

Supplementary results

Sleep diaries

Caregiver 2

Parents classified as caregiver 2 showed very similar levels of sleep quality ($\bar{X}=3.5$ [SD: 0.7] vs $\bar{X}=3.5$ [SD: 0.9]), sleep duration ($\bar{X}=7.7$ [SD:0.5] vs $\bar{X}=7.5$ hours [SD: 1.0]) and SOL ($\bar{X}=28.3$ [SD: 22.2] vs $\bar{X}=27.2$ mins [SD: 28.5]) in both groups. However, parents from the CL group reported more awakenings ($\bar{X}=2.2$ [SD: 1.2] vs $\bar{X}=1.6$ [SD: 1.3]) and more time awake at night ($\bar{X}=27.6$ [SD: 34.7] vs $\bar{X}=19.1$ mins [SD: 16.9]) (Supplementary Table 1; Supplementary Figure 1).

Overall, ANOVA tests showed that the factors (caregiver and treatment) were non-significant for all the sleep diary variables except for awakenings (but only for the analyses with outliers removed) where treatment had a significant impact ($p=0.031$), the interaction between treatment and caregiver was also significant using the whole sample ($p=0.026$) but this association did not survive multiple test adjustment ($0.05/5= 0.01$) (Supplementary Table 2).

Actiwatch

Caregiver 2

Focusing on secondary caregivers, they showed shorter SOL in the CL group as compared to the SAP groups ($\bar{X}=21.6$ [SD: 15.0] vs $\bar{X}=39.4$ mins [SD: 43.1]). They reported similar sleep duration ($\bar{X}=6.7$ [SD: 1.2] vs $\bar{X}=6.7$ hours [SD: 1.2]), sleep efficiency ($\bar{X}=82.3$ [SD: 9.8] vs $\bar{X}=81.8\%$ [SD: 12.7]) and NWAK ($\bar{X}=51.2$ [SD: 18.5] vs $\bar{X}=46.0$ [SD: 32.5]). However, parents from the CL group showed more WASO

(\bar{X} =49.0 [SD: 27.3] vs \bar{X} =36.1 mins [SD: 41.4]) (Supplementary Table 1; Supplementary Figure 2).

ANOVAs showed that caregiver was a significant factor for sleep duration ($p=0.023$) and the interaction between treatment and caregiver for WASO ($p<0.001$) and NWAK ($p=0.020$). Just the interaction for WASO remained significant after controlling for multiple testing ($.05/5=.01$) (Supplementary Table 2).

Questionnaires

Caregiver 2

Regarding secondary caregivers, sleep quality was similar for the CL group (\bar{X} =6.4 [SD: 4.5]) and the SAP group (\bar{X} =6.3 [SD: 5.3]) and also CSHQ scores (\bar{X} =48.2 [SD: 4.5] vs \bar{X} =47.4 [SD: 5.4]) (Supplementary Table 1; Supplementary Figure 3). The ANOVA test showed no significant differences (Supplementary Table 2).

Supplementary Table 1: Means (SD) of the sleep variables by treatment group and caregiver order for the sample with and without outliers excluded

	Treatment	Caregiver	Total sample	Outliers removed		Treatment	Caregiver	Total sample	Outliers removed
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Sleep diaries (N° outliers)					Actiwatch (N° outliers)				
Sleep quality	SAP	1	3.3 (0.9)		Sleep duration (4)	SAP	1	7.2 (0.9)	7.4 (0.4)
	CL	1	3.6 (0.4)			CL	1	7.2 (1.1)	6.9 (0.7)
	SAP	2	3.5 (0.9)			SAP	2	6.7 (1.2)	7.00 (0.9)
	CL	2	3.5 (0.7)			CL	2	6.7 (1.2)	7.0 (0.9)
Sleep duration (1)	SAP	1	8.2 (0.7)	8.2 (0.7)	Latency (1)	SAP	1	25.5 (11.6)	25.5 (11.6)
	CL	1	7.9 (1.1)	7.6 (0.9)		CL	1	16.7 (8.6)	16.7 (8.6)
	SAP	2	7.5 (1.0)	7.5 (1.0)		SAP	2	39.4 (43.1)	26.5 (20.1)
	CL	2	7.7 (0.5)	7.7 (0.5)		CL	2	21.6 (15.0)	21.6 (15.0)
Awakenings (5)	SAP	1	3.2 (2.5)	2.5 (0.6)	Efficiency (3)	SAP	1	85.1 (4.3)	85.1 (4.3)
	CL	1	1.9 (1.1)	1.7 (0.8)		CL	1	88.1 (4.1)	88.1 (4.1)
	SAP	2	1.6 (1.3)	2.0 (1.1)		SAP	2	81.8 (12.7)	87.6 (5.5)
	CL	2	2.2 (1.2)	1.9 (0.6)		CL	2	82.3 (9.8)	85.0 (6.1)
Latency (3)	SAP	1	19.3 (10.4)	19.3 (10.4)	WASO (2)	SAP	1	39.1 (15.2)	39.1 (15.2)
	CL	1	19.9 (18.2)	14.5 (6.5)		CL	1	28.2 (11.5)	28.2 (11.5)
	SAP	2	27.2 (28.5)	18.0 (7.9)		SAP	2	36.1 (41.4)	22.8 (12.6)
	CL	2	28.3 (22.2)	22.5 (13.1)		CL	2	49.0 (27.3)	41.8 (17.8)
Time awake at night (5)	SAP	1	52.6 (48.9)	21.2 (15.7)	Number of awakenings (2)	SAP	1	45.3 (12.2)	45.3 (12.2)
	CL	1	28.6 (30.9)	20.3 (17.6)		CL	1	42.5 (16.7)	42.5 (16.7)
	SAP	2	19.1 (16.9)	19.1 (16.9)		SAP	2	46.0 (32.5)	36.4 (15.8)
	CL	2	27.6 (34.7)	17.3 (13.0)		CL	2	51.2 (18.5)	46.0 (10.6)
PSQI					CSHQ				
	SAP	1	6.5 (4.1)			SAP	1	44.5 (5.4)	
	CL	1	5.2 (3.3)			CL	1	46.0 (7.2)	
	SAP	2	6.3 (5.3)			SAP	2	47.4 (5.4)	
	CL	2	6.4 (4.5)			CL	2	48.2 (4.5)	

