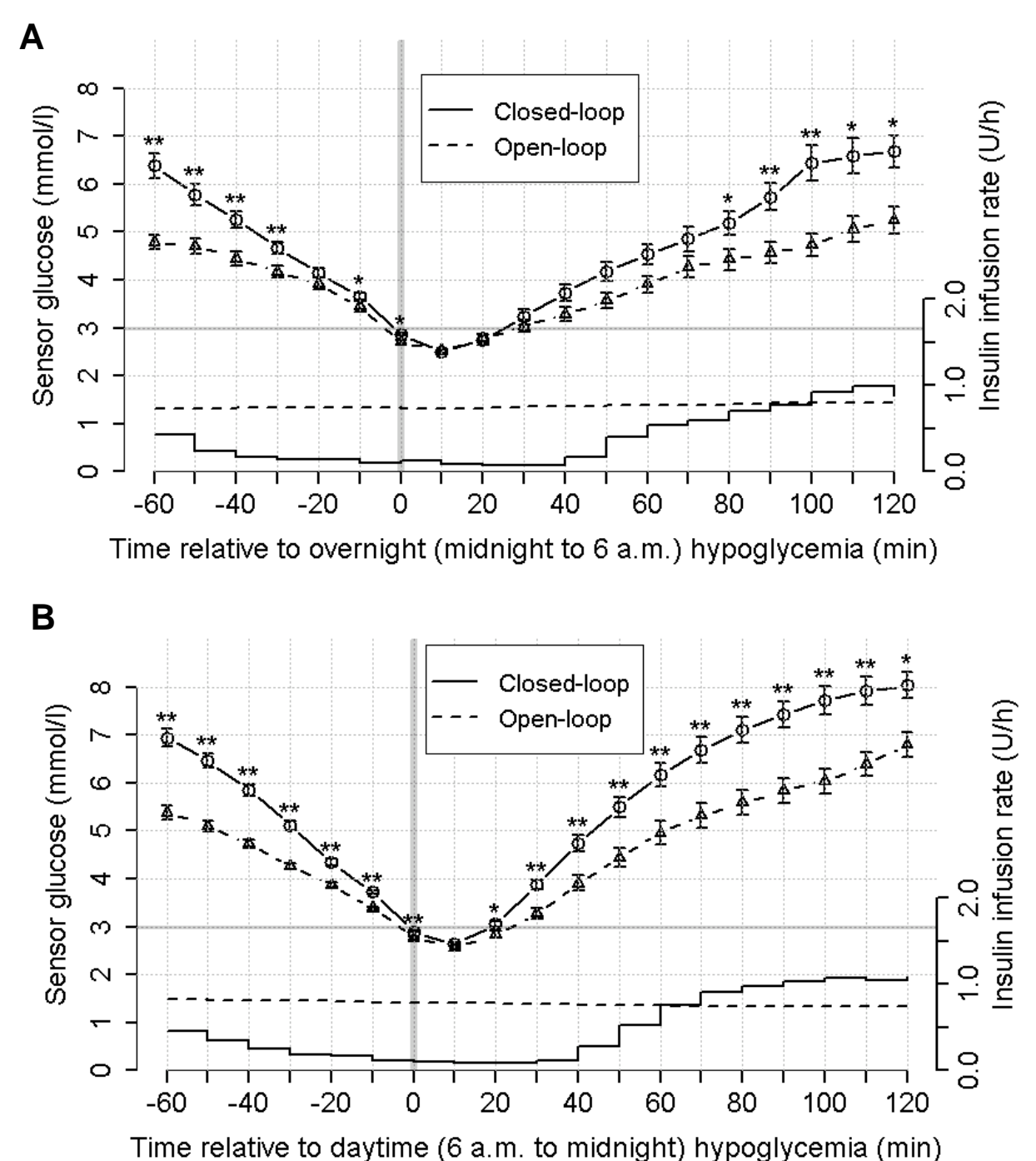


**Figure 1.** Incidence of hypoglycaemia events (sensor glucose < 3.0 mmol/l for at least 10min) during hybrid closed-loop insulin delivery (dark grey bars) and control periods (light grey bars) (mean; N = 60).

**Figure 2.** Probability of observing a sensor glucose value < 3mmol/l (y-axis) conditional on the sensor glucose value 60 min earlier (x-axis).

**Table 2.** Sensor glucose values at 30, 60, 90 and 120 min following the onset of hypoglycaemia (sensor glucose < 3.0 mmol/l for at least 10 min) during hybrid closed-loop insulin delivery and control periods.

Time relative to onset of hypoglycaemia (min)	Sensor glucose (mmol/l) [mean(SD), N = 60]		P value
	Control	Closed-loop insulin delivery	
	Overnight period (midnight to 6 a.m.)		
+30	3.0 (0.9)	3.2 (1.2)	0.80
+60	3.9 (1.3)	4.5 (1.7)	0.53
+90	4.6 (1.8)	5.7 (2.2)	0.003
+120	5.2 (2.2)	6.7 (2.5)	0.010
	Daytime period (6 a.m. to midnight)		
+30	3.3 (0.9)	3.9 (0.8)	0.006
+60	5.0 (1.8)	6.2 (1.8)	0.007
+90	5.8 (2.0)	7.4 (2.1)	0.001
+120	6.8 (2.0)	8.0 (2.1)	0.020



**Figure 3.** Sensor glucose values from -60 min to 120 min relative to the onset of hypoglycaemia (sensor glucose < 3.0mmol/l; vertical bar) during hybrid closed-loop period (circles connected by solid line; mean ± SEM; N=60; \* P < 0.05, \*\* P < 0.01 compared to control therapy) and during control period (triangles connected by dashed line). Piecewise-constant lines without error bars represent mean insulin infusion rates during closed-loop period and dashed lines without error bars are insulin infusions during control period. Panel A shows glycaemic and insulin infusion data during the night-time period (midnight to 6 a.m.) and panel B shows the daytime period (6 a.m. to midnight).