Footnote. SAP: Sensor-augmented pump; CL: Closed-loop. Number of participants: 21 participants classified as caregiver 1 (SAP=11 and CL=10) and 19 participants classified as caregiver 2 (SAP=9 and CL=10). Treatment refers to whether the children were using a closed-loop system or sensor-augmented pump and caregiver refers to whether the parents were considered the primary or secondary caregiver at night. Outliers were identified as a score ± 1.5 times the interquartile range. No outliers were identified for the PSQI or the CSHQ (total sample).

Sleep quality was reported using a five-point scale from very poor [1] to very good [5]), sleep latency, time awake at night and WASO were coded in minutes, sleep duration was coded in hours and sleep efficiency in %.

Supplementary Table 2: ANOVA tests examining sleep variables by treatment group and caregiver order for the sample with and without outliers

		Total sample			Outliers removed		
		F	P	Eta ²	F	P	Eta ²
Sleep diaries (N° outliers)							
Sleep Quality (0)							
	Treatment	0.568	0.461	0.024			
	Caregiver	0.112	0.742	0.002			
	Treatment* Caregiver	1.847	0.192	0.029			
Sleep duration (1)							
	Treatment	0.002	0.962	<0.001	0.203	0.658	0.008
	Caregiver	2.046	0.171	0.038	1.241	0.282	0.026
	Treatment* Caregiver	0.783	0.388	0.015	1.892	0.188	0.039
Awakenings (5)							
	Treatment	<0.001	0.997	<0.001	5.720	0.031*	0.153
	Caregiver	1.670	0.214	0.025	0.849	0.372	0.033
	Treatment* Caregiver	5.940	0.026*	0.083	2.664	0.125	0.096
Latency (3)							
	Treatment	0.002	0.968	<0.001	0.096	0.761	0.005
	Caregiver	2.051	0.170	0.036	1.265	0.280	0.030
	Treatment* Caregiver	0.023	0.882	<0.001	1.393	0.258	0.033
Time awake at night (5)							
	Treatment	0.038	0.847	0.002	0.028	0.870	0.001
	Caregiver	3.203	0.092	0.046	0.650	0.435	0.024
	Treatment* Caregiver	2.765	0.116	0.040	0.097	0.761	0.004
Actiwatch (N° outliers)							
Sleep duration (4)							
	Treatment	0.091	0.768	0.004	0.047	0.832	0.002
	Caregiver	6.366	0.023*	0.131	2.241	0.160	0.068
	Treatment* Caregiver	0.109	0.745	0.003	0.304	0.591	0.010
Latency (1)							
	Treatment	3.375	0.086	0.117	2.237	0.157	0.099
	Caregiver	1.197	0.182	0.051	0.881	0.364	0.019
	Treatment* Caregiver	0.320	0.580	0.009	0.411	0.532	0.009

Efficiency (3)							
	Treatment	0.627	0.441	0.026	0.020	0.890	0.001
	Caregiver	3.444	0.083	0.075	0.198	0.664	0.005
	Treatment* Carer	0.367	0.554	0.009	3.984	0.069	0.088
WASO (2)							
	Treatment	<0.001	0.991	<0.001	0.942	0.349	0.044
	Caregiver	0.568	0.463	0.014	0.782	0.392	0.022
	Treatment* Caregiver	3.444	0.087	0.076	18.581	<0.001**	0.346
Number of Awakenings (2)							
	Treatment	0.036	0.852	0.001	0.580	0.460	0.030
	Carer	0.078	0.784	0.002	2.014	0.179	0.047
	Treatment* Caregiver	1.041	0.324	0.026	7.016	0.020*	0.146
PSQI							
	Treatment	0.068	0.798	0.004			
	Caregiver	0.000	1	0.000			
	Treatment* Caregiver	0.427	0.524	0.017			
CSHQ							
	Treatment	0.758	0.406	0.070			
	Caregiver	0.045	0.837	0.001			
	Treatment* Caregiver	0.193	0.671	0.002			

Note. CSHQ: Children's Sleep Habit Questionnaire; PSQI: Pittsburgh Sleep Quality Index; WASO = wake after sleep onset. Number of participants: 21 participants classified as caregiver 1 (SAP=11 and CL=10) and 19 participants classified as caregiver 2 (SAP=9 and CL=10). Treatment refers to whether the children were using a closed-loop system or sensor-augmented pump and caregiver refers to whether the parents were considered the primary or secondary caregiver at night. Outliers were identified as a score ± 1.5 times the interquartile range. No outliers were identified for the PSQI or the CSHQ (total sample).

* significance level $p < .05$; **significance level $p < .001$.